WONDRIUM

Topic
Food & Wine

The World of Beer

Tastes of History, Science, and Culture

Guidebook

J Jackson-Beckham

WONDRIUM

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J Jackson-Beckham

J Jackson-Beckham is the Equity & Inclusion Partner for the Brewers Association, the not-for-profit trade association for American craft brewers, and is the founder of Crafted for All, a consultancy and professional development platform. She earned her PhD in Communication and Cultural Studies at the University of North Carolina at Chapel Hill. She has published extensively on various aspects of beer history and the modern beer industry. Her work has been featured in *The New York Times*, *USA TODAY*, and *VICE* and by the James Beard Foundation. In 2020, she was named the Beer Person of the Year by *Imbibe* magazine.

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BEER TASTING: FROM HELLES TO LAMBICS

A source of sustenance and life, joy and frivolity, anxiety and regulation, profit and passion, beer is woven throughout the history of civilization. Beer offers a window into a creative human endeavor that dates back 13,000 years. This course offers a satisfying taste of curated cultural moments that will not only change the way you think about beer but also inform your knowledge of history, botany, biology, geography, mythology, sociology, economics, politics, and marketing.

But you won't just study beer—you'll also drink it (if you choose to). This course has curated beers from around the world that offer a taste of the incredible diversity of brewed beverages, and you'll be invited to taste a few beers selected for the theme of each lesson.

If, after your journey with this course, you find yourself looking for a more technical and scientific exploration of beer or just want a deeper dive into how beer is made, then check out Charles Bamforth's *Everyday Guide to Beer*, available on Wondrium.com.

Basics of Tasting Beer

When tasting the beer featured in this course, you'll want to have a fresh, unopened sample of the beer chilled and ready to pour. If you can't get the exact brand that's being tasted, you should be able to find another in that style at a supermarket, liquor store, or local craft brewery. And you should drink your beer fresh! Though many consumers and even beer enthusiasts don't think of beer as a perishable product, in most cases you'll want to consume beer within 90 days of the date it was packaged. In fact, for some styles, such as New England or hazy IPAs, the character and quality of the beer can change dramatically within just a few weeks.

When shopping for beer, flip over cans and bottles to look for a date code stamped on the package and consume within 90 days of the date it was packaged—or better yet, buy your beer straight from a brewery, where it'll always be freshly packaged.

If you've frequented a bar, restaurant, or brewery that serves beer on draft, you've seen a pint glass—specifically a shaker pint. These reliable, durable glasses are the go-to beer vessel for many establishments. Unfortunately, they're a terrible choice for tasting beer. Their shape and size, while sturdy and practical for rowdy beer halls, detract from several subtle sensory experiences of tasting beer.

So, the beers you taste as part of this course are associated with ideal glassware to enhance the sensory experience. Some glasses do this by concentrating aromatic compounds in the glass or slowing the dissipation of carbonation. Others stabilize foam, help control temperature,

or enhance the visual aesthetics of a particular style. Still others have historical and cultural significance for that style. But you don't need to buy a set of special beer glasses—a stemmed white wine glass is always a great default choice for tasting beer.

And it's the condition of your tasting glass, rather than the type, that's crucial. Have you ever ordered or poured a beer and seen bubbles on the side of the glass? If you have, here's some bad news: Those bubbles were the result of dirt, oils, or detergent residue clinging to the inside of the glass. Residues like these can introduce off flavors and significantly decrease how long the foam stands on the top of your beer. So, to make sure you're drinking from a "beer-clean" glass, follow these steps:

1. Clean your glass by hand in very hot water that isn't shared with dirty dishes that served food or other beverages. Use an unscented detergent that isn't fat- or oil-based.

2. Use a brush or sponge to scrub the entire glass inside and out, and don't forget the bottom. After you're done, rinse the glass thoroughly in clean, cold water.

3. Set the glass out to air-dry. Though you'll be tempted to use a towel, don't. Towels can leave behind residual odors and lint. Use a wire rack to encourage air circulation rather than setting your glass on a towel or plastic surface, which can transfer and trap odors inside the glass and slow the drying process.

4. Rinse clean glasses one more time in cold water just before pouring to ensure that no dust or other airborne particles settled while drying.

You'll know you've done the job right if there are no bubbles clinging to the side of the glass after you've poured and the collar of foam on the top remains intact as you begin to drink. And you should see a beautiful lacing effect on the side of the glass after every sip.

Once your glass is clean, do not put it in a freezer! Freezing coats a glass with microscopic ice crystals, which become nucleation sites. The dissolved carbon dioxide in beer will form bubbles at these sites that will rise to the top of the glass, which greatly accelerates decarbonation. Not only do frozen glasses lead to prematurely flat beer,

but an ice-cold liquid numbs your taste buds, which makes for a bland and unenjoyable sensory experience. If you're looking for a cool glass, you can pop it in the refrigerator. But room temperature will do just fine.

Now that your glassware is ready, it's time to pour beer. You can go into a lot of depth in perfecting the beer pour, but here's a quick method for getting a great pour for most beers:

1. Open the beer package and be ready to pour immediately. Carbonation and aromatic compounds start to dissipate the moment you open the container.
2. Lift your glass and hold it at a 45° angle so that beer will initially flow down the side of the glass.
3. About two-thirds to three-quarters of the way through the pour, gently turn the glass upright and pour down the middle of the glass to create a one-inch collar of foam.

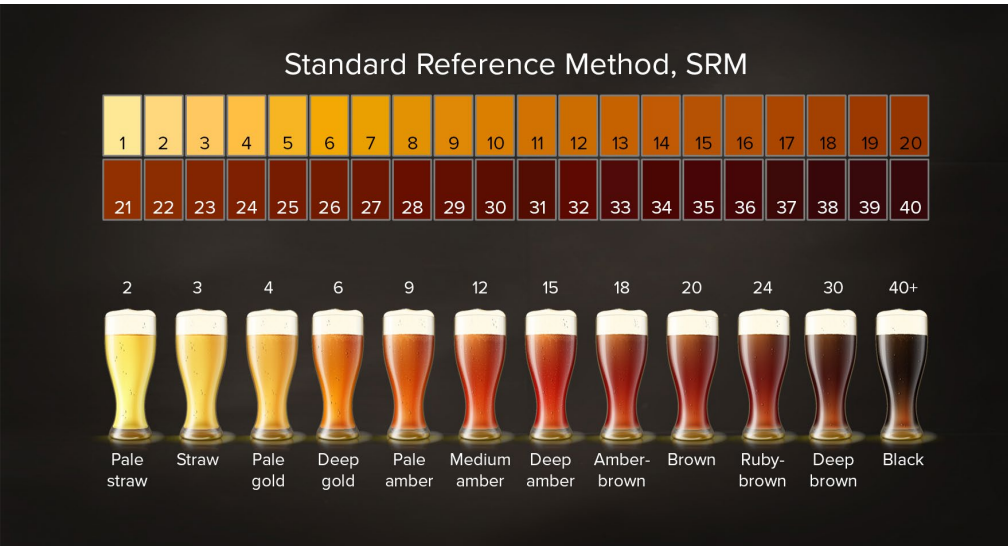
Method for Evaluating the Sensory Aspects of Beer

When you're tasting a beer, there are four sensory markers you want to evaluate: appearance, aroma, mouthfeel, and flavor.

The first is appearance. When assessing this, you are looking primarily at color and clarity as well as the structure of the foam that tops the glass.

Beer color is officially judged by the Standard Reference Method (SRM) scale. It's assessed by passing a beam of light through a one-centimeter column of beer and measuring the attenuation of that light. The SRM scale can be translated into a common range of familiar colors, with lighter colors at the low end and darker ones at the high end. Pale lagers clock in around 2 SRM and are a very light straw-yellow color. At the other end of the scale, dark stouts and porters can register at 40 SRM and above and are deep ebony to virtually black in color.

Clarity, or turbidity, is another important visual quality of beer, and it can range from brilliant and clear to cloudy and opaque. There's a scale for measuring turbidity, too: formazin turbidity units. Clarity depends on how much insoluble material is in your beer. And traditionally, greater clarity was a sign of quality since it requires greater care and filtration after brewing to minimize any suspended solids.



Of course, there are always exceptions. For example, a traditional German hefeweizen is in part defined by its cloudiness due to a large amount of suspended yeast sediment. And in recent years, deliberately hazy beers have become more popular—for example, hazy IPAs, which are hazy because of plant-based solids left over from the huge number of hops added during conditioning. All of this is to say that appropriate clarity—like color—depends on the style of beer you're drinking.

Finally, the foam at the top of a beer can have several structural and aesthetic qualities. It can be loose and airy or dense and creamy, be stiff and persistent or more fleeting, and have color ranging from bright white to a subtle tan color. What sort of foam your beer should have depends on the style you're tasting.

The second sensory marker is aroma. How something tastes is enormously influenced by aromas, though you often don't consciously notice smell in the same way you experience taste. It can take a bit of effort to train your nose to pick up on subtle aromatic notes, but keep at it and you'll get the knack—a good excuse to taste a lot of beer!

Generally, there are three moments during the tasting process when you'll want to be evaluating the aroma of your beer.

The first occurs while you are pouring beer from the package and before you take that first sip. Pouring agitates the beer and releases a huge quantity of aromatic compounds. Take some time to evaluate the aromas you get from a distance of 18 to 24 inches. Employing a technique that some call a drive-by is a great way to identify dominant aromas and some common flaws.

Next, take a whiff from the glass up close as you prepare to take your first sip. This process is referred to as orthonasal olfaction. You are pulling aromatic particles up through the nostrils, through the nasal cavity, and to the olfactory bulb, where signals are sent to the brain. You may want to gently swirl your glass to help this process along.

Finally, take a sip of beer and let it coat your entire mouth. Then, breathe out and take note of the impression of the aroma as you gently exhale. This process is referred to as retronasal olfaction. Aromatic

Beer Styles

When it comes to styles, beer is a lot like dogs. When dogs are judged in competitions, they aren't judged against each other. Rather, each dog is evaluated for how well it meets the defined standard for the breed. Beer competitions work the same way. Individual beers are assessed on how well they meet the criteria for their style as defined by a set of published standards, such as those published by the Beer Judge Certification Program, which provides a great baseline if you want to start getting serious about evaluating beer.

But many pets can't be compared to the ideals of a breed standard. They are the product of an untraceable genetic lineage that has resulted in the most perfect family pet. Many beers, especially those produced by small and independent local breweries, are the product of creativity and innovation that eludes the boundaries of traditional styles and doesn't conform to a set standard. That's as it should be! Exploring and evaluating the world of beer should never take away from what it's really there for: your enjoyment! Sometimes the best beer in the world is the random mutt of a brew you find at your local pub and enjoy with friends. Cheers to that!

particles are volatilized when they are warmed across the surface of your tongue and then travel up through the back of the throat to the olfactory bulb.

Orthonasal and retronasal olfaction can produce quite different impressions of a beer's aroma, so make sure you take the time to do both.

The third sensory marker is tactile—what's called mouthfeel: how a beer feels when you hold it in your mouth and then swallow. Mouthfeel captures all the attributes that aren't sensed by your taste buds. When you eat, you don't actually taste how spicy or hot your food is, for example—it's actually pain receptors in your mouth that detect those sensations. The same goes for the heat in the alcohol of beer.

The most noticeable element of a beer's mouthfeel is carbonation. Some beer styles are lively and effervescent, while others are completely still. Carbonation with more carbon dioxide in the gas blend will create bigger bubbles that tingle and feel sharp in the mouth. More nitrogen in the gas blend will create a tight foam with small bubbles, and that will feel silky and creamy.

A second mouthfeel element is the impression of fullness and weight. Does the beer feel heavy, filling, and dense in the mouth (what might be called full-bodied)? Or does it feel light and thin?

Finally, aftertaste is what you perceive in your mouth after you swallow. Some beers can be syrupy, with residual sweetness lingering in your mouth long after you swallow. Oiliness, acidity, and bitterness are also sensations that tend to linger. Other beers can be crisp and dry, with a palate-cleansing finish and very little aftertaste.

The fourth sensory marker is the taste, or flavor. And of the five basic tastes humans perceive—bitterness, sweetness, sourness, saltiness, and savoriness—it's really only the first three that you'll commonly experience in beer. Salty- and savory-tasting beers are rare, though there are a few out there—such as gose, a sour German wheat-based beer that has a pronounced saltiness. And oyster stouts are brewed with oyster shells or even whole oysters that can lend a savory brininess.

Bitterness, primarily provided by hops or roasted malts in darker beers, is balanced in varying degrees by the sweetness provided by malted grains and yeast-derived compounds. Other additions can also

contribute to the balance of bitterness and sweetness in beer. Some more common ones include fruit, chocolate, and coffee, but ingredients as exotic to beer as peanut butter, breakfast cereal, and bacon have been added by daring craft brewers.

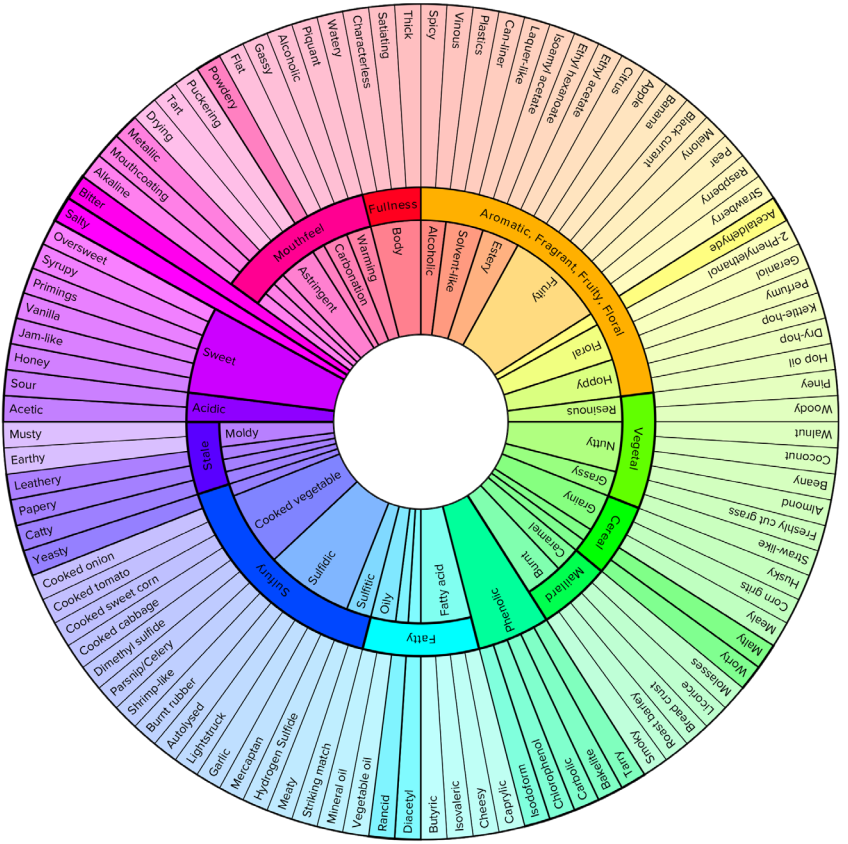
There's an incredible diversity of flavors a beer can take on, but most flavors you'll be able to trace back specifically to the malt, hops, or yeast. The malt profile of a beer can have a tremendous range. It can be sweet, toffee-like, or caramelly; or bold and roasted like chocolate and coffee; or doughy and biscuity; or gently toasted and graham-crackery.

Similarly, depending on the strain of yeast used, the fermentation process can produce a wide range of tastes and aromas. Phenols can be peppery or clove-like. Esters often produce fruity notes or the perception of a bubble gum–like sweetness. Other microorganisms can produce sourness comparable to that found in sauerkraut and yogurt—sometimes even barnyard flavors you might describe as "horse blanket" or "hay."

Even when the beers you're tasting aren't particularly strong or robust, you're going to want a palate cleanser before you move on to the next beer. Water is a great choice for cleansing your palate, but you might want to eat something like a bland cracker or unsalted bread. You can also sniff some coffee beans or just smell yourself to clear your olfactory senses.

Hops are generally bitter, though there's still a lot of variety in just how bitter, depending on how hops were utilized during the brewing and conditioning process. Hops also have a massive variety of botanical flavors and aromas, from herbal and peppery to piney and dank. Today's most popular hops are known for their big fruit flavors. Citrus, tropical, and stone fruit profiles are all increasingly common in the hop-forward styles of North America.

But one descriptor that's inaccurate is *hoppy*. Given that nearly all modern beer has hops in it, this is like describing the taste of a sandwich as bready. What people often mean when they say this is that the beer is bitter, but today that's rarely accurate. Many of the most heavily hopped beers on the market utilize hops in ways that produce almost no bitterness in the finished product.



A useful tool that can help you start building a vocabulary to describe the taste of a beer is the flavor wheel. It's been used internationally since the 1970s to help brewers and aficionados find a common language. The first version of the wheel identified 122 flavor notes in 14 categories, ranging from fruity flavors like black currant to off flavors like papery (a sign of excessive age or mishandling). You can find a lot of different takes on the flavor wheel online, and many of them are helpful.

However, the lexicon used when tasting and evaluating beer can be intimidating and confusing and can even come across as a bit elitist. So, feel free to create your own vocabulary that's drawn from your culture and past experiences.

Tasting List

Style	Brand	Special Glassware
Munich helles	Augustiner Lagerbier Hell Hacker-Pschorr Münchner Gold Löwenbraü Original Paulaner Münchner Lager Schönramer Hell Spaten Münchner Hell **Weihenstephaner Original Helles**	pilsner glass
fruit lambic	3 Fonteinen Schaerbeekse Kriek Cantillon Fou' Foune Cantillon Lou Pepe Framboise Hanssens Oude Kriek **Lindemans Framboise** Oude Kriek Boon	

Pilsner glasses were developed around the same time that pilsner and other light-colored lagers were becoming popular in Bavaria.

Lambics are some of the most atypical beers. They are often produced using some raw ingredients that are not fresh, such as aged hops.

Tasted in lesson!

Helles means "pale" in German. Helles is a lager, but it's not a pilsner. In fact, the style helles was developed in 1894 by the Spaten Brewery to compete with the pilsners and other light-colored lagers that were becoming popular at the time. Helles is a session beer, which means low in alcohol and high in refreshment (you can have a few of these in a session and not feel too impaired).

2

BEER ARCHAEOLOGY: CIVILIZATION AND ANCIENT ALE

This lesson dives into ancient history and archaeology through the lens of beer. You'll sample beer that can help take you back to the long-distant past, when what was understood to be beer was radically different from beer today.

Dogfish Head's Midas Touch

What if a beer could take you back in time? What would it taste like? What would it illuminate about the people and places of the past? These are the questions that the brewers of Dogfish Head Craft Brewery attempted to answer when they teamed up with a biomolecular archaeologist to make Midas Touch.

In 1957, the Midas Tumulus, a tomb in central Turkey at the ancient site of Gordion, was excavated. Found along with the remains of a man believed to be the father of the fabled King Midas were 157 bronze vessels, including vats, jugs, and drinking bowls, that contained the residues of the beverages left for the departed sovereign to enjoy in the afterlife.

Those vessels sat undisturbed in the archives of the Penn Museum until Patrick McGovern, a scholar of ancient alcohols, unearthed them for a second time. Using gas and liquid chromatography as well as infrared and mass spectrometry, McGovern identified traces of the ingredients of traditional fermented beverages: grapes, beeswax, yeast, and barley. This led McGovern and his team to conclude that the vessels contained a drink that was a hybrid of grape wine, barley beer, and honey mead. With his findings in hand, McGovern challenged a group of craft brewers at an industry event in 2000 to reverse engineer a palatable beverage from the ingredients his team discovered. And Sam Calagione of Dogfish Head Craft Brewery, known for brewing off-centered ales with unexpected ingredients, received the honor of working with McGovern's lab to do just that.

History, like the Midas Touch ancient ale they created, includes elements of interpretation, storytelling, and invention. Inevitably, artifacts from the past are interpreted through contemporary sensibilities, tools, and technology. And while people may speculate about what ancient people were imbibing, ultimately those speculations are filtered by the palates and tastes of today. Midas Touch, like many historical beer recreations, inevitably falls within the

boundaries of what 21st-century cultures find palatable. They also reflect the use of modern technologies such as precise temperature control, the ability to create sterile environments, and intimate knowledge of the chemical and microbiological processes that produce beer. Modern yeasts have undergone generations of guided evolution by brewers and likely bear only a fleeting resemblance to those used to brew beer in ancient Turkey.

What is preserved from the ancient past overwhelmingly favors the powerful elite, too. The beer preserved in the tomb of a Phrygian king might itself have been a rare and luxurious thing, unobtainable by or unrecognizable to the average citizen, whose culture, habits, and beers virtually nothing is known about. But while the Midas Touch ale is undoubtedly nothing like that which graced the lips of Phrygian celebrants living in the 1st millennium BCE, it might just get you closer to experiencing the tastes, smells, sights, and sounds of the world of King Midas than your grade-school history texts ever could have.

Beer in Early Human Civilization

It is often said that beer is as old as human civilization itself. There are six cradles of civilization—parts of the world where ancient civilizations arose independently, or free from the influence of another civilization—that are generally recognized by historians. And in all six, evidence of beer has been found. This is no coincidence. Civilizations are primarily characterized by the development of cities and settled populations, which rely on agriculture and/or aquaculture for their sustenance rather than nomadic hunting and gathering. To support an urban population, and new classes of rulers and professions that do not make their living off the land, an agricultural surplus is required. High-yield caloric crops are the key. Rice, maize, wheat, and potatoes are the staple crops for about 80% of the world and have been since humans gave up their nomadic ways of life. Nearly all the staple crops of civilization are high in starches—perfect for meeting the energy needs of growing populations efficiently, but also for fermentation.

Easily accessible sources of water are another key precondition of civilization. The Tigris, Euphrates, Nile, Yellow, Indus, and Coatzacoalcos Rivers all provided a critical source of drinking water and a means of transportation for spreading people, materials, and ideas across regions where civilization emerged. These rivers also provided ample fresh water for staple crop irrigation, and alluvium—rich, fertile soils—were

periodically deposited in the rivers' floodplains. The ample water and soils that support the cultivation of cereal grains also supported the proliferation of certain microfauna—in particular, wild yeast—which meant that fermentation, and ultimately beer, would eventually be discovered by all these riverine cradles of civilization. That said, the styles and traditions around these beers would vary hugely.

The Mesopotamian cradle of civilization is where the earliest evidence and recorded histories of beer are found. Encompassing the areas regularly flooded and irrigated by the Tigris and Euphrates, an area known as the Fertile Crescent, archaeological evidence of brewing activity in Sumer dates to the late Stone Age. In the Raqefet Cave in today's Israel, beer residue and evidence of fermentation has been found in rock cavities that are possibly 13,000 years old.

The first written records of beer also come from Mesopotamia—specifically the Sumerians, among whom beer appears to have been a popular drink. Though Sumer was an oral culture, writing and the first written recipe for beer emerged from this region. Tablets have been found recording beer sales and barley rations, and there are several cuneiform pictographs related to beer.

The Sumerian goddess of beer and brewing, Ninkasi, had nine children, all named after the alcoholic drinks or their effects—one child is named "the brawler," for example.

The Sumerians also had a goddess of beer and brewing: Ninkasi. The *Hymn to Ninkasi*, believed to be recorded in approximately 1800 BCE, is widely believed to be the world's first written record of a beer-making process. Because knowledge in oral culture is frequently passed down through hymns and verse, the *Hymn to Ninkasi* was more than likely recited and sung by generations of brewers for millennia before it was committed to a clay tablet.

Sumerian beer was a thick, porridge-like substance made from fermented barley bread. And the evidence suggests that beer was served in large communal urns and drunk through straws. These earliest beers, then, would have been like gruel or porridge—part food, part drink—virtually unrecognizable to most people today.

Nevertheless, these beers were undoubtedly both decently caloric and alcoholic, a winning combination for those who toiled in ancient Sumer. And Sumerian beer culture seems to have been transmitted to the

Nile River valley, the next-closest cradle of civilization. But Egypt was very soon a vibrant hub of brewing activity whose brewing traditions date back nearly as far as the Sumerian tradition.

Beer was an essential part of ancient Egyptian culture, too, consumed daily among every walk of life. The beverage was an essential source of energy for laborers, who were provided with a generous daily ration. Undoubtedly, Egypt was a civilization whose economy ran on beer and bread, and the Egyptians constructed much larger breweries and bakehouses to increase the efficiency of their production.

Beer was also an important part of ceremonial and ritual life; it was consumed by pharaohs and conferred with divine status by association with the gods. Like in Sumer, beer seems to have been served in large urns or heavy ceramic jars, and these same urns can be found throughout Egyptian tombs, some with depictions of people drinking from them with large straws. Elaborate versions of these straws, inlaid with precious stones and metals, have been found in the tombs of various pharaohs.

On the other side of Eurasia lies the Yellow River valley in today's northern China, where gunpowder, papermaking, printing, and Chinese dynasties all have their origins. And archaeologists have discovered evidence of beer making from around 5000 to 7000 BCE. Residue found on the inner walls of pottery vessels from a Yellow River valley excavation site has found evidence of brewing with millet, barley, an ancient grain called Job's tears, and tubers like yam and lily root. The presence of barley suggests that early beer making may have been the motivation for the translocation of barley from western Eurasia into the central plain of China, which is remarkable given its later centrality to the Chinese diet.

Chinese beers would have also been a thick, porridge-like brew that would have been consumed with straws. However, scholars have posited that these beers were not commonly consumed and were likely associated with ceremonial occasions, in contrast to the widespread

consumption of beer in the Fertile Crescent. In 2021, evidence of beer was discovered in a platform mound, surrounded by a human-dug ditch, along with a pair of human skeletons, indicating a brew was likely part of a ritual to honor the dead.

Sometime during the Han dynasty, however, around 2,000 years ago, Chinese beer was completely supplanted by *huangjiu*, a drink fermented from boiled rice or millet using rice yeasts and molds. Like wine, *huangjiu* is typically sweeter and more alcoholic than how beer is thought of today. Beer was reintroduced by Europeans to China in the 19th century, but archaeologists are only now discovering fascinating details of its earlier origins there.

The Indus valley civilization is another cradle of civilization that encompasses an area that now spans northeast Afghanistan, much of Pakistan, and western and northwestern India. A wide variety of fermentable starches, including barley, eleusine, millet, legumes, and rice, were extensively cultivated in the region and held in large granaries. Stores of surplus grain are largely acknowledged to be a precondition for the development of large-scale brewing. Some traditional brewing methods that date back to early civilizations in the Indus River valley can still be observed in northeast India today. Traditional beer vats of stone, used to brew rice beer, were likely once a common sight in areas of India such as Meghalaya before locals converted to Christianity and repurposed or recycled the stone from these vats.

Like with ancient Egypt and China, there's strong evidence in ancient India of beer's religious and social importance, too. A beer-like drink called surā is mentioned in the Rigveda, a book of verses that is one of four canonical texts (the Vedas) of the Hindu religion and is mentioned in later Brahmin texts, too. Surā beer was used in spiritual rituals but was also consumed regularly by elites, merchants, and farmers alike as an everyday beverage. Some smaller ethnic groups in India, such as the Asur people, still incorporate beer into their customary and spiritual rituals. Vedic literature points to an expertise in multiple brewing methods, including grain malting as well as amylolytic ferments, that degrade complex starches into simple fermentable sugars with the help of enzymes found in yeast, mold, and fungi.

While the civilizations of Mesopotamia, Egypt, China, and the Indus may have exerted some influence over each other's brewing culture through long-distance trade and communication—direct or indirect, over

thousands of years—in the cradles of civilization of Mesoamerica and the Andes, no such contact was possible. And yet here, too, evidence of beer culture emerging independently is found.

Andean civilizations emerged in the river valleys in the coastal deserts of present-day Peru. They stretched from the mountainous region of southern Colombia southward to Chile and northwest Argentina. And right in the middle of this cradle of civilization, on a mountaintop excavation site in southern Peru, the remains of an ancient brewery have been found. *Brewery* generally means a big manufacturing facility equipped with large stainless-steel tanks and the means of heating, cooling, and moving huge volumes of liquid. Remarkably, the brewing complex built by the Wari culture at Cerro Baúl is not much different.

The Wari culture, who controlled the Peruvian coast and highlands several centuries prior to the rise of the Inca empire, built a dedicated brewing facility between 600 and 1000 CE. It boasts a row of 12 large ceramic jars which held roughly 40 gallons of liquid each. The Wari brewing complex featured separate rooms for milling sprouted grains—which, in the case of beers from the early Americas, would not have been barley, rice, or wheat, but maize—to produce a beer commonly referred to as chicha.

In addition to evidence of corn-based beers, archaeologists at the Cerro Baúl site found seeds of *Schinus molle*, a native berry that, when dried, is sold as pink peppercorns. The Wari would have soaked and heated molle to release the sugars and then discarded the pits or seeds. These seeds were found in abundance on the floor of the brewery site.

Mesoamerican civilizations emerged in present-day Central America and southern North America, on the coast of the Gulf of Mexico and the basin of the Coatzacoalcos River. Like the early civilizations of the Andean regions of South America, Mesoamerican cultures would have produced a corn-based chicha. However, the addition of cacao—the seed from which cocoa and chocolate are derived—made Mesoamerican chicha distinct.

The brewing process of early Mesoamerican civilizations was also distinctive. Rather than relying on malting corn to prepare it for the brewing process—during which kernels are sprouted and then ground or milled—Mesoamerican chichas were most commonly produced via a process called insalivation. Those involved in brewing would have chewed the corn and then spit it into a vessel. The chewed corn would

have been later heated and strained before fermentation. Though the process of insalivation more than likely offends modern sensibilities, given the widespread understanding of microorganisms, bacteria and viruses, and infectious disease, the process is an ingenious one that utilizes naturally occurring enzymes in human saliva to convert complex starches to simple fermentable sugars. Intoxicants were often reserved for the elite in ancient Mesoamerica. For example, pulque, an alcoholic drink fermented from the agave plant, was sacred in Mesoamerican society and highly restricted in its availability.

Tastes of the Ancient Past

So, beer is indeed as old as human civilization. Early urbanization was dependent on the presence of fertile soils and fresh water that supported the widespread cultivation of cereal grains. And political and economic consolidation created the conditions ripe for social and spiritual integration of beer into everyday life. Ironically, however, none of the regions discussed in this lesson are centers of modern beer making, and many ingredients once commonly used to make ancient beers—millet and quinoa, corn and rice, tubers and legumes, berries, seeds, and spices—have given way to the primacy of barley and hops.

Indeed, one of the legacies of centuries of conquest and colonialism is that much of the world's indigenous beer culture was effectively suppressed or supplanted by the version of beer that evolved in medieval Europe. The result is that while beers like the Midas Touch ale can offer a vague sense of the tastes of the ancient world, they are at best theoretical imitations—educated guesswork—and the window to the ancient beer-drinking past is a distant one.

There are, however, some pockets in the world where local brewing traditions have remained relatively unchanged since ancient times. And some are undergoing revivals. Chicha de jora, a descendant of those ancient Andean beers and prevalent in the Incan empire, has survived as a local brewing tradition in some villages and towns in Bolivia, Ecuador, and Colombia and has even become mainstream again in southern Peru.

Sorghum-, maize-, and millet-based porridge beers can still be found in parts of sub-Saharan Africa, usually home-brewed for use in local rituals and customs. Umqombothi, for example, is a ritual beer drunk as part of the initiation and circumcision ceremony for young men of the Xhosa culture. Low commercial appeal, a lack of industrial-scale production, and modern health regulations mean that many of these drinks are likely never to be found in your local supermarket—they remain experiences you'll just have to go on an adventure to have.

But there are a few tastes of the ancient past that can still be found if you're willing to look around a bit. For example, *tej* is an Ethiopian drink that ranks as even more ancient than any of the beers discussed in this lesson, originating in the part of Africa where likely all mankind originally emerged.

Tej is a mead, fermented from honey. Meads are generally considered neither wines nor beers, but its historical connection to the two is likely critical. Mead doesn't need agriculture or pottery to develop, given the widespread prevalence of honey in the wild, so evidence suggests that meads predate even the most ancient civilizations. Mead at its most basic can be produced by natural fermentation in a bee's nest that's been flooded. Early tribes of hunter-gatherers likely discovered, perhaps by accident, that flooded hives produced a sweet and mildly intoxicating beverage and learned how to recreate the conditions.

Meads independently arose across Africa, Asia, Europe, and the Americas. With the coming of agriculture and settlement, beer and wine soon took over, in large part because honey is much harder to produce at scale than grapes or cereal crops. But it's very likely that knowledge of mead guided ancient peoples to discover other fermentable drinks. The simplicity of mead, though, has meant that its basic ingredients and production have remained largely unaltered for millennia, and it is still readily reproducible today. *Tej* is just a mix of honey and water, spiced with an herb called gesho, or shiny-leaf buckthorn. It is still the national drink of Ethiopia.

Tej is still widely available at Ethiopian restaurants, sometimes described as "honey wine," with a taste that is still similar to what our earlier ancestors experienced. It's incredible to think that by sipping *tej*, you're getting a sense of what our ancestors drank in the cradle of humanity.

Tasting List

Style	Brand	Special Glassware
ancient ale	**Midas Touch** is an ancient ale produced by **Dogfish Head Brewery**. Historical recreations may not conform to a particular style. Commercial examples can be hard to find. Microbreweries sometimes produce historical beers as specialty offerings.	white wine glass
Ethiopian *tej*	Commercial examples of *tej* may be available in international supermarkets, but it is easiest to obtain from Ethiopian restaurants, where it may be sold under names like "honey wine."	

Tasted in lesson!

3

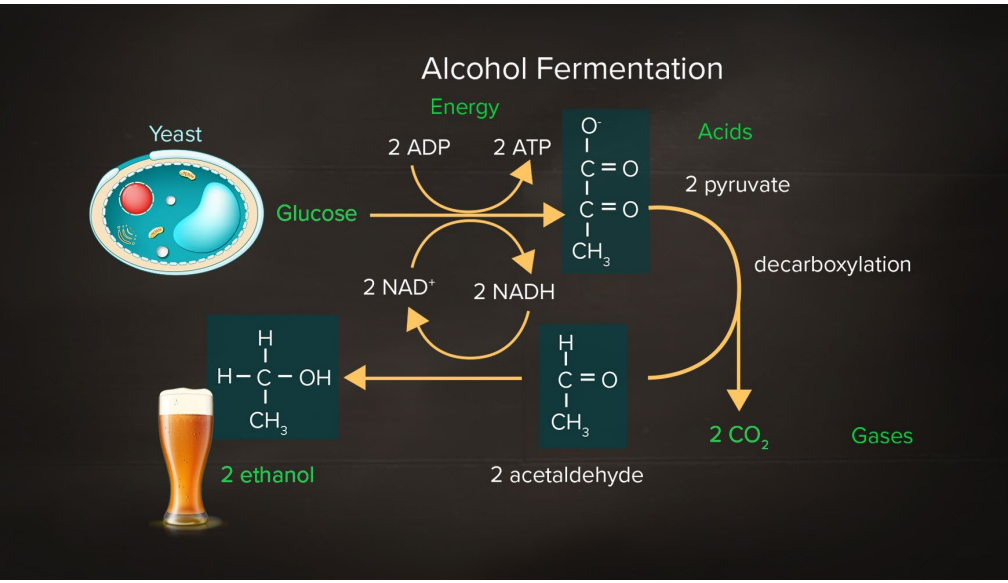
BEER BIOLOGY: YEAST, FERMENTING, AND SAISONS

In 1680, the Dutch scientist Antonie van Leeuwenhoek stared down his microscope—one of the most powerful yet invented—into a sample of beer. In a letter to his colleague Thomas Gale, van Leeuwenhoek describes little globules, similar in size to blood cells, floating around. He draws some diagrams of their shape and speculates that these globules must be some by-product of the brewing process, perhaps originating from the malted grains. He also notes bubbles of air that come to the surface of fermenting beer, but where they were coming from, he couldn't say. Of course, the globules von Leeuwenhoek drew were, in fact, yeast, and far from being a by-product of the brewing process, they are the living, metabolizing organisms that drive the whole show. Yeast is the biological wonder behind beer. And beer has a great deal to teach us about one of the most basic, prolific, and ecologically important forms of life.

Yeast and Fermentation

Yeasts are single-celled microorganisms that are classified as fungi. They evolved hundreds of millions of years ago, and more than 1,000 different species have been identified. Yeasts live just about everywhere on earth—you can find them on the surface of fruits and vegetables, in the soil, in the sea, on insects and animals, and even on and throughout the human body. Most yeasts proliferate by consuming simple sugars and metabolizing those sugars to produce energy while leaving behind a few by-products, usually acids and gases. This process is called fermentation. We've come to think of it as a process discovered and manipulated by human beings, but in fact fermentation happens all around us all the time, as organic matter is broken down and digested by fungi in every conceivable environment.

Humans have had a complex relationship with yeasts, molds, and other microorganisms that interact with our primary food sources for millennia. In the modern era, we've come to view most spontaneous fermentation as negative—it's the spoilage that makes our food unpalatable, or even toxic. This point of view has prompted a great deal of innovation, from refrigeration to chemical preservatives. But



for much of human history, we've had far more tolerance for foods undergoing transformations initiated by fungi—like yeast and mold—or bacteria. Nearly every culture on earth has used fermentation as a means of culinary preservation and innovation. Fermentation produces wonderfully rich and complex flavors that are still found today in foods like yogurt, kimchi, miso, sauerkraut, vinegar, and cheese. And luckily for us, our ancestors figured out how to collaborate with microorganisms to repeatedly achieve those delicious results.

Yet a small set of yeasts and molds do something especially interesting to humans and some animals: metabolize sugars into carbon dioxide and ethanol, aka alcohol. And out of that small set, there is one genus of fungi that humans have been using for thousands of years to bake bread, ferment wine, and brew beer. It's called *Saccharomyces*, which means "sugar fungus." Yeasts that are part of this genus have been of great use to humans because they ferment sugars at a fast and predictable rate, in environments and at temperatures humans tend to be comfortable in and in places that make them easy for people to find. *Saccharomyces* has been such a hospitable collaborator that for most of history, humans have enrolled them in the production of alcoholic beverages without even knowing they were there.

That is not to say that the history of controlled fermentation can be put down to luck and ignorance. Rather, cultural knowledge served as an excellent stand-in for scientific knowledge. A woman whose mother, centuries ago, taught her that adding a bit of home-brewed beer to her dough would do in the absence of a bread starter didn't have to understand that she was inoculating her dough with a live yeast culture—nor did the alewife, who insisted that using her great-granny's wooden paddle made the best beers in the village, need to understand that the porosity of the paddle's wood made it an excellent storage and inoculation tool for dormant yeasts. Nor did it take formalized scientific training to observe that what made bubbles in beer could also make bubbles in dough, and that the baker and the brewer had more than just grains in common. It's no wonder that evidence of leavening enters the archaeological record around the same time as brewing.

The Microbiology That Drives Brewing

The process of beer making can be broken down into four basic steps: wort making, wort boiling, fermentation, and packaging. The first two steps will be covered in the next lesson. It makes sense to look at the third stage of the beer-making process first because fermentation is central to the decisions that brewers make in the other three stages.

Fermentation starts with a wort: an infusion of malted grain. If you've ever made a cup of tea, you've made an infusion of tea leaves and herbs. Swap out the tea for crushed malted grain and you've got wort. Wort that will eventually become beer is handled in very precise ways, including a lengthy period of boiling during which hops are typically added. However, the main thing to understand for the purposes of this course is that the first two stages of beer making have one very important goal in mind: to create an ideal environment for yeast to thrive and fermentation to occur.

You could say that home brewers don't make beer—they just make amazing places for yeast to live.

Most modern beer fermentation begins when yeast is introduced to a roughly room-temperature wort in a nonporous, nonreactive vessel—such as the large stainless-steel tanks you see at your local brewery or a glass carboy you might use at home. In addition to being inert, these vessels are designed to be sealed off from the environment outside. The yeast that is introduced—or pitched—into wort today is generally of a specific strain that has been isolated in a lab, and modern brewing processes take great pains to ensure that the only microorganisms able to flourish during brewing are the strain or strains of yeast that are intentionally introduced. Commercial yeast labs have dozens of strains in their libraries, each with different characteristics that are suited to specific beer styles and brewing environments.

Not too long ago, though, beer would have commonly been fermented in wooden barrels and clay pots and inoculated with yeast by leaving the brew open to the elements. Or bigger breweries could skim part of a rocky-textured foam that forms on the top of an actively fermenting beer, called the krausen, to kick-start the fermentation of subsequent batches. Under such circumstances, the beer would have almost certainly been fermented by a combination of different yeasts and bacteria—not just *Saccharomyces*.

When *Saccharomyces* arrives in wort, it finds a virtual paradise. Wort is full of simple sugary nutrients as well as ample oxygen for it to feast on. Upon entering its new environment, yeast builds up internal glycogen stores—energy it will use to reproduce. For brewers, this is the calm before the storm, referred to as the lag phase, where there doesn't appear to be any discernible activity. That changes in a hurry. Once the yeast has built up sufficient glycogen stores, it enters the respiration, or growth, phase, budding and multiplying in numbers up to four to six times its original cell count.

While the yeast colony grows, it metabolizes the abundant sugar into energy and produces several by-products, including carbon dioxide. This vigorous off-gassing, observed in the first few days of fermentation, is what produces a foamy krausen on young beer and what gives rise to bread when *Saccharomyces* is introduced to dough. Other by-products produced by yeast depend on whether it undergoes aerobic or anaerobic respiration.

In the presence of oxygen, *Saccharomyces* produces carbon dioxide, acid, and water. But in the brewing of beer, yeast will quickly use up all the available oxygen in the environment, and the rest is lost through carbon dioxide rising to the surface. So then, *Saccharomyces* switches to anaerobic fermentation, which primarily produces carbon dioxide and alcohol. In this state, yeast will gradually transform its environment, converting sugars and other trace nutrients into alcohol and producing other by-products, such as esters and phenols. It is during this process that yeasts dramatically transform the flavor of wort to something that would be recognized as beer.

Eventually, the environment that was at first a paradise becomes inhospitable. As the fermentation winds to a close, individual yeast cells will clump together in groups called flocs and sediment out of the solution. Flocculation allows the yeasts to take advantage of their collective density and either float to the surface or drop to the bottom, where they are more likely to find a hospitable environment. After flocculation, yeast enters a state of dormancy that can last months or even years in harsh conditions, until the right environment comes along and they can reactivate and reproduce again in the future.

Flocculation is dependent on the specific strain of yeast that's used. Highly flocculant strains come out of solution early, leaving behind fermentable sugars and by-products that can produce undesirable flavors. Such strains

may need to be resuspended late in the brewing process to deal with that, but one of the advantages of high flocculation is that it produces a very bright, clear beer. On the other hand, wheat beers, especially the iconic German Hefeweizen, use low-flocculation strains that produce beers that are intentionally hazy with yeast.

Yeast strains also vary in their capacity for attenuation, which refers to the proportion of sugar that has been fermented in a wort. Highly attenuative strains ferment a greater proportion of the available sugar before flocculating—up to 85% or 90%—creating beers that are more alcoholic and drier in taste. Strains with less potential for attenuation leave more residual sugar in a finished beer, resulting in a sweeter product of lower alcoholic strength.

The temperature of the fermentation environment also produces significant variation in yeast behavior and beer flavor. Two identical worts using two identical yeast strains can produce two very different beers simply by manipulating the temperature during fermentation. As a rule, heat makes yeast more active and more expressive. That's especially the case with *Saccharomyces cerevisiae*, the species of yeast that produces the beers known as ales. They typically ferment at temperatures between 60°F and 75°F and complete fermentation fairly quickly, within a matter of days or weeks. This species can produce some very pronounced yeast-derived flavors that are most commonly fruity but can also be clove-like, peppery, or reminiscent of bubble gum.

Even slight temperature variations can change the balance of flavors that result. *Saccharomyces pastorianus* produces the beers known as lagers. These yeasts typically ferment at temperatures between 35°F and 50°F and complete the fermentation process relatively slowly, over weeks or months. They tend to produce very clean, restrained beers with little to no detectable yeast-derived flavors.

When yeast completes fermentation and begins to flocculate, a number of undesirable intermediate compounds will still be present in the "green," or young, beer—such as acetaldehyde, which smells or tastes like green apples, cut grass, or latex paint; or diacetyl, which tastes like movie theater popcorn butter. Thus, beer is generally given some additional time to condition, or rest.

Even after fermentation is complete, yeast will continue to break down or absorb these compounds. Meanwhile, aromatic and flavor compounds continue to evolve and mature. Conditioning may be as short as a few days in a stainless-steel tank, or it may be months tucked away in a cool cellar or refrigerated room (known as lagering), or it may even be years in a wooden barrel that may have first held wine or spirits like whiskey (known as barrel aging).

In addition to being at least minimally conditioned, most beer drink is carbonated. How it gets that way varies depending on the needs and resources of the brewer. Today, most commercially produced beer is force carbonated. Carbon dioxide is added, under pressure, to fermented beer that has generally been filtered and conditioned in a vessel called a brite tank. By manipulating the pressure, brewers can dial in precisely how many volumes of CO_2 are dissolved in the finished beer and then transfer it to cans, bottles, and kegs, where it is sealed and ready for dispensing.

However, some commercially produced beers, many home-brewed beers, and all historic examples of carbonated beer would have relied on yeast to take care of carbonating duties. Once fermentation is complete, beer is "racked," or transferred from its fermentation vessel into a package, such as a bottle or cask, where it will be carbonated. A small amount of priming sugar is added, and the package is capped,

corked, or sealed with an airtight bung. This small amount of sugar is enough to wake up the trace amounts of yeast to respire and start producing CO_2 again. However, since the package is closed, the CO_2 doesn't escape into the atmosphere. Instead, it builds up pressure in the package and remains dissolved in the beer, ensuring a reliably effervescent beer when opened.

Over millennia, strains of *Saccharomyces cerevisiae* and *Saccharomyces pastorianus* have evolved in a dizzying array of climates, geographies, and ecologies, producing countless individual strains that ferment under different ideal conditions and produce different perceivable by-products. Many of the unique styles of beer today are at least in part due to very specific yeast variations that produce distinctive flavors.

Pasteurization and Bacteria

Thus far, this overview of beer biology has demonstrated that fermentation is a complex process that's carried out in collaboration with a remarkable genus of living organisms. You've probably also concluded that modern brewing places far more emphasis on isolating particular microorganisms and excluding others—something that was not possible until it was discovered that microorganisms were responsible for the purposeful transformation of grain into beer that humans have been presiding over since the Stone Age.

That discovery didn't happen until the 1850s, when French scientist Louis Pasteur finally solved the mystery of yeast. He started with an exceedingly practical question: Why does beer spoil? In this case, spoilage wouldn't have meant the beer was unsafe to drink, but rather, it would have taken on a pronounced sourness that made it unpleasant. Pasteur wasn't the first to try to address the issue of beer spoilage, but he did have a particularly personal motivation for answering this question. Exquisitely brewed German lager beers were taking over the French market. A patriot through and through, Pasteur decided to use his talents to give French brewers an advantage, though ultimately the entirety of humanity benefited in ways he never could have imagined.

Pasteur discovered that beer was not only alive with organisms that were the engine of fermentation—the large yeast cells—but it was also alive with smaller bacteria cells. He concluded, correctly, that these bacteria were causing the spoilage. His next intellectual leap would

change the world, because Pasteur asked: If bacteria could spoil beer, could they sicken people? The answer forms the basis of germ theory and the key to treating many diseases.

Several processes innovated by Pasteur would eventually revolutionize commercial brewing and food production. Most notably, heating beer or other comestible liquids at approximately 150°F—a process aptly called pasteurization—deactivated the yeast and killed most unwanted microorganisms. Unfortunately, pasteurization does degrade the flavor and aroma of beer and can introduce stale flavors. But at the same time, pasteurization improves the shelf stability of beer and a host of other products, such as juices, dairy, and eggs. Modern brewers, though, realized that the trick was to keep spoilage organisms from getting into beer in the first place—something that requires much more precision in cultivating and using yeasts.

The Danish scientist Emil Christian Hansen was the first to isolate a single yeast strain in 1883. By placing a single yeast cell in a sugary solution, he was able to propagate a pure single-strain culture. The yeast that Hansen isolated and cultured is known today as *Saccharomyces pastorianus*, lager yeast—which, like the term *pasteurization*, bears the name of Louis Pasteur. It's somewhat ironic that Hansen isolated a lager yeast when the ale yeasts from which lager yeasts were derived are far older and far more abundant and were more commonly used in more parts of the world. This is most likely an indirect piece of evidence that confirms the dominance of German lagers across Europe in this period.

And in perhaps another great irony, modern brewers are now using some of the techniques pioneered by Pasteur and Hanson to reintroduce into beer the very same spoilage organisms that they had fought to eradicate. Wild yeasts, for example, are ubiquitous in nature, and several historic styles and modern adaptations are defined by their inclusion. *Brettanomyces*, a different genus of yeast entirely to *Saccharomyces*, is one of the more common additions. Brett, as it is often called, is generally used in combination with more traditional brewer's yeast to produce a mixed-culture or wild beer. Secondary Brett fermentation can produce flavors and aromas that range from floral and earthy or spicy and smoky to descriptions like "funny," "barnyard," or "horse blanket." Typically, *Brettanomyces* adds noticeable acidity and dryness to beer, as it is capable of using more complex sugars than *Saccharomyces*.

Some brewers also continue to invite bacteria to the party—specifically *Lactobacillus*. This class of bacteria ferments sugars, but instead of producing alcohol, it produces lactic acid, a powerful souring agent in beer and other food products. Belgian sour beers such as lambic, some American sour beers, and traditional German Berliner weisse and gose all make use of the souring power of *Lactobacillus*. And if you've eaten yogurt, sauerkraut, kefir, sourdough bread, or kimchi, you've tasted the signature tang of *Lactobacillus*.

Tasting List

Style	Brand	Special Glassware
saison	Boulevard Tank 7 Ellezelloise Saison 2000 Lefebvre Saison 1900 Saison de Pipaix **Saison Dupont** Saison Voisin	
oud bruin	Ichtegem's Oud Bruin Liefmans Goudenband **Liefmans Oud Bruin** Petrus Roodbruin pFriem Oud Bruin VanderGhinste Roodbruin	

Saisons are ales, which means they are fermented with ale yeast. As such yeasts become warmer, they become expressive, adding lots of yeast-derived flavors into the finished beer.

The oud bruin, or Flanders brown, style originates from the Flemish Region of Belgium and has roots that date back to the 1600s.

Tasted in lesson!

Saison Dupont was originally produced in the 1920s. It would have first been a rustic, artisanal ale made with local farm-produced ingredients. But now it's mostly brewed in larger breweries on an industrial scale and is exported around the world.

4

BEER BOTANY: BARLEY, HOPS, AND IPAS

As you learned in lesson 2 on ancient brews, beer is a thoroughly agricultural product that emerged as humans began to congregate in urban civilizations that relied on agriculture rather than hunting and gathering. And in this lesson, you'll get a crash course on the two agricultural products that are used in nearly all modern beer: malted barley and hops.

Barley

Four basic ingredients are needed to make any beer: water, a source of fermentable sugars, a microorganism to power fermentation, and a bittering agent to balance flavor and inhibit spoilage. Often, this list gets simplified as water, malt, yeast, and hops, because nearly all beers today use those ingredients. But as you learned in lesson 3 on yeast, there's a lot more to it than first meets the eye.

Barley is the starting point for most beers. Since it's the staple crop once used to make most bread in Europe and the Middle East, it's no surprise that the first beers were barley-based as well. For various reasons, wheat would eventually take over as the primary cereal grain used for bread and other starchy food products in much of the world—but not so for beer. And that's because barley has several botanical qualities that make it uniquely suited for beer making.

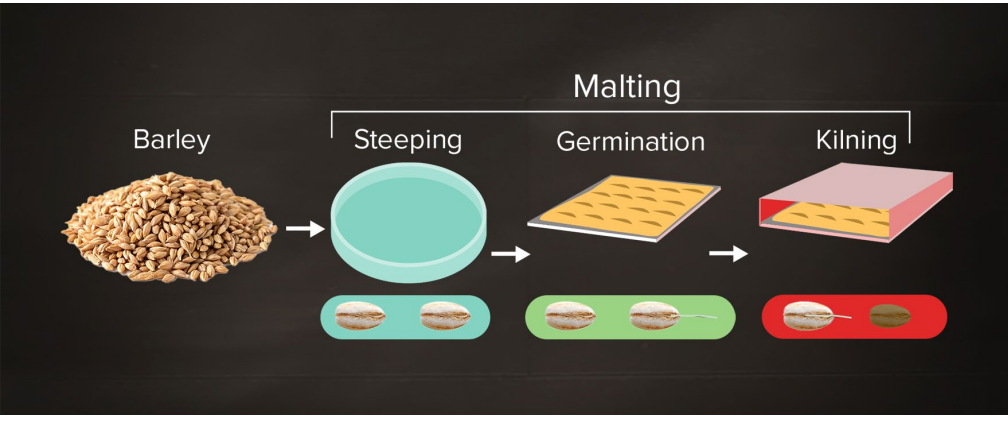
A closer look at the earlier steps of the brewing process explains why. Remember that the previous lesson divided beer making into four steps: wort making, wort boiling, fermentation, and packaging. Yeast was the star player in fermentation and packaging. But yeast can only do its thing when it has a great wort to play in, and that's where barley and hops come in.

But worts don't just grow in fields. If you were to walk into a field of ready-to-harvest barley, pinch a few of its plump grains, and pop them in your mouth, the end result would not taste terribly pleasant, and it certainly would not be sweet. Barley and other cereal grains need a lot of coaxing to get them to eventually produce a wort with plenty of fermentable sugar. That coaxing starts with a process called malting, which itself consists of three steps: steeping, germination, and kilning.

During steeping, cleaned and sorted barley kernels are submerged in water and drained repeatedly over the span of roughly two days. This increases the moisture content of the grain, and when that happens, enzymes are activated that will start breaking down proteins and carbohydrates within the kernel. They do this to create energy for a tiny sprout that is about to grow. Remember, a barley grain is a seed! And that moist environment is telling the grain that it's a good time to start growing.

Next, the second step, germination, begins. The sprout that emerges during steeping is allowed to grow a little, and the grain kernel continues to break down protein and carbohydrates over the course of four or five days.

The final step is kilning, or drying. Kilning halts the germination process, stopping the young sprout from consuming too much of the starch reserves that have been converted over the previous steps. And after the grains are sufficiently dry, the tiny sprouts are removed. And then you have malted barley, commonly called malt.



Changing up the conditions during malting—such as the moisture level, drying temperature, or time in the kiln—can produce a wide variety of flavors in the resulting malt, such as hints of dark fruit like raisins and currants or roasted coffee and chocolate flavors. Like with fermentation, it's pretty incredible what sorts of flavors you can create by just adjusting a few variables.

The main point of a malt is to create a source of sugar for yeast to turn into alcohol, so most of the malts a brewer will use to make their wort will be so-called base malts, which have been malted with fermentation potential in mind, as well as the basic flavor profile, color, and foam collar desired. Specialty malts, though, can be added to the mix of grains used in the wort (known as the grist), and they can provide some of those more exotic flavors, colors, and mouthfeel qualities.

Malting is not actually part of the brewing process itself; it's a pre-brewing step used to make raw ingredients for a wort. It's also not unique to brewing—malted barley is also a key ingredient in the production of some spirits, such as whiskey. And because malting traditionally took up a lot of space and time, it became its own specialized process that was typically completed separately from breweries.

A few hundred years ago, you could find malthouses all over the beer-producing world. These were often long, large, well-ventilated buildings, because much of the germination and kilning was done on massive malting floors, where the germinating grains could be spread out to sprout and then dry. Malthouse workers had to constantly monitor the sprouting grains, which were gently heated using a natural draft kiln and carefully ventilated by natural breezes controlled by windows. Huge malting floors are a thing of the past now, though. Today, revolving drums are used that are quite similar in function to coffee roasters.

With their malts and grain mix in hand, the brewer can start the process of making that sugary wort. First comes milling, where you gently crush or crack the malted grain by passing it through a mill. This process is critical, as it separates away the husk and exposes the endosperm of the barley grain, where the starch is stored.

After milling comes mashing. Hot water is carefully added at a specific ratio to the total weight of the grist, and the resulting mixture is held at precise temperatures known as steps. Each temperature step activates some of the enzymes that were formed in the barley kernel during malting. Once activated, these enzymes act like chemical scissors, breaking down the malt's complex starches into simple, fermentable

sugars. This takes place in a large vessel called a mash tun. Home brewers can use a converted cooler as a mash tun. The insulated walls of the cooler are perfect for holding a mash at a specific temperature over the course of an hour or more, and it can be easily modified by adding a false bottom: a perforated bottom that allows liquid to pass through and captures solids, much like a screen or a mesh strainer.

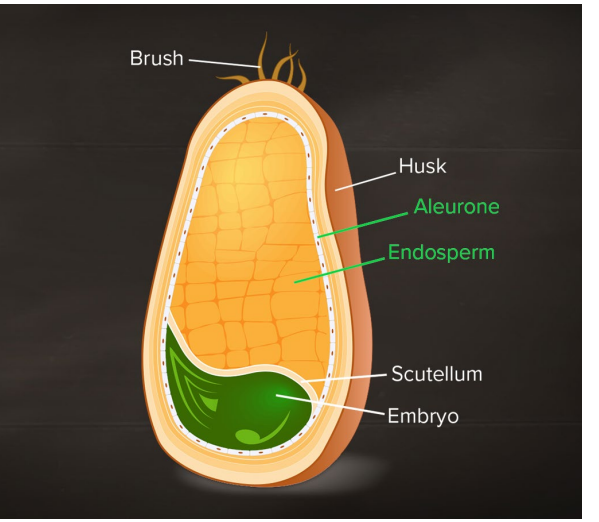
At the end of the mashing process, when the enzymatic conversion of starches into simple sugars is completed, the water that was added to the milled grains is drained, and more hot water is used to rinse the grains of those newly formed sugars. This stage is called lautering, and the vessel equipped with a false bottom that allows solid material to be separated out is often referred to as a lauter tun. Conveniently, the husks that were broken to expose the endosperm during milling come in handy here. They're deliberately not removed from the mash tun because they help physically strain the sugary liquid as it passes through to the bottom. And now you have your wort.

After mashing, the spent grains are no longer used in the brewing process, but that doesn't mean they are useless. High in fiber and crude protein, spent grain is often used by farmers to supplement agricultural feed. Spent grain can also be recycled for use in dog treats or milled into a flour that can be productively used in a wide variety of baked goods.

This process of malting, milling, and mashing can be used to make a wort from any cereal grain. You can brew a great beverage from wheat, oats, corn, rye, or rice, and as you learned previously, civilizations have been doing so for millennia. But barley has some very specific qualities that make it uniquely suited to beer making. It all has to do with the way a barley plant is structured. Barley grains grow in rows along the central axis of the spike, or head, of a blade of barley.

Barley is a grass, and its grains are its seeds.

Remember, during milling, the malted barley has its husk broken to reveal the starch-rich endosperm beneath. But between the husk and endosperm is a thick layer of cells called the aleurone. Though it's physically a tiny part of the kernel's anatomy, the aleurone is of critical importance to beer production because this is where enzymes that perform starch conversion are found—the ones that are activated during the malting process. Barley is unique because its aleurone layer is three cells thick, while in nearly all other grains, the same layer is just one cell thick. As a result, barley has an unmatched capacity to drive the enzymatic



processes that break down starches into fermentable sugars. This capacity is called diastatic power. In fact, it has so much diastatic power, it can convert the starches in other grains that might be included in the grist but do not produce many of their own enzymes.

Common non-barley beers, such as wheat- or rice-based beers, almost always include a fair percentage of barley—commonly 30% to 40% of the grist or more—purely for that diastatic power. Other types of grain, often in an unmalted form, are commonly added to beer grists along with base and specialty barley malts. Commonly called adjuncts, these functional additions lend variety and nuance to beer or offer cost-saving shortcuts.

For example, corn and rice are common adjuncts used in the production of mass-produced American light lagers. They are sources of fermentable sugar that are less expensive than barley malt. For some, *adjunct-laden* is a derogatory term used by beer drinkers who are loyal to the all-malt versions of these beers that were produced historically. Other adjuncts, such as barley that has been roasted before sprouting or oats, can be used to produce particular effects. For example, unmalted oats produce the silky, full-bodied mouthfeel of an oatmeal stout.

After learning about the all the work that goes into malting and mashing, you might be thinking that it's a complicated way to get a source of fermentable sugar—and it is! But keep in mind that sugarcane was virtually unknown in regions of the world where barley-based brewing emerged until the 12th century. Refined sugar wouldn't be readily available until the 19th century. Moreover, barley provides much more than just a source of sugar. Adding brewer's yeast to a solution of refined sugar alone would result in a harsh, foul-tasting beverage.

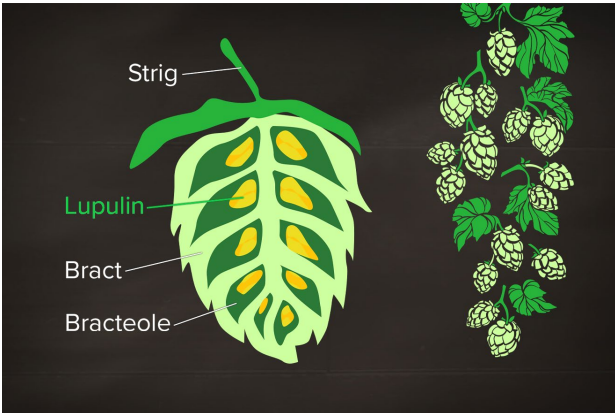
So, can you make a decent beer without barley? Of course. In fact, it would be a terrible mistake to discount styles of beer in which rice, corn, and other adjuncts figure prominently. It's a deeply unfortunate act of cultural bias to discount entire brewing traditions where grains that are often considered adjuncts in Western beer making form the foundation of fermentable material—such as the corn-based brews of Central and South America or those that originated in Africa that are based on sorghum and millet.

Hops

In addition to barley, beer's other major botanical ingredient is hops.

After lautering, the collected wort is transferred into a brew kettle, where it is brought to a vigorous boil, which does several things. First, it sterilizes the wort, killing off the huge populations of microorganisms that live on the surface of barley and other grains. Second, boiling produces some degree of caramelization, developing malt flavors and colors that will be present in the finished beer. Third, boiling reduces the total volume of liquid, producing a precise concentration of sugar that, when combined with the expected attenuation of a particular strain of yeast, will produce a predictable alcoholic strength. Boiling is also the point at which bittering botanicals, spices, fruits, and adjunct sugars are added to a wort. Of the first category, hops are by far the most common; in fact, it's difficult to find a commercially produced beer today that does not include hops.

When boiled, hops undergo a process called isomerization, the end product of which varies greatly depending on the length of the boil. Longer boils efficiently release alpha acids from the hops, which are contained in the lupulin glands of a hop cone. Hop varieties are characterized by the percentage of their weight that is made



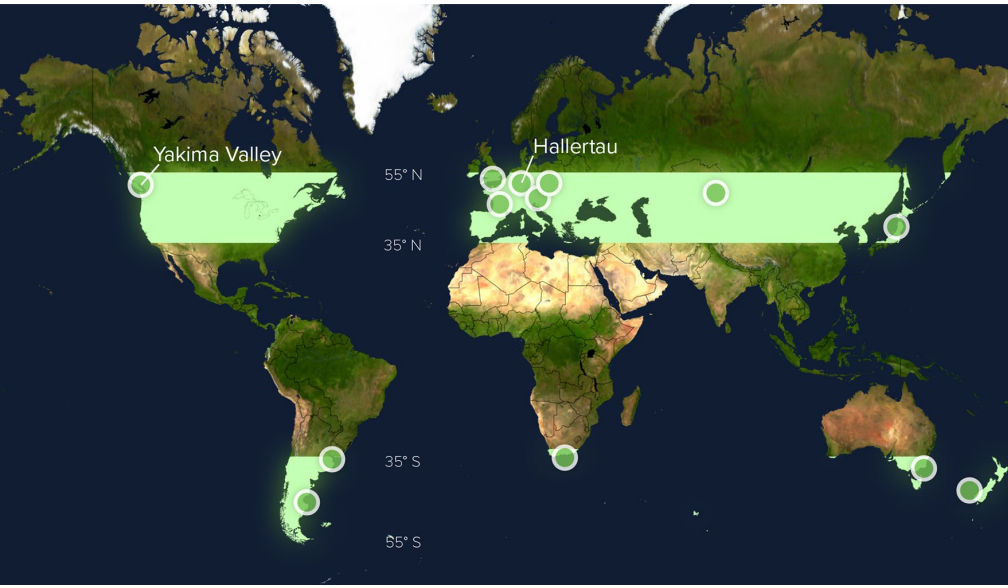
up of alpha acids. Those with higher alpha acid content have higher bittering potential and are often referred to as bittering hops. But in prolonged boils, the pungent aromatic and flavor compounds that make hops so distinctive are volatilized and largely lost.

Short boils, or introducing hops at the very end of the boil, help preserve those compounds. However, almost no alpha acids will be extracted, so different varietals of hops known as aroma hops are used for this purpose. There are also flavoring hops, which split the difference between bittering and aroma additions, lending a considerable amount of hop flavor. It's not uncommon to include multiple hop additions during the boil and for each of those additions to utilize one or more different hop varieties chosen for their unique profiles.

Given beer's long history, hops joined the party pretty late. Historians believe it wasn't until the 6th century CE that hops started to appear in beer. And the first historical mention of hops in brewing isn't until the 12th century, when Benedictine nun Saint Hildegard of Bingen describes the hops plant as "not very useful to mankind." But she also hypothesizes their bitterness might have useful preservative effects on beer. She was on to something—hops do have antimicrobial properties that improve both the quality and longevity of the beers in which they are used. Yet while this preservative property of hops was certainly one reason for their eventual widespread adoption in brewing, there were a variety of political, economic, and religious forces that also played a role in the takeover of hops in the 15th and 16th centuries.

Hops are a curious plant. They are a close cousin to cannabis, though not nearly as strictly regulated due to a lack of psychoactive ingredients. But when consumed in large enough amounts, they can have a mildly sedating effect. Hops grow in climbing vines called bines that reach 15 to 20 feet in length. To maximize growing area and encourage ventilation, hop growers build towering networks of trellises to support them. And they need them—hops not only grow tall, but they also grow quickly! At the height of summer, hops bines can grow up to 20 inches a week. However, hops don't grow everywhere. They are photosensitive to day length. Thus, most of the world's commercial hops are grown between latitudes 35° and 55°.

The Hallertau region in Germany, at 48°N, and Yakima Valley in the United States, at 46°N, are the world's two largest hop-growing regions by production.



The part of the hop plant that is used in beer making is its flowers, or cones, which look like delicate pinecones. Within the cones are deposits of oils, resins, and those all-important alpha acids, which impart distinctive bitterness, flavor, and aroma to beer, depending on how they are utilized. With all the bittering, aroma, and flavoring varieties, hops are incredibly diverse. But they are often categorized by their regional tendencies. Noble hops include four old landrace varieties grown across Germany and areas of the Czech Republic: Hallertauer Mittelfrüh, Tettnang, Spalt, and Saaz. These hops are used in most continental European lagers and Belgian-style ales. They are very low in bitterness, generally containing alpha acid content below 5%. They are also rather mild in flavor and aroma and lend an earthy, slightly spicy, or floral impression to beers. Noble hops are very commonly used to achieve a subtle balance.

British hops were introduced to the UK by Flemish farmers who fled their homeland during the Hundred Years' War. Goldings-type hops flourished in the UK's cool, wet climate and came to define the iconic British bitter and pale ales. They tend to be described as earthy and woodsy, minty or grassy, and (fittingly) tealike.

Hop breeding became much more serious and scientific, though, in the early 20th century. The British botanist Ernest Stanley Salmon set up one of the first scientific breeding programs for hops at Wye College in 1904, in the hopes of developing varieties less susceptible to disease, pests, and variation in rainfall. His big breakthrough was Brewer's Gold in 1919, which was released in 1934. Its key improvement was a high predictable annual yield and cones with a high ratio of alpha acids. Brewer's Gold itself is not used in many beers today, but a great many modern hops cultivars are descendants of Salmon's work.

New World hops are cultivated in North America, Australia, and New Zealand. This category of hops is enormous and has benefited from university-led hop-breeding programs, as well as growers seeking to produce new and exciting proprietary genetics. Today, hop breeding is big business, but it's an involved and long-term process—it can take decades for a new breed to make it to market and to scale up production sufficiently for it to be seen in your local brewery.

IPAs are an aggressively hopped group of beers, and hops are a relatively unstable ingredient. Excessive age or heat can produce unpleasant flavors.

New World hops tend to turn up the volume on flavor, aroma, and bittering potential. Super-alpha varieties are cultivated to be powerful bittering agents. These typically don't taste or smell particularly good, but that doesn't matter. They are used as early hop additions and allow brewers to get more bang for their buck when it comes to bittering hops. Other New World varieties have pushed the boundaries of flavor and aroma, producing tropical fruit, stone fruit, and citrus fruit flavors. These hops are commonly added during secondary fermentation, rather than the boil, in a process called dry hopping that is meant to maximize the addition of these bold flavors.

One style of beer that is especially known for highlighting hops and is today a major driver of new hops breeds is the India pale ale (IPA). It has become, in a very short time, the best-selling style of craft beer in the US. And it has a lot of variations: New England, hazy, or juicy IPAs; fruited and otherwise flavored IPAs; IPAs at imperial strength; and even milkshake IPAs that are brewed with lactose.

Tasting List

Style	Brand	Special Glassware
Munich dunkel	**Ayinger Altbairisch Dunkel**	pilsner glass
	Eittinger Urtyp Dunkel	
	Ettaler Kloster-Dunkel	
	Hacker-Pschorr Münchner Dunkel	
	Hofbräu Dunkel	
	Weltenburger Kloster Barock Dunkel	
English IPA	Fuller's Bengal Lancer	
	Marston's Old Empire IPA	
	Meantime London IPA	
	Samuel Smith's India Ale	
	Thornbridge Jaipur	
	Worthington's White Shield	
American IPA	**Bell's Two Hearted Ale**	tulip glass
	Cigar City Brewing Jai Alai	
	Fat Head's Head Hunter IPA	
	Firestone Walker Union Jack	
	Maine Beer Company Lunch	
	Russian River Blind Pig IPA	

The Munich dunkel is a classic dark beer out of Munich. It has a bit more substance than a typical lager but still has that easy-drinking, clean lager profile.

The American IPA was an evolution of the English style. American hops are much more aromatic than British hops.

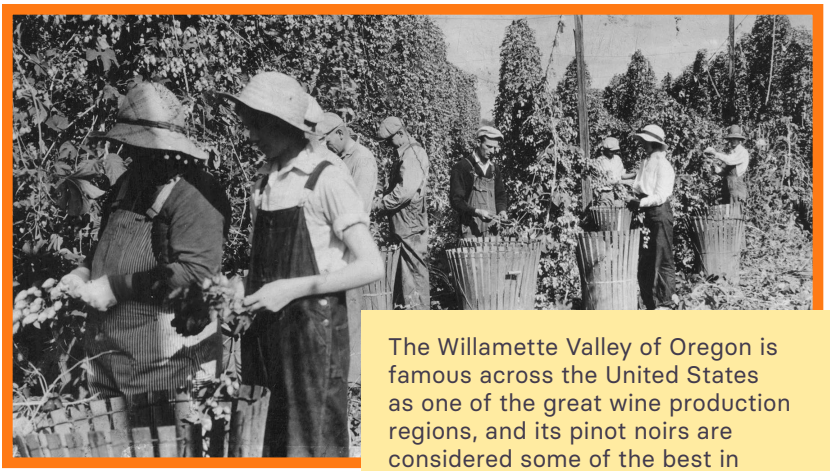
Tasted in lesson!

The India pale ale (IPA) style was developed in England. Pale ales had been around for a long time, but the IPA was developed specifically for export to England's colony in India. The style had to last, because the boat journey from England to India is quite long, so this style is well attenuated and uses lots of hops for their preservative effects.

5

BEER GEOGRAPHY: TERROIR, CAVES, AND GUINNESS

The story of beer has always been inextricably linked with geography, both physical and human. It was the Fertile Crescent's physical geography that produced environmental conditions that were ripe for not just the emergence of civilization but also the discovery and production of beer. Ample fresh water and fertile soils supported the growth of abundant grain, and its climate was ideal for airborne yeasts to spontaneously ferment. And its human geography is what helped beer reach distant corners of the globe.



Beer and Wine Regions

A land bridge between Europe and Asia, the Fertile Crescent contributed not only to the biodiversity of plant and animal species in the region but also to the wide migration of humanity, who spread brewing practices north into Europe, east into Asia, and south into Egypt and the rest of Africa.

But when the Phoenicians, Greeks, and Romans began to dominate the cultural and political life of the Mediterranean and the Near East, there was a marked change in the drinking culture of the region. These new powers preferred wine to beer, seeing the latter as a drink for commoners.

The Willamette Valley of Oregon is famous across the United States as one of the great wine production regions, and its pinot noirs are considered some of the best in the world. Yet wine is a relative newcomer to the valley. From the 1870s to the 1950s, the Willamette was better known as one of the hop-growing capitals of the world, drawing in thousands of migrant workers every year for the hop harvest.

Willamette's productivity is all down to its favorable geography. The valley is blessed with deep soils caused by prehistoric flooding that left rich volcanic and glacial deposits. Bounded by mountain ranges on three sides, the valley has its own protected climate. Rainfall and temperatures are very consistent, while storms and frosts are rare. With a bountiful river and gentle slopes to boot, Willamette is an agricultural sweet spot—and one of just a handful of global regions where most of the world's hops are produced. Of course, it's no coincidence that nearby Portland, Oregon, is one of America's beer capitals, with dozens of breweries to choose from.

The Greek god of merriment, Dionysus, had given the secret of wine as a divine gift to civilization. Contrary to its image today in masculine culture, the ancient Greek playwright Aeschylus derides beer as an effeminate drink. The Romans extolled and celebrated wine, devoting whole volumes to the subject, while making only occasional references to beer.

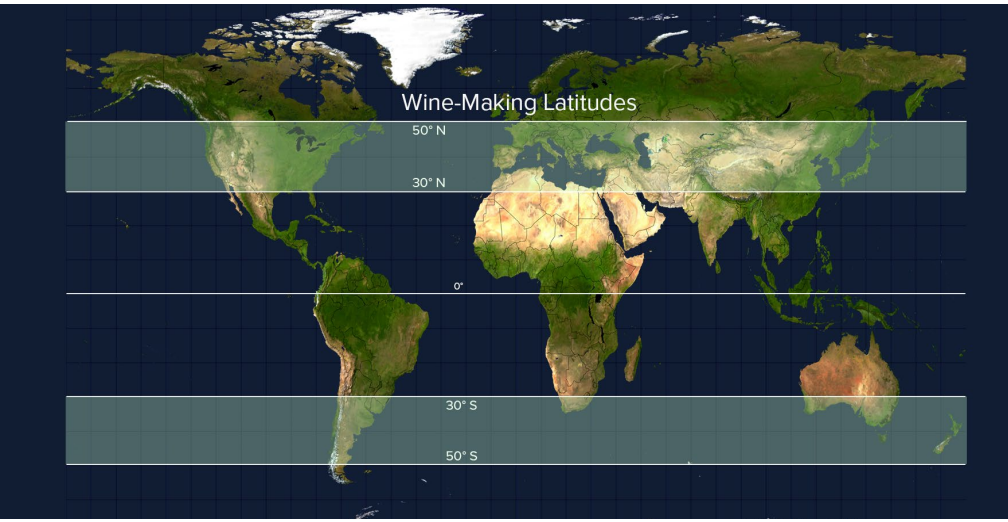
In Greek and Roman art, evidence of wine is everywhere, from beautiful mosaics to stunning statues.

There's no great mystery to why wine held the attention of ancient Greeks and Romans. Viticulture thrived particularly in Italy, and the Romans made wine making a fine art and developed sophisticated techniques to reduce its acidity and balance its sweetness. Compared to the thick and gritty, gruel-like beers of the ancient world, wine in this period was a more alcoholic and far cleaner drink with a longer shelf life, allowing it to be traded farther and more profitably.

But beer had not disappeared. Rather, it spread to the various Celtic and Germanic tribes of Europe. Subsequently, the Greeks and Romans soon began describing beer as a drink of barbarians. For instance, ancient chroniclers and travelers to Gaul described beer as among their uncivilized habits, some speculating it was responsible for their warlike ways. As the Gauls were incorporated into the growing Roman world, one of the markers on their journey to peaceable civilization was the adoption of wine over beer as the drink of choice, at least among their chieftains and elite.

The Greco-Romans saw that geography was destiny when it came to wine. The Mediterranean climate is ideal for the growing of grapes, which are highly sensitive to climate. Too hot and the grapes will overripen and taste unpleasant; too cold and they won't ripen at all. Humidity, wind, soil, seasonality, and altitude are also complicating factors—most wine making occurs in a fairly narrow area of the Earth, between the 30th and 50th parallels in the Northern and Southern Hemispheres.

The Greek geographer and philosopher Posidonius, traveling extensively through Gaul, noted that its colder climate was an impediment to growing vines and olives, forcing them to drink beer. Because beer was widely thought to encourage brawling and uncouth manners, Posidonius concluded that climate thus influences the character of peoples and that Rome was naturally destined to rule the world because of its



ideal Mediterranean, wine-drinking temperatures. But it's not that the Romans didn't try to change that—as they conquered ever farther north, they tried growing varieties of white grapes that did better in these new, colder climes.

Beer, on the other hand, is possible in just about any climate due to the diversity of where grains can grow and the ability to use different cereal grains to brew it. Barley, the most widely used base grain, prefers slightly cooler climates but can be cultivated over large portions of Europe, North America, and Asia. Wheat and corn, grains that are also used widely in beer production, can be cultivated in warmer climates. Meanwhile, rye can withstand frosts, and rice will grow in the tropics. Drought-resistant sorghum is a staple for beer brewing in hot climates, particularly in Africa, where sorghum beers are still domestically and commercially brewed.

Though the Romans and Greeks traded wine far and wide—and made a fortune in the process—those in Europe beyond the reach of their routes, or unable to afford their wares, continued to brew beer for themselves.

Cultural geography was also a big factor in splitting Europe into wine and beer regions. For many Celtic and Germanic tribes, wine was so closely associated with the Romans that it was fiercely resisted, even

prohibited. Julius Caesar, in his travels through northern Gaul, noted especially that the Belgian and German tribes he encountered did not allow wine to be imported, believing it to be an unmanly luxury that would weaken their spirit and ferocity as warriors—an interesting inversion of the way the Greeks thought!

Archaeologists have long since backed this up. Wine amphorae have been unearthed in great numbers all over the former provinces of the Roman world and many of their trading partners in the Near East and Mediterranean, but they are very rare finds among their northern neighbors. In the ancient world, before borders were fixed, whether wine or beer was drunk might have been a very clear signal of whether you were in the Roman world or beyond it.

Pliny the Elder, in his landmark encyclopedia *Naturalis historia* in the 1st century AD, also made another important observation about geography and wine. Book 17 discusses the unique impact of local geographical conditions, such as climate and soil composition, on the taste and quality of wine. In fact, he suggests that the vineyard a grape is grown in is more important than even the type of grape used. Pliny is also one of the first authors to describe the concept of terroir. From the Latin term for "land," *terroir* is a term mostly used in wine making, and it describes the distinctive flavors and qualities of a wine that the local geography of a vineyard imparts. Soil, altitude, climate, local geology, water quality, and even the slope of the ground are thought to have an impact.

Oenophiles take terroir very seriously—many of the world's most expensive wines come from specific vineyards whose terroir is considered superior. With the right vintage year, wines from French chateaus with highly prized terroirs can sell for hundreds of thousands of dollars. So why isn't terroir a big deal for beer? That's a trick question. It's true that barley and hop growers, maltsters, and microbiologists don't commonly use the term *terroir* to describe the

distinctive qualities of malt, hops, yeast, and water from a particular region or season. And it's also true that the industrialization and mass marketing of beer worldwide has served to remove traces of terroir from most mass-produced examples. But when used in the production of beer, especially craft and artisanal beer, geographical influences matter. And there are beer styles that still include vestiges of terroir as a product of how they are produced.

Remember that the last stage of the malting process is to kiln, or dry, the grains after they've sprouted. But for millennia, long before there were big malthouses with sophisticated kilns to manage the process, grains would have been dried over an open flame, giving most beer a slightly smoky undertone to its flavor. The taste that smoking imparts is specific to not just the type of wood burned but also the geographical characteristics of where the wood was sourced, such as soil quality, altitude, and weather, just like grapes—in other words, terroir!

Smoked beers, or rauchbiers, are still made in certain places today and are probably one of the few ways you can get a sense of the smokiness that most primitive, old European beers would have had.

Geography of Lagers

Geography has shaped the history of beer in incredible and sometimes surprising ways. For instance, Bavaria is one of the great beer-making regions of the world and, as the region that pioneered the development and mass production of lagers, has profoundly shaped modern beer culture. Approximately 9 out of 10 beers brewed and consumed worldwide today are lagers, and nearly all the major lager styles have their origins in Bavaria. And part of the reason for this is because of its caves.

In the 16th century, Duke Albrecht V outlawed the brewing of beer in Bavaria between April 23 and the fall equinox in an attempt to ensure that beer brewed in the region was of high quality. He did not know it at the time, but the summer heat was making Bavarian beer more susceptible to spoilage microorganisms like *Lactobacillus* and *Acetobacter*.

Remember that all brewing yeast belongs to the genus *Saccharomyces*. Ales are made with *Saccharomyces cerevisiae*, which ferments at warmer temperatures, between 60°F and 75°F. Lagers are fermented with *Saccharomyces pastorianus*, which prefers cooler temperatures, between 40°F and 55°F. Albrecht's law meant that Bavarian brewers

could only brew in the cooler months of late fall, winter, and early spring. Yeast that could ferment at cooler temperatures had been known about in some places prior to Albrecht's law, but afterward, yeast strains suited to the cooler temperatures would naturally outcompete other microorganisms. Bavarian brewers, seeing one batch of beer ferment better than others, would naturally use that batch to kick-start the next batches, and so on, so that over many iterations, a yeast mix high in *Saccharomyces pastorianus* would result.

One challenge they faced is that *Saccharomyces pastorianus* is slower to ferment, and after fermentation you need to let the beer condition and mature quite a bit longer to remove unpleasant by-products. So Bavarian brewers put their new type of cold-fermenting beer—lager—in barrels for weeks or months so it could condition. The result is a clean, crisp, and utterly drinkable character that has come to typify lager beers.

The word *lager* comes from the German *lagern*, which means "to store."

But although the Bavarian brewers could now brew a decent beer in the colder months, there was still the problem of being able to sell it year-round. Prior to modern refrigeration and pasteurization, beer—particularly lagers—didn't have a long shelf life. Their solution was to brew a huge batch of beers at the end of the brewing season, known as March beer, or Märzen, and then store it at just above freezing temperatures in the cold caves that dotted the foothills of the Alps. These lager caves, packed with barrels of beer and cooled with ice cut from nearby lakes, were a crucial part of the area's geomorphology that helped drive the natural selection of lager strains of yeast and ultimately put clean, crisp, and well-conditioned Bavarian lagers on the map.

As Bavarian lagers became popular across the world, brewers looked to make them elsewhere. But unless you were in a cold climate, how could you achieve the lower temperatures needed for lagers to ferment and condition over weeks or months prior to refrigeration? The solution was caves. A major reason St. Louis became one of America's biggest lager brewing cities, and why Anheuser-Busch got started there, is because of the complex of several dozen caves around the city that the brewers could use to lager their beer.

Hydrology

You've learned about how yeast, grains, and hops all play their role in the creation of a great beer. But there is one key ingredient that hasn't really been addressed so far—and, given that it comprises more than four-fifths of any given brew, it's pretty essential: water. And geography, or maybe hydrology more specifically, has a lot to do with the water that has traditionally gone into beer.

Historically, breweries have always been near a steady and clean supply of water. Not only is water essential during malting and brewing, but rivers could also be used to run waterwheels to assist with the milling, mashing, and lautering processes. Brewers would have quickly noticed that the taste of their beer could vary significantly depending on where they drew their water from. The most important distinction is whether the water comes from a ground source, such as wells or underground aquifers, or a surface source, such as rivers, springs, or lakes. The big difference lies in mineral content. Water drawn up from the ground has seeped through layers of soils, sediment, and rock and has thus been shaped by the local geology. Such water tends to have a high mineral content, so elements like calcium, magnesium, potassium, and sodium are found in greater proportions than they are in surface water.

But higher mineral content is not always a bad thing. The right mix can impart unique flavors to a beer and impact the brewing process positively. A little zinc in your water can improve foaming and stimulate the yeast. Sodium and potassium in the right proportions can help create a fuller mouthfeel and a sweeter taste. But too much of any mineral and the brew chemistry will be off. It's a tricky thing to get right.

Because of this, hydrology is a big historical factor in beer taste, and some styles of beer are defined by the flavors imparted by their local water source. One famous example is the Burton ale, which comes from the town of Burton-on-Trent in the UK. Burton's breweries draw their water from local aquifers, which rise through layers of sandstone and gypsum under the ground, making Burton's water high in the compound calcium sulfate. This in turn gives their beers a distinctive bitter edge; a clean, crisp taste; a pale color; and a distinctive sulfurous aroma, known as the Burton snatch. Pale and bitter ales have long been extremely popular in Britain, so Burton's ales were especially desirable. More and more brewhouses opened to take advantage of Burton water.

Other geographical factors helped Burton's beer industry grow. The relatively high dissolved salt content in its water also allowed more hops to be added to the mash without excessively bittering it. Because hops is a natural preservative for beer, more hops meant a longer-lasting brew. Prior to the development of pasteurization, this gave Burton ales a big edge in the export market, since their brews could be transported farther for sale. Combined with Burton's strategic location on the Trent River, by the 18th century, Burton ales were being shipped around the world. At its height, Burton was producing more than a quarter of all the beer sold in Britain! Bass Brewery, which opened in Burton in 1777, became the largest beer company in the world by the 19th century, selling more than a million barrels a year.

Today, home brewers can mimic the famous Burton-on-Trent water profile by buying Burton salts to add to their brewing water.

Brewers in other places eventually found ways to Burtonize their water and add calcium sulfate to mimic Burton's unique taste, so Burton is no longer as dominant as it once was. But there are still several major brewers, including Bass, that operate there.

Guinness: Ireland's Undisputed Icon

Even if the term *terroir* might not commonly be used when talking about beer, there's no doubt that physical and human geographies have deeply shaped beer culture and global beer styles—so much so that some styles have become inextricably linked with certain places and countries and powerfully evoke a sense of place. One of them is Guinness stout, recognized the world over as a symbol of Ireland.

Hops are not grown in Ireland. Thus, all the hops used for brewing were imported, primarily from Belgium. In 1733, however, the British imposed a ban on such imports, forcing Irish brewers to purchase more expensive hops that were cultivated in England. As a result, three modern beer styles with Irish roots—Irish stout, red ale, and gruit—are malt-dominant styles utilizing relatively few hop additions. Of the three, Irish stout is the most famous today. It's related to the porter,

which originated in the 1700s in London and for roughly 150 years was the most popular style of beer produced and consumed in England. Porters quickly became very popular in Ireland as well. Yet, as often happens, local tastes and geography saw new variations emerge in the style, and, like Burton, water played a big role.

Much of Ireland is composed of limestone, a soluble rock that produces groundwater with elevated levels of calcium bicarbonate. Dublin sits on the boundary between the limestone rock formation that composes most of the center of Ireland and an igneous (or volcanic) rock mass that makes up the southeastern coast. Igneous rock is inert and contributes little mineralization to the groundwater that runs through it, resulting in soft water with low alkalinity.

The near-black mahogany color of stouts and porters is a product of roasted grain, produced via a process that is not unlike coffee roasting. The roasting process results in grains that are high in acidity. Waters high in calcium bicarbonate, like those found in central Ireland, neutralized the acidity of the roasted grains that were used in the production of porter and stout. However, the characteristic acidity and crisp sourness of the dry Irish stout, made famous by Guinness, is a direct product of taking advantage of the region's soft, low-alkalinity water.

The original Guinness Brewery is in Dublin, near the banks of the river Liffey. Water was originally supplied to the brewery from the river and local wells. But as it grew to international fame, taking over from Bass in the late 1800s as the largest brewery in the world, the Guinness Brewery came to be described as a city within a city. The river and wells could not meet the needs of the growing brewery or the growing city around it, so Dublin constructed the Grand Canal in the late 1700s. The canal's water was sourced from the Wicklow Mountains, supplying the brewery and recharging local wells with soft water from the south. Then, in the 1860s, the city of Dublin constructed a system of aqueducts and reservoirs that delivered water straight from the mountains to south Dublin and the brewery—a dramatic example of how beer-loving humans have shaped physical geography.

The Guinness Irish stout is now produced in subsidiary breweries around the world. Through modern brewing science, the unique taste once produced by Ireland's water can be recreated elsewhere. But few beer styles are as strongly associated with a sense of place as Guinness is. Human geography has played a unique role in this sense.

The Irish diaspora from the late 1700s onward saw the migration of millions of Irish around the world, particularly across Europe, the Americas, and Oceania. Though Irish pubs can be a marketing ploy today, they have their roots in the displaced Irish peoples, who established them across the world to serve immigrant communities and offer the taste of home—especially Guinness, which soon became popular with non-Irish drinkers as well.

Tasting List

Style	Brand	Special Glassware
rauchbier	**Aecht Schlenkerla Oak Smoke Doppelbock**	modified pint glass with wide mouth at the top and thin walls
	Aecht Schlenkerla Rauchbier Märzen	
	Cerveja Bamberg Rauchbier	
	Göller Rauchbier	
	Rittmayer Rauchbier	
	Spezial Rauchbier Märzen	
Irish stout	Beamish Irish Stout	nonic pint glass
	Belhaven Black Scottish Stout	
	Guinness Draught	
	Murphy's Irish Stout	
	O'Hara's Irish Stout	
	Porterhouse Brewing Company Irish Stout	

Tasted in lesson!

Guinness Draught is a stout, which originally started as a stout porter, so it was a variation on the porter style. And originally it was meant to describe a porter that was extra strong—so, a stout porter. But as the porter moved to Ireland and stout started to stand on its own as its own style, the alcohol by volume (ABV) of stout dropped back down, so the classic Irish stout is actually a fairly low-ABV beer, probably between 4% and 5%.

The Märzen is a higher-alcohol beer that's lagered through the summer and gets broken out in the fall or late summer. The rauchbier is simply a smoked version of that beer.

6

BEER AND RELIGION: MONKS, BOCKS, AND TRAPPISTS

With more than 200 scriptural references to alcoholic drinks, the Bible is just one of multiple sacred texts that reflects the centrality of beer to religious and spiritual life. This lesson explores the role that religion and ritual has played in shaping beer tastes and explains how beer has in turn influenced practices of faith.

Biblical Beer

The strong ritualistic and religious associations of beer stem not just from its importance for sustenance and enjoyment in early societies but also from fermentation itself. Prior to the 19th century, fermentation was poorly understood, and prior to science unlocking its secrets, it would have seemed utterly miraculous that a watered-down barley bread could, under the right circumstances, be transformed into an intoxicating beverage. And in many ancient societies, those substances known to alter perception or intoxicate were themselves highly regarded as special or spiritual substances, often with elaborate rituals around their preparation and use.

When the Roman Empire fell and Europe entered the early medieval period, many of the world's major organized religions were beginning to emerge and spread across the globe. As you learned in lesson 2 on ancient civilizations, beer was already associated in many cultures with spiritual and ceremonial practices, with some societies restricting its access to the elites or the priesthood. But there was a major shift in the 6th and 7th centuries CE. In Mesopotamia and Egypt, where beer was born, Islam spread—and with it new prohibitions on *khamr*. *Khamr* translates as "wine," because the Quran only mentions it as being derived from grapes or dates. Most Muslim scholarship, however, quickly established that its prohibition extended to all intoxicating drinks, including beer.

As Muslim caliphates spread across the Near East and into North Africa, Persia, and central Asia, beer was pushed into the background. There were plenty of places where brewing continued and beer was consumed locally, so it didn't completely vanish, but the prospect of big breweries and alehouses emerging in this part of the world was effectively shut down. Much the same happened across Asia. Jainism and Sikhism similarly prohibited intoxicating beverages. And though Buddhists don't prohibit beer as a rule, it's strongly discouraged and thought of as incompatible with spiritual growth.

This is a huge change in the history of alcohol—from explicit gods of beer and wine to nearly universal condemnation. Fermentation was no longer something divine and magical from the gods; it was increasingly something sinful. The major exception is in Christianity—or at least in the beginning. Both beer and wine are mentioned repeatedly in the Bible as an offering, a blessing from God. Drunkenness is a sin in which a person willingly and knowingly deprives themself of the use of

To say that the Catholic Church has maintained a complex relationship with beer is a profound understatement. In many ways, it's the church that spurred the continued development of beer in Europe from a traditional drink made by pagan and barbarian tribes beyond the borders of Rome to the mass-produced beverage that millions enjoy today.

their reason, the engine of virtuous deeds, but drinking in moderation is not—just the opposite, in fact. Wine is a holy representation of the blood of Christ in Christian Communion services.

Early Christians were more ambivalent about beer, the preferred beverage of Europeans in northern climates. Given that wine was significantly more intoxicating than beer, beer escaped the church's condemnation on the grounds that it contributed less to the vice of drunkenness. Further, as the church sought to expand its power across the European continent, it commonly took on local and regional customs, imbuing them with new church-driven ideological significance.

Monastic Beer

Though the so-called Dark Ages, approximately 500 to 1000 CE, are generally considered to be a time of intellectual stagnation on the European continent, the brewing tradition did not suffer. It's reasonable to surmise that this is because brewing was taken up by monasteries, which were not only centers of cultural and spiritual enlightenment but also local commerce, scientific inquiry, and literacy. The Benedictine order of monks and an offshoot order, the Cistercians, were particularly instrumental in consolidating the manufacture of beer under the centralized and heavily patriarchal power of the church. Both Benedictines and Cistercians lived by a rule of self-sufficiency: In addition to a life of prayer and reflection, the monks made just about everything they needed for sustenance within the confines of the monastery and its lands.

From the 6th to 9th centuries, these monastic orders started promoting the manufacture of beer. Some of this was a product of cultural osmosis. As Northern European peoples were converted to Christianity, local beer-making traditions became infused with local monastic practices. Some of this is practical. Beer is a mildly alcoholic and lighter drink that can be made from the excess grains harvested

by the monastery and is less reliant on a favorable climate than wine. Monasteries were large communities with vibrant internal economies that enabled brewing on a large scale.

One of the first monastic breweries about which there is documentation comes from about 820 CE, from the monastery of Saint Gallen, located in present-day Switzerland. Saint Gallen became the first truly large-scale brewing operation in Europe. The brewery complex included a granary for sorting and storing grain, a kiln for drying malt, a mill and mortar for cracking malted barley, and a brewhouse to turn raw agricultural ingredients into beer. They also had coopers who made barrels, blacksmiths to maintain the kettles, oxen to transport the beer, and huge fields in which grain was grown. The brewing operations alone are thought to have involved hundreds of monks, servants, and students.

Saint Gallen distilled brewing to a science. They experimented with different ratios of grain in their grists and—being a rare literate class of artisans—recorded their recipes, including exact proportions and timings. As they experimented with the brewing process, they found ways to speed it up. To mill the grains, they used water to power their mills. To boil the wort, they constructed large kettles over direct-fired furnaces that could do it in large batches. They filtered their wort through straw to rid it of impurities. And though they still didn't know what yeast was, they'd learned that taking a bit of actively fermenting beer and adding it to a new batch would kick-start the fermentation, which they did in large, custom-made wooden tanks.

The sophistication of the monks' operation meant that their beers were of a much more consistent taste and quality than would have been the case elsewhere. Not only did the monks of Saint Gallen record their findings, but they also sent manuscripts to other monasteries so they could replicate their techniques.

In the 9th century, monasteries were the main centers of innovation and technology, sharing their findings through networks of monks across Europe.

Another interesting practice of the Saint Gallen brewery that would eventually become commonplace is that it specifically brewed three different beers in three different breweries within the complex. Medieval Europe was a class-driven society, and these beers were designed for the people who occupied very different rungs of the social ladder.

The first, or *prima* (in Latin), beer was made from 100% barley malt. Fairly strong and carefully filtered, it was reserved for the abbots, local church leaders, and special visitors.

The *secunda* beer was of poorer quality, likely brewed with adjuncts, more quickly produced, and brewed at session strength. It was the everyday beer for the monks of the monastery, to power them through long days in the workhouses and in prayer.

The *tertia* beer was the most inexpensive and most quickly produced. It was made from what's called second runnings. You've learned previously about how a wort is produced by lautering mash, which separates the sweet liquid from the grains. The grain bed is rinsed, or sparged, with hot water until the volume of wort needed is collected. While the sparging process rinses the bulk of simple sugars from the grain bed, inevitably a small amount is left. A second batch of hot water is run through the sparged grain bed—the second runnings—to create another, much less sugary wort.

Second runnings were commonly used in the Middle Ages to produce "small beer," or table beer. It generally fermented to only about 1% or 2% alcohol by volume and was considered suitable for consumption by women and children. The making of small beer with second runnings was an economic practice that was common in household brewing. Saint Gallen's *tertia* beer was made from the second or even third runnings. It was provided for the lay workers of the monastery who

toiled in the fields and to pilgrims and townspeople who visited the monastery. It could be drunk pretty constantly throughout the day without causing much drunkenness.

That wasn't all they drank, though. There's a popular myth that medieval people drank small beer instead of water because the quality of water in that period was so polluted and disease ridden. But scholars have looked into this extensively, and there's no evidence to support that story. Scientific estimates of historical agricultural production have found that there simply was not enough grain being produced in Europe to make enough beer for everyone to be drinking it constantly—not by a long shot—especially when you think of all the grain needed to make flour and bread as well. Plus, most water really wasn't that dangerous in this period. Most medieval settlements were situated by relatively unpolluted rivers and other freshwater sources. But small beer was still a big part of medieval life and a major supplement to the diets of the peasants and farmers.

The Doppelbock

The doppelbock is a classic German bock beer that has its roots in monastic traditions. Bock beer was developed in Einbeck, a small town in Lower Saxony. Einbecker beer, as it was called, grew in popularity far beyond the borders of Einbeck. As the story goes, Einbecker brewers produced a beer with a high residual sugar content—from unfermented wort—to act as a preservative for the long journeys. Maximilian I, a 17th-century Bavarian monarch, liked the sweet Einbecker beer so much that he hired a brewmaster to produce a version in Munich. The strong Bavarian accent morphed the name, which over time became *bockbier*.

The doppelbock, or "double bock," has its origins with the Paulaner friars of Munich, who in the 1700s adapted the Munich bock recipe by upping the alcohol content and the amount of residual unfermented sugar. The origin story often told is that the beer was developed to help sustain the monks during the 40-day stretch of fasting for Lent. Food was forbidden, but liquids were not, so doppelbock served as liquid bread. Some historians have provided an alternative explanation: The Paulaner monks were strict vegetarians, and the doppelbock was a high-energy supplement for their diets.

These strong, malty beers are steeped in tradition. For example, the term *bock* is the product of a regional accent and has no etymological connection to the Einbecker beers from which they were derived. But

it just so happens that *bock* means "male goat" in German, so many of the doppelbocks produced historically and today incorporate goat imagery in their labels.

Here's another example: The Paulaner monks called their new beer "Blessed Father" or *Sankt Vater*, which later morphed into *Salvator*, or "Savior" in Latin. Other breweries quickly imitated the style, and to this day, commercially produced doppelbocks are named with the suffix *-ator*.

Monastic Monopolies

The monastic tradition of brewing spawned a scholarly and scientific approach to brewing beer. And as the Dark Ages ended and the 11th and 12th centuries began, it was in the monasteries that modern beer started to really take shape. Beer was big business for the church. In fact, in many areas, the church held a legal monopoly over the brewing industry.

The Břevnov Monastery in Czechia, for instance, has a brewing history going back to the 10th century. Along with several other monasteries in the region, they managed to secure a legal monopoly on the production and sale of beer in Bohemia that lasted for centuries. One of the ways

the church maintained that monopoly was by having the exclusive rights to forage and sell gruit, the mixtures of herbs and plants that were used to flavor most beer in the Middle Ages.

Getting a nice balance in your gruit mix is hard, as is identifying and harvesting the right plants to make it. Mugwort was commonly used as one of the primary bittering plants in monastic gruit, but it's easily mistaken in the wild for wormwood, which produces a very different taste and is used to flavor absinthe. Yarrow was another plant commonly used in monastic gruit, but to the untrained eye it can be confused with several other plants, including the very dangerous poison hemlock. The monasteries jealously guarded their botanical knowledge and herb gardens, making it hard for any domestic brewer to make a beer that tasted nearly as good. It forced many to buy their gruit at inflated prices from the monasteries.

Until very recently, the large-scale commercial production of beer would have been the exception, not the rule. The vast majority of beer brewed and consumed in the world would have been made domestically, for consumption in the home or a hyperlocal community of friends and neighbors. And as was the case for so many domestic responsibilities, particularly those related to food preparation, women presided over the production of most of the world's beer for most of history.

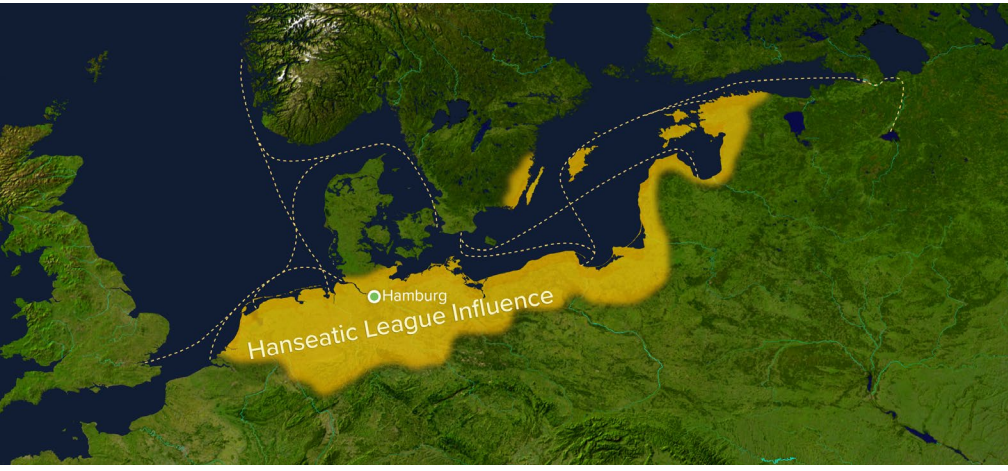
Women in medieval societies didn't just produce beer for domestic consumption. Brewing seems to have been one of the earliest professions in which women could be engaged commercially as well, making beer and selling it from shop fronts and taverns. Women who brewed beer commercially were called alewives.

Alewives, or brewsters, often also had excellent knowledge of the botanical herbs needed to make gruit and passed this knowledge from mother to daughter over centuries. In areas of medieval Europe around the towns and castles, where commerce thrived, merchants and larger brewers probably dominated, but alewives would have still dominated beer making in villages and the countryside, where the vast majority of people lived. But the rise of monastic brewing began to disrupt the traditional dominance of women in beer. The increasing sophistication of beer production developed by the monasteries, and the lack of female access to education or opportunities, meant that the industry became increasingly dominated by men. And alewives were often forced out of the profession with accusations of witchcraft.

Somewhat ironically, though, it was the church's attempt to control the beer trade through monopolizing gruit that played a central role in the eventual takeover of hops as the standard flavoring agent. The monasteries, as centers of agricultural innovation and experimentation, were where hops were first cultivated. It was an order of Bavarian monks who rediscovered the hop plant and began its domestication for the express purpose of beer production, thus inventing and meticulously recording techniques for the production of modern beer. The monks themselves were slow adopters, but other brewers were interested. Since hops weren't regulated or taxed by the church, secular brewers started cultivating it for their own use and bypassing the church's control.

The Hanseatic League, a partnership of German-speaking trading cities in northern Europe, included some of the biggest beer exporters in Europe, with Hansa ships carrying beer across the Baltic and North Seas. Hamburg was soon the biggest beer-producing city in Europe, with more than 400 manufacturers involved in beer production by the 14th century. At its height during the 1400s, Hamburg was producing more than 10 million gallons of beer.

Because the Hansa were traders and made their beer for export, they needed their beer long-lasting, and hops—with its natural preservative qualities—was the natural choice. And the influence and range of the Hansa merchants meant hopped beer started to become popular across northern Europe and the Baltic. The changeover to hops



occurred at different times elsewhere in Europe. France was an early adopter, as hops began to take over beer flavoring as early as the 12th century. Yet hops were subject to a ban in beer production as late as the 16th century just across the channel in England.

The takeover of hops got a further boost with the great religious schism of Europe: the Reformation. Martin Luther was a hearty and enthusiastic drinker of hopped beer, and his wife Katharina was, by all accounts, an excellent homebrewer. Given the historical association between gruit and the Catholic Church, did Luther explicitly preach to his new followers to start drinking hopped beer?

Probably not, but in a continent now bitterly divided over church reform and soon to be engulfed by religious warfare, it's not inconceivable that Protestant brewers and beer drinkers deliberately used hops to thumb their nose at the Catholic authorities. Moreover, the Reformation did not believe in monasticism, and in places where it took hold, monasteries and convents were dissolved—and with them their local beer-making monopolies.

Trappist Beers

There are still some styles of beer that continue to be brewed in the monastic tradition today, stretching back to the early Middle Ages. The most well-known order is the Trappists, an order of monks who split from the Cistercians around the time of the Reformation Wars and, like their forebears, lived a life of self-sufficiency.

Trappist breweries didn't really open as commercial operations until the 19th century, and most of the Trappist beer for sale isn't actually brewed by monks; the brewing operations became so large that the order began employing outsiders to run their operations. Westmalle Abbey, just outside of Antwerp in Belgium, is one of those stories. This community of Trappist monks, established there in the late 1700s, didn't start major brewing until the mid-1800s. But they soon gained a reputation for brewing strong ales, notably the dubbel and then the tripel.

The styles became extremely popular in Europe. By the 1930s, a large, modern brewery complex had replaced the traditional monastic brewhouses, and today Westmalle produces more than 100,000 barrels of beer a year. The Trappist monks themselves still exist and live a life

of prayer and reflection at Westmalle Abbey, but today they only act as overseers for the brewery operations, which are staffed, like modern breweries everywhere, by trained professionals.

Tasting List

Style	Brand	Special Glassware
doppelbock	Andechs Andechser Doppelbock Dunkel	snifter
	Ayinger Celebrator	
	Paulaner Salvator	
	Spaten Optimator	
	Tröegs Troegenator	
	Weihenstephaner Korbinian	
Belgian tripel	Chimay Tripel	
	La Rulles Triple	
	La Trappe Tripel	
	St. Bernardus Tripel	
	Val-Dieu Triple	
	Westmalle Tripel	

Doppelbocks can be sneaky with higher alcohol contents.

Tasted in lesson!

Belgian Trappist beers are produced by only a small number of monasteries around the world. Trappist beers are usually categorized by style and strength: the Trappist single, often a witbier, or wheat beer, flavored with spices; the Belgian dubbel, which is usually a darker beer; and the tripel, which is typically the strongest beer in the lineup, but a few monasteries make a quadruple, or quad, which is often a very strong beer.

7

BEER LEGENDS: MYTHS, WITCHES, AND VIKINGS

Myths and legends are stories that are based on tradition that can have origins in fact or be completely invented. Whether they are factual or fictional matters less than the cultural work they perform. These stories explain the world and our role in it. They answer important questions and pass knowledge from generation to generation—a function that was of critical importance in oral cultures or cultures in which literacy was reserved for elites. Myths and legends can give us heroes to model our lives after or villains to serve as cautionary tales. They tend to take up common themes or concerns that unite humanity across cultures. Beer customs, folklore, and tradition are inextricably linked with the people in a society who have been the custodians of beer making. And until the relatively recent industrialization of beer production, those custodians tended to be women.

The Chuvashia Republic lies right in the heart of the European side of Russia. It's a small, autonomous region that's about the size of New Jersey and home to around a million Chuvash, an ethnic group of Turkic origins. Chuvashia is known for its distinctive clothing, culture, architecture, and language. And since ancient times, it's also been known for its beer. Russia is a relative latecomer to the world of beer, but Chuvashia is a notable exception, and there is evidence of beer culture there dating back almost two millennia. A unique microclimate in the Chuvash region makes it ideal for the cultivation of barley and hops and the development of a local yeast culture.

Beer is woven into just about every major ritual in Chuvash culture. It is given to guests as a sign of hospitality, drunk at social gatherings and community meetings, and served on holidays and harvest celebrations. It's used in prayer and as part of religious ceremonies and offerings to their ancestors. In some specific clan rituals and meetings, beer is optimally served 40 times over a 24-hour period. And perhaps the most ceremonial of roles beer plays here is at weddings, where getting married represented a transition when young men and women could graduate from low-alcohol beer to the stronger stuff. At a traditional Chuvash wedding, the couple and their parents would each drink a large scoop of beer as part of the ceremony, and the newlyweds would spend their first night with a gift of strong ale.

Given the centrality of beer to their culture, it's not surprising that the Chuvash tell many legends and tales that involve beer. Beer is the drink of their principal god, Tură, and there are all sorts of legends and tales about how he first gifted the ingredients of beer and knowledge of brewing to the Chuvash. Anthropologists have recorded dozens of Chuvash folk songs and poems that involve beer, from songs sung in the fields during the barley harvest to chants made to welcome guests to a drink in their home. There are folk tales of evil spirits that live in cellars and scare children and protective charms that involve brewing beer.

Alewives and Witches

Thanks to its popularity among the industrial working classes and relentless modern marketing, beer in recent centuries has become a drink more associated with men. But some of the most enduring tales about beer and beer making involve women. And that's not surprising. Alewives were at the center of the rural brewing trade for centuries and are thought to have occupied elevated roles in their communities. An alewife was something of a village elder who held not only the secrets of brewing beer but also healing and what passed for medicine in their day. In some places, alewives doubled as midwives, and perhaps it was only natural that they would use beer as part of that process.

In the United States today, less than 10% of those who work professionally as brewers are women, and less than 3% of breweries are owned exclusively by women.

Groaning ales were a type of beer brewed specifically for women in labor. Evidence suggests midwives might also have used the brew to help induce or ease difficult pregnancies. While it's a definite no-no today given the risks of alcohol for babies, groaning ales were the lesser of two evils in an era before anesthetics and painkillers and when pregnancy complications and death in labor were exceedingly common. The term *groaning ale* itself probably comes from Scotland, where *groaning* is a traditional term for childbearing, and a variety of other "groaning" foods, such as cake and cheese, were also prepared as pregnancy refreshments. Groaning ales remained in use there even until the 18th and early 19th centuries, though by that point it was being served as a refreshment for the hardworking midwife and a celebratory brew for the husband and wife after the labor had been completed.

Groaning ales, given their purpose, were what are now called high-gravity beers. Gravity is a measure of the amount of dissolved sugar in a wort before fermentation, so saying that a beer is "high gravity" is the same as saying it's high in alcoholic strength. This is because lots of sugar to ferment means lots of alcohol. Though traditionally produced groaning ales probably tasted very different depending on where you were, a beer that perhaps evokes the kind of taste you'd experience comes with the Scottish wee heavy, a traditionally high-alcohol brew that likely evolved out of the strong-ale traditions that were still present there domestically during the early 19th century. Scotland's climate is not conducive to hop production, so Scottish beers tend to be malt-forward as well.

Alewives also brewed beers for popular communal celebrations. Inns were the center of community life and where travelers stayed in medieval Europe, and alewives and their daughters were usually the innkeepers, and hence the party starters. The word *ale* itself was an archaic term that could also mean "celebration" or "feast ." Bride ales, for instance, were celebrations that took place in the days preceding or during a wedding ceremony. Some legends say that the women of a community brewed a batch of beer for the wedding and took a portion to be sold in the village green or at the town inn. That beer may also have come to be called the bride ale. The beer was sold to travelers and passersby at a common rate—part of the cost of lodging at the inn—but friends, family, and townsfolk who were to attend the wedding paid an exorbitant price for the beer, thereby helping the family to meet the bride's dowry or helping to set the young couple on its feet.

Bride ale is thought to be the origin of the term *bridal.*

With beer being associated with women for so long, it seems inevitable that folklore about witchcraft came to be mixed up with alewives and brewing—especially prior to the takeover of hops in beer. Alewives would have used a variety of herbs and plants to flavor their beers instead, knowledge of which has been associated with the occult and magic. Many have speculated that the traditional symbolism and imagery of witches—a mythology in itself—have their origins with alewives. According to some folk histories, female brewers wore tall, pointed, conical hats so that they might be seen in busy marketplaces.

Since grain stores are particularly desirable to mice and rodents, alewives might have had cats around their homes as well, though not necessarily black ones. And brewing would have involved a large fire-heated kettle or cauldron full of a bubbling liquid to which a special blend of herbs was added. Alewives might even provide an explanation of the iconic witch's broomstick. There are accounts of alewives mounting brooms over the doors of their homes to indicate to potential customers that there was beer available for sale.

While it's difficult to verify that these elements of medieval folklore produced contemporary depictions of witches, it is known that accusations of witchcraft have been used at various times in history to exert social control and curtail the activities of people who ran afoul of a powerful authority—often the church. And since brewing was one of the very few industries women could independently earn money in, it would have been a lifeline to widowers, spinsters, or any woman who lacked a husband to support her. And, as has been evidenced in countless communities across cultures and time, unattached women often occupied precarious positions in traditional social orders.

During the height of witchcraft crazes of the 1600s, accusations were often made of women brewing especially strong beer to control men, poison enemies, or send people into unholy trances. Some have argued that these negative associations were an aspect of the takeover of brewing by men in the 16th century, though industrialization and religion play a much more definitive role.

Myths and Legends

In addition to involving the domestic and limited professional lives of women, the tales that have been shared here all have something else in common: They involve major moments in a person's life or transitions from one kind of social identity to another. Coming of age, or transition into adulthood, is another one of these moments. If you think about it, this is a fairly natural association. Reaching an age where your constitution can handle alcohol is a very conspicuous sign of transitioning from one stage of life to the next. And anywhere that beer permeates everyday life, myths and legends that involve beer will spring up.

In the contemporary world, at least in the US and UK, there may be no more beer-soaked social setting than college campuses. Beer drinking is, for better and for worse, ritualized on college campuses, where chugging beer in quantity becomes a rite of passage into college life. Ritual overconsumption is used often in hazing initiations for fraternities and university clubs—an unfortunate practice that educational leaders have worked hard to curtail. The English yard glass or sconce pot, which can hold more than two and a half pints of beer, has been used as a drinking punishment among Oxford University colleges since the 17th century—a similar concept to the beer bong, a funnel attached to a length of hose that became popular at American fraternity parties in the late 1990s.

In a drinking culture so rooted in youth and excess, it's no wonder that the urban legends that circulate college campuses are largely about evading consequences, be they hangovers or something more serious. The urban legends that are passed from mouth to mouth on college campuses take advantage of some of the basic technologies of mythmaking—linguistic tools that make these stories more memorable and easier to pass along: verse and rhyme, metaphor and humor, and a healthy dose of wishful thinking. Here are some of the more popular urban legends.

It's widely believed that popping a penny in your mouth will help you pass a breathalyzer test if you've been drinking. The theory is that the zinc and copper that comprise pennies neutralize or mask the level of alcohol in your system through a chemical reaction. This is patently false. There's only one surefire way to pass a breathalyzer test: Do not drink and drive. Your lungs are where deoxygenated blood in your body is reoxygenated. When alcohol is in your bloodstream, some of it will evaporate, concentrating as vapor in your lungs. The concentration of alcohol in the lungs directly relates to the concentration present in the blood.

Here's another one: "Beer before liquor, never sicker. Liquor before beer, you're in the clear." It's a catchy rhyme that is supposed to help revelers avoid getting sick, but the fact is that the order that you consume alcohol in doesn't really matter. Overdoing it is overdoing it.

On the same theme, those who have overdone it can supposedly find relief from a hangover by drinking another alcoholic beverage: "the hair of the dog that bit you." This saying refers to a folk remedy that was used for rabies centuries ago. It was thought that placing a few hairs in the wound from the dog that bit you would ward off evil consequences. Interestingly, there is evidence that the phrase has been used as a metaphor for the treatment of hangovers since the 16th century. Sadly, this just means that revelers have been wrong for nearly 500 years. Drinking more alcohol just prolongs the time it takes to recover from a hangover. Water and rest are always the best bet.

Beer has also been part of marking another significant transition: that from life into death. Death, and what's beyond, is one of the great mysteries of life. So it's unsurprising that it's a common theme in folklore, myths, and legends and that beer is often part of the commemoration of the dead. One ancient funerary custom is not to actually drink a beer but to pour one onto the ground as an offering or as a memory of the dead. This practice is known as a libation, and it can be traced back to the Sumerians and Egyptians, who used beer for the practice. In the Quechua and Aymara cultures of South America, it's not uncommon for a small amount of chicha to be poured before drinking it, as a ritual offering to Mother Earth.

In some of the most enduring myths, beer is a means of communing with deities. Dionysus, as he's called in Greek mythology, or Bacchus, as he's called in Roman myths, is the god of wine and pleasure, and on his eventful forays into the world of humans, he planted grapevines and

taught people the art of viticulture. The notion that the knowledge of fermenting agricultural products into beverage alcohol is a gift from the gods is not a new one. Like stories of great floods or virgin births, this is a theme that turns up in the mythologies of multiple cultures.

Take, for example, the story of Mbaba Mwana Waresa, a goddess of rain, rainbows, agriculture, fertility, and beer in the Zulu culture of South Africa. According to the myth, Mbaba Mwana Waresa longed for a husband but could not find a partner in the heavens. So she descended to South Africa in search of a mortal man. A herdsman called Thandiwe sang a song of such striking beauty that it piqued her interest. But she remained unconvinced of his worthiness, so she tested him. Mbaba Mwana Waresa disguised herself as a crone and tempted Thandiwe with a beautiful young woman. But Thandiwe was true and recognized his love immediately, and he and Mbaba Mwana Waresa were married.

But the other gods of heaven weren't pleased with the match. They were affronted by the goddess's choice of a mere mortal. To resolve the conflict, Mbaba Mwana Waresa invented beer and taught humans the secrets of its making. Beer, it is said, helps us feel closer to the gods. And to ensure that the bond between heaven and earth remains unbroken, the women who brew Umqombothi—a traditional Zulu beer—pour a small portion onto the ground as an offering to the ancestors and spirits.

Vikings and Norse Mythology

It's clear from all of these tales that beer has a way of creating its own mythology. One society with a number of beer myths and legends is the Vikings. You can probably conjure up images of the classic Viking in his horned helmet and forked beard, drinking huge quantities of ale and eating massive legs of lamb in a banqueting hall after a day of slaying his enemies. The first bubble to burst is that the Vikings didn't wear horned helmets. And secondly, the Vikings may have been far more restrained drinkers than people think, and beer might have been fairly rare back home.

There's no doubt that Norse mythology gives a prominent place for beer. The legendary giant Ægir, a personification of the sea, was renowned in the sagas for his hospitality, hosting the gods in his halls and supplying them with ale. And then there's Heiðrún, a mythical goat who is responsible for producing an endless supply of mead for all

those Vikings who die in battle and are brought to Valhalla. Gods and mythical goats that supply endless beer might be a good indication of just how rare access to it was during the Viking era.

Beer production is strongly associated with the rise of settled civilizations and the cultivation of grains, both of which were not as compatible with the Nordic climate as in the Mediterranean. Growing sufficient barley to brew beer was likely very difficult in the Far North or Iceland. Archaeologists have struggled to identify brewing sites that would indicate the intensity of beer culture the modern stereotype suggests. Mead specifically is often thought of as a Viking drink, even in modern Scandinavia, yet modern scholars have questioned this wisdom, too, given the short flowering season and historical difficulty of producing honey there. Certainly, the Vikings did drink ale and mead, but it's likely that what they brewed locally was fairly weak and in limited supply, possibly augmented by trading and raiding at some stages of the year.

Some of the best evidence of Norse beer-drinking culture comes from its preparation and storage for use at Yuletide, the Germanic/Nordic period of winter celebration that would eventually morph into Christmas after the coming of Christianity. Warm cider, ale, or wine mulled with spices and herbs—a style called wassail—likely came to the rest of Europe via Denmark and the Nordic world. Of course, when people say "drink like a Viking," they probably aren't imagining sipping a warm, weak, spicy ale on a winter's night.

So, what did regular Viking beer taste like? Again, there's no real way to know, and it would have varied enormously depending on what they had at hand, but almost certainly it would have been a gruit-style beer that used herbs or other plants to flavor the ale, or fruits and berries, rather than hops. Luckily, Dogfish Head Craft Brewery has worked to come up with something that approximates the taste of an ancient Viking beer: Kvasir. The recipe for Kvasir was developed with the help of chemical, botanical, and pollen evidence taken from a 3,500-year-old Danish drinking vessel. The vessel, made of birch bark, was found in the tomb of a leather-clad woman who was probably an upper-class dancer or priestess. The analysis pointed to the ingredients

used in this unique brew: wheat, lingonberries, cranberries, bog myrtle, yarrow, honey, and birch syrup—the kinds of ingredients rarely used today but common ingredients in meads a thousand years ago.

Mixed evidence of Viking beer culture hasn't stopped modern companies from embracing the popular mythology that the Vikings were legendary drinkers, and there are dozens of Viking-themed beer brands today, some of which cleverly describe the ancient springs and waters they draw from without mentioning their very recent origins. But part of the fun of beer is the enduring mythology associated with it.

Tasting List

Style	Brand	Special Glassware
wee heavy	**Belhaven Wee Heavy** Broughton Old Jock Ale McEwan's Scotch Ale The Duck-Rabbit Wee Heavy The Orkney Brewery Skull Splitter Traquair House Ale	snifter
ancient ale	**Kvasir** is an ancient ale produced by **Dogfish Head Brewery**. Historical recreations may not conform to a particular style. Commercial examples can be hard to find. Microbreweries sometimes produce historical beers as specialty offerings.	

A wee heavy is generally a higher-gravity beer, anywhere between 6.5% and 10% alcohol by volume, so a smaller volume is great for tasting and for drinking.

Tasted in lesson!

Even though it's difficult to tell whether historical recreations are accurate as far as what they reference, brewers and scientists making ancient ales try to offer a sense of what they might have tasted like.

8

BEER AND SOCIETY: TAVERNS, DARTS, AND WITBIER

At its heart, beer is an incredibly social drink. From the time of its origins, beer has brought people together. And since the Middle Ages, beer has been one of the most important, enduring, and widespread social institutions. This lesson examines the sociology of beer and the profound impact it's had on everyday culture.

Social Stratification

In many regards, beer's status as an everyman's drink stems from its social stratification as the drink of common folk—made from humble ingredients for humble people. This stratification partly resulted from the wide range of people who brewed beer, from alewives to monks, and the domestic settings in which beer was commonly brewed. And it was partly a result of those who disdained beer, such as the Greeks and Romans, who elevated wine as the nobler choice in beverage alcohol. When the Normans took over England in 1066, for example, they brought with them wine from France, which the new ruling class in England continued to drink, at great expense, to distinguish themselves from the beer-drinking conquered. Wine had to be expensively imported in colonial America, so drinking it was a luxury of the elite.

Madeira wine was a favorite of Thomas Jefferson, John Hancock, and George Washington.

And that stratification continues today, in one form or another, throughout the globalized world. For instance, in countless cities, high-end restaurants and clubs will often feature extensive wine lists specially curated by sommeliers, yet only a small number have begun to develop similarly sophisticated beer programs with the help of Certified Cicerones. Going to someone's house for a classy dinner party? You'd probably take a nice bottle of wine. Going to someone's house for a casual backyard barbeque? You'd feel more comfortable taking a six-pack of beer. All of this is to say that the social significance of beer and other alcoholic beverages constantly plays out spatially and situationally.

When people think of beer occasions, they often think of neighborhood pubs and bars, relaxed crowds full of familiar faces, laughter, and conversation among friends. Places where beer is drunk also tend to be thought of as open and welcoming. In fact, the term *pub* is short for *public house*. Historic inns, which often brewed and always served beer, for centuries were meeting places for locals and travelers alike from all walks of life. And beer festivals bring hundreds, sometimes thousands, of people together to celebrate.

Sociologists use the term *third place* to describe social surroundings that are separate from the two usual social environments: where you live and where you work. The third place is where you congregate with others. Urban sociologist Ray Oldenburg argues that third places are incredibly important,

as they're where some of the most important civic engagement and social connectivity occur. For many people, the third place is the place they can choose to be a part of and where they can most authentically express themselves. This is particularly true for the working classes or marginalized peoples, who may have limited choices in housing or employment.

Third places can be found in the archaeological record of many civilizations. Roman underclasses, such as the enslaved, plebs, and workers, socialized in bars called *popina*, which served inexpensive food and drinks. In the ruins of Pompeii and Herculaneum, several were preserved, and their structure is vaguely recognizable to people today. They featured counters or bars that people would sit at on stools and bigger open areas where large tables were placed for communal gatherings. More than 100 *popina* of various sizes have been tentatively identified among the ruins of Pompeii. They were probably like favorite neighborhood dives.

Evidence of other popular diversions could be found in *popina*—games, gambling, and sex work, among others. Additionally, these establishments were sometimes located on major roads so that they might also offer places for travelers to sleep. These were early forerunners of the inns that had the ability to house lodgers. The *popina* is an ancient version of a tavern, and taverns have existed in one form or another for millennia.

Taverns, Beer Gardens, and Inns

All over Europe and the Americas—and really any place where beer is commonly consumed—some variation of the tavern can be found. And different cultures have adapted the tavern concept in different ways. In Balkan countries, a popular type of tavern is known as a *kafana*, which serves both coffee and alcohol and often features local folk music as well. In Brazil, *boteco* are establishments

that have historically been popular with the artistic and bohemian set and those looking for beer, inexpensive food, and relaxed conversation with like-minded patrons.

In Germany, the beer garden might be considered a kind of open-air tavern. Beer gardens emerged for the most practical of reasons. Remember how Bavarian breweries were restricted by law from brewing beer in the summer months? Well, in addition to using caves, many breweries dug out extensive underground cellars for lagering and storage over the summer months. To help keep the cellars cool, brewers planted leafy trees like chestnuts and elms on the grounds above. With the addition of gravel, tables, topiary, and benches, beer gardens became trendy places to meet and drink that were suitable for mixed company.

By the early 19th century, these extensions of breweries became so popular that the proprietors of more traditional inns and taverns complained and petitioned the authorities to revoke the breweries' right to sell beer directly to the public. In a compromise, brewers retained the right to sell beer in these spaces but could serve no food other than bread. These new regulations didn't stop patrons from bringing their own food, so these gardens became popular spaces to picnic, establishing a unique parklike social environment that distinguished beer gardens from typical taverns.

There is a word in German that evolved to describe the friendly, warm, and cheerful atmosphere that people found to be a central aspect of the beer garden: *Gemütlichkeit*. Beer gardens were about community, family, and good times. They became focal points of Bavarian culture.

A hefeweizen is a unique style of German wheat beer that harkens back to the shaded summer gardens of Bavaria. But despite hefeweizen's Bavarian origins, historically wheat beers weren't actually legal for Bavarian brewers to make, because local beer purity laws stipulated that brewers could only use water, hops, and barley to make beer. But wheat beers were well enjoyed by the Wittelsbach family, the royal house of Bavaria, who created a loophole in the laws to give a single brewery in the village of Schwarzach permission to make wheat beer. That brewery passed into the hands of the Wittelsbachs themselves in the 1600s, and, seeing how popular hefeweizen was, they decided to open more breweries and make wheat beer a state-run business. It

was a such a success that wheat beers at their height provided more than a third of the state income of Bavaria and spread the style far beyond its borders.

Hefeweizens are also distinguished by the specific yeast strain used to brew them, known as W68, which is a strain of *Saccharomyces cerevisiae*. This yeast converts ferulic acid found in wheat malt into the compound 4-vinyl guaiacol, which smells like cloves. It also produces isoamyl acetate, which is uncannily reminiscent of bananas. Today, the Bavarian State Brewery, Weihenstephan, still brews hefeweizens and is legendary for its yeast library, which preserves, cultivates, and sells hundreds of yeast strains. That includes W68, so breweries can make that taste of the Bavarian summer anywhere.

So, the tavern in all its forms has been a central institution of European life for centuries. But it wasn't a third place strictly reserved for drinking, gambling, and sleeping. Public business was often conducted in taverns, particularly in small towns and villages that lacked a town hall or other community space. Throughout the Middle Ages and into the industrial era, they were also places where you could recruit; employers looking for hired hands like sailors, farm workers, or laborers could find them in the taverns they frequented. In colonial America, the local magistrates' courts would sometimes convene in taverns, and several of the Founding Fathers had their first unofficial meeting of the Continental Congress in a Philadelphia tavern.

Taverns weren't just places to drink and relax, or even to hold a meeting; they were part of the public commons that were relied on by the community to do things that couldn't be done at home or work. Tavern paintings depict birth announcements, romantic dates, proposals and marriage contracts, funerary celebrations, and sometimes even deaths as occurrences that would have taken place in taverns.

Inns were a type of tavern that was equipped and licensed to house lodgers. They were essential for the transportation network prior to the development of railways. Traveling long distances by horse required places where one could not only stop but also feed and board a horse

overnight—particularly once coaches and carriages became popular. Many inns added stables and sometimes fresh horses you could swap out.

And prior to syndicated daily news, a town probably got most of their outside information first from travelers staying there. Inns and taverns were vital communication and transportation links, particularly in the early history of the United States and Canada, where distances between settlements could be significant. Colonial Americans could go to their local tavern to hear newspapers and proclamations read aloud, find out the latest crop prices, and argue about weather forecasts. In many areas, the tavern effectively served as the local post office and, after the revolution, polling place. The Fairbanks Tavern, which once stood in Boston, was proclaimed America's first official post office in 1639.

Towns with large markets or on the intersection of major roadways would be full of inns servicing the travelers. The town of Barnet in England has half a dozen historic pubs virtually next to each other that used to service all the traffic coming in and out of London on the Great North Road. The Angel in Islington was one of the most famous coaching inns in England, where generations of travelers started their journeys north, so much so that it's a property square on the English version of Monopoly.

English Pubs

English pubs, like inns and beer gardens, were a type of tavern that developed a very specific culture. Short for *public house*, the name *pub* helped distinguish these places from private residences, where most beer was historically brewed and served. Licensed publicans were, by common law, expected to receive all travelers who were willing to pay the price for food, drink, and lodging. However, far more than being simply purveyors of food and ale, pubs in England slowly evolved into a unique kind of social institution.

Many pubs would feature two places to drink your beer. The public bar was the rough-and-ready space where the working classes would come. They generally had bare wooden stools and booths, sawdust on the floor to absorb spilled drinks, and cheap and cheerful decorations. Men could come in with their dirty clothes from the workday without fear of

causing too much damage and get the cheapest beers in town. And it was only men—these public bars were thought of as rough places, so they usually didn't permit women.

Women could drink, if accompanied, in the other bar of the pub. That was known as the saloon or lounge, and it featured nice, upholstered furniture; a bigger range of more expensive drinks, such as wine and spirits; and maybe live entertainment or other features, such as billiards tables. An unaccompanied woman might be able to get away with a drink by herself in what was known as the snug. This wasn't a full bar but a smaller private space that had access to the bar but was partitioned off or sometimes concealed by frosted glass. Drinkers who did not want to be seen could come and enjoy themselves here. Snugs were once particularly common in Irish pubs; there are many tales told of Irish priests dashing into their local snug after Sunday service so they wouldn't be sprung by their parishioners.

Pubs took on an iconic character in the social history of England and its colonies. The monumental architecture of Australian pubs from the Victorian era can give you a sense of their importance in the community—indeed, in many small Australian communities, the pub was the fanciest building in town. CAMRA, the Campaign for Real Ale, is an organization dedicated to protecting and preserving traditional English cask ale as well as "pubs and clubs as social centers and part of the UK's cultural heritage." The organization has published a fourfold definition of a pub but concedes that what really defines a pub is somewhat intangible.

What's indisputable is that English bitter is a style of beer that coevolved with English pub culture. *Bitter* refers generally to cask-conditioned draft ale, and in many establishments, a "pint of bitter" was simply the standard way to order a beer. Now, the term is commonly used to describe a group of well-hopped pale English ales, from about 3.5% to 7% in strength. English brewers will sometimes use terms like *best bitter*, *special bitter*, *extra-special bitter*, and *premium bitter*, but these are not well-defined terms, and usually they just indicate a stronger form of their ordinary bitter.

A popular American stereotype of the English is that they drink their beers warm. The story probably got started because while pub cellars are still quite cool, around 55°F, they are not ice-cold like the beers Americans might take from a fridge.

A classic English pub will fill your bitter from a beer engine, a device invented in the late 1600s to pump beer up from the pub's cellars to taps at the bar with a pump clip to show off the beer the tap was connected to. Sometimes a sparker would be attached to the nozzle; it works a bit like a shower head and gives your beer a frothier head.

Pub Games

English pubs, and the copycats they've inspired around the world, have spawned an incredible variety of social practices and traditions of their own. English cuisine, music, and even language has been shaped in part by pub culture. But maybe the most enduring cultural artifact is the pub game. Games have a much longer association with taverns and beer culture than just the English pub. The Royal Game of Ur, one of the most ancient games that's known of, originated in ancient Mesopotamia, and a cuneiform tablet describing its rules mentions both betting and drinking beer as part of the game's excitement. And when playing cards took Europe by storm in the 15th century, those, too, became iconic features of taverns and inns. There are dozens of paintings from the Renaissance and Enlightenment periods showing card players with beers at the ready playing in their favorite drinking spot. Trick-taking games like whist and scoring games like cribbage became particularly popular in taverns. Skittles, quoits, and horseshoes were other popular tavern entertainments.

But arguably the most famous game to evolve out of pub culture is darts. The exact origin of darts is somewhat obscure. Variations of throwing games involving darts date to the Middle Ages and probably had military associations. But dartboards became an increasingly popular feature of pubs around England during the Georgian and Victorian periods. Towns tended to have their own variation of the board, but by the late 1800s, a standard scoring system and the classic board with a bullseye and two rings began to circulate.

The rise of darts again reflects some of the social and class tensions associated with beer culture. Darts is a challenging game that requires fine motor skills and steady nerves. Yet despite the fact that it was probably one of the most popular games in Britain at its height, played daily in thousands of pubs around the country, it struggled to gain recognition as anything but a drunken amusement. Classist associations still dogged darts when tournament games began to be televised in the 1970s. During the first years of the world championships, it was normal to see the best darts players in the world compete while smoking and drinking beer. But despite beer's inseparability from the culture and evolution of the game, middle-class viewers were scandalized, and darts' ratings suffered as a result, so much so that televised matches were eventually reformed to prohibit these activities. Though hidden from the cameras, raucous dart tournament audiences still sit at large tables and drink beer as they spectate.

Popular Culture

The social stratification of beer and wine persists in popular culture, too. Television and movies use both as quick signifiers of class. When the snobbish, intellectual character of Dr. Frasier Crane made his debut on the show *Cheers* in 1984, the first drink he ordered was a white wine spritzer, reinforcing his social distance from the beer-drinking, working-class character of the bar. At the same time, *Cheers*—one of the most popular television series in history—celebrates many of the aspects that have made beer the focal point of working-class social spaces for millennia: camaraderie, laughter, and conversation. The bar where "everybody knows your name" still deeply appeals to the need for a third place, a space that fosters social belonging.

In recent decades, though, the craft beer revolution has increasingly created new social spaces for drinking that have inverted traditional class divides. The gastropub, for instance, inverts the tradition of pub food—which is usually cheap and hearty—by offering more sophisticated dishes that make dining at the pub a more enticing option for middle-class patrons. Brewpubs, defined as small breweries that make a significant amount of their income from on-site food sales, have become increasingly popular.

Far from the unfinished sawdust floors and dark, smoky rooms of 18th-century taverns and pubs, modern brewpubs and taprooms in most countries are clean, light, smoke-free, and often family-friendly. Beer is

transcending some of its traditional associations with class divisions. With more than 9,000 breweries in the United States, the vast majority being neighborhood brewpubs and taprooms, beer has truly remarkable reach, and these spaces are poised to be inclusive third places that everyone can enjoy, serving much the same role as they have for thousands of years.

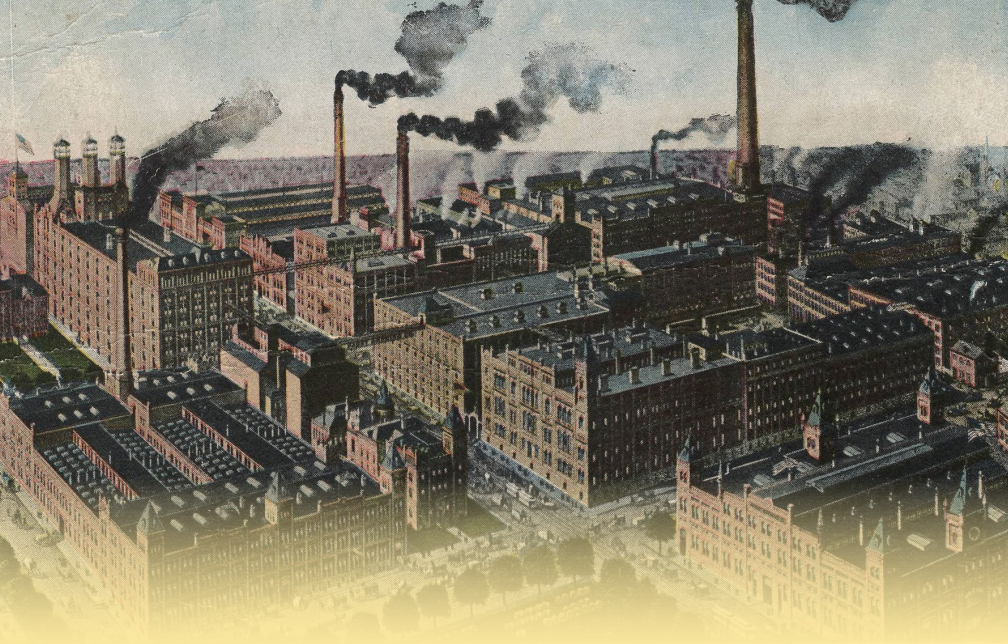
Hefeweizen means "yeast wheat."

Tasting List

Style	Brand	Special Glassware
weissbier	Ayinger Bräuweisse Distelhäuser Weizen Hell Hacker-Pschorr Hefe-Weissbier Hofbräu Münchner Weisse Schneider Weisse Weissbier **Weihenstephaner Hefe Weissbier**	hefeweizen glass (tall with a bowl at the top)
best bitter	Adnams Southwold Bitter **Fuller's London Pride** Harvey's Sussex Best Bitter Salopian Brewery Darwin's Origin Surrey Hills Brewery Shere Drop Timothy Taylor's Landlord	

Tasted in lesson!

Bitter isn't exactly a style of beer; it's more accurate to describe it as a treatment. A bitter is any hoppy, pale beer that's traditionally served out of a cask. Many in the UK refer to this as real ale. When the same beer is not cask-conditioned and is served out of a bottle, it's often called pale ale.



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BEER INDUSTRY: PORTERS, STEAM, AND BOTTLING

This lesson explores the Industrial Revolution, which would completely transform brewing. In many ways, the English porter represents the start of this massive transition in the history of beer and the birth of large industrial breweries.

From Cask Ale to Porters

For centuries, purveyors of beer had brewed on a modest scale, selling mostly to pubs in their local area. And critically, breweries didn't deliver ready-to-drink products to taverns and pubs. Instead, they shipped young, unconditioned beer that would be then aged in casks by experienced cellarmen on the premises. If you visited a pub in England circa 1700 and asked for a beer, you would have been treated to a demonstration of the cellarman's art. Cask ale, so called because it was racked into a cask after primary fermentation and then sealed, is unfiltered, which provides a rounder mouthfeel and a bit more complexity in flavor and aroma. The live yeast in the cask would have provided a soft carbonation, and this beer would have been served at cellar temperature, around 55°F.

Cask ale can change noticeably from day to day, so it was standard practice for the publican to draw your beer from more than one cask, to mitigate dramatic changes and to take advantage of the complexities of blended beer. Traditional cask ale is still served across England, and its purveyors and fans are represented by CAMRA, the Campaign for Real Ale, an organization that promotes cask-conditioned and dispensed ales.

Around 1720, however, London brewers began changing their practices to gain a competitive advantage over rural brewers entering the London market, as well as to cut out middlemen who were buying young beer from the breweries, conditioning it themselves, and then reselling it to the pubs for a profit. So, they began brewing a new kind of beer: the porter. One popular theory is that in creating the porter, these brewers were trying to imitate a blending process popular among London publicans called three-threads, where a pale ale, young brown ale, and strong aged ale were combined to create a dark, complex beer. To get the right mature taste, porters required a lengthy conditioning period, so the brewers completed the conditioning process in large tanks at the brewery so that they arrived at the pub ready to drink.

Soon this new beer was the sensation of London, particularly among the laborers, sailors, and porters of the city, which is where it got its name. And within a few decades, the market for London porter was booming. New pubs sprung

up selling nothing but porter, because its ready-to-drink nature didn't require the publicans to mature and mix the beers themselves. Porter would become one of the first mass-produced beers and kick-start a revolution in brewing.

The porter boom benefited from and produced important new brewing technology. As early as the 1740s, London brewers began to use thermometers to more precisely control mash and fermentation temperatures and ensure a consistent end product.

Then, in 1770, the first saccharometer, a type of hydrometer, appeared. With it, brewers could measure the density of sugar in a solution, which gave them a way to gauge how much fermentable sugar was available in a wort and how much remained after fermentation. That gave brewers a means to see how far fermentation had progressed and estimate how alcoholic their beer had become.

Though fermentation occurs without human intervention, brewing beer requires a number of steps that are labor intensive. Spurred by the profits made from the sale of porter, large English brewers now looked for ways to reduce the labor intensity of the process and increase their productivity. And they soon turned to the new technology of steam power to achieve this.

Steam Power and Industrialization

In 1784, brewer Samuel Whitbread commissioned James Watt to build a 35-horsepower rotative steam engine, one of the first in the world. Whitbread's engine was first used to replace a horse-powered grist mill, but it was eventually used to drive other machines as well, including conveyors, stirrers, and hoists. It also turned a large Archimedean screw—a device often called a grain ladder when used in the brewhouse. It even pumped water from a well into a tank on the roof of the brewery. After installing steam power, Whitbread Brewery tripled its beer production within just 10 years. Incredibly, the Whitbread engine remained in working order at the brewery for 102 years, and when it was finally retired, it moved to a museum in Sydney, where it still runs today.

Other brewers quickly followed suit, looking for ways to automate their beer making and harness steam power to make more beer more efficiently. By 1800, there were 14 steam-powered brewery operations in London. Canals and then railroads made it easier and cheaper to import ingredients and export London porter around the countryside.

Brewers were some of the first big adopters of steam technology.

Malthouses were also becoming increasingly industrialized to meet the growing demand for porter malts. At the beginning of the 1800s, a British engineer and inventor named Daniel Wheeler modified a coffee roaster to invent the world's first drum roaster for malting gain. With it, he could achieve high temperatures that roasted malts an ebony black without charring.

Up until this time, brewers used large quantities of expensive brown malts, lengthy boils to create kettle caramelization, blending techniques, and sometimes artificial colorants to achieve the deep brown coloring of porter. But with Wheeler's new drum-roasted black patent malt, a very small quantity could be added to lightly kilned base malts to achieve the color, mouthfeel, and slightly roasty astringency of the porter style. The Whitbread Brewery, which was on the cutting edge of emerging brewing technology, was the first to start using the new black malt in 1817. Other large brewers soon followed, defining modern dark ales from that time forward.

Porter became one of the first truly international beer styles. Arthur Guinness started brewing his own version, a stout porter, in Ireland, and it eventually came to be defined as its own style—simply stout. Imperial (or high-alcohol) stout porters exported from England became popular in the countries on the Baltic Sea and inspired domestically brewed versions in those countries. Often brewed with lager instead of ale yeast, this style is now called Baltic porter.

Robert Hare, son of a London porter brewer, emigrated to Philadelphia in 1773 and is thought to have started the porter craze in the colonial United States. By the mid-1800s, the London porter brewers had made a fortune. Several of them, including Samuel Whitbread, became members of parliament, part of the new generation of self-made millionaires created by the Industrial Revolution.

And throughout the 19th century, a steady stream of new machines appeared that further improved the brewing process. For example, after a wort is boiled, it needs to be cooled down before the yeast can be pitched. Traditionally, there was no other way to do this than to pour the wort into shallow tubs and wait, perhaps eight hours or more, with someone needing to stir the wort as it cooled. Not only was this time consuming, but the prolonged exposure of the wort to the still air made infection by wild yeasts and bacteria more likely. In the 1850s, the Baudelot cooler—commonly called a wort chiller—was invented to specifically solve this problem by running the wort through a matrix of copper tubes that were filled with cool water, cutting the cooling time by 75% while significantly reducing the chance of infection. Soon, every step of the brewing process had new machines and tools that increased not only the profitability of beer making but also the quality of the beer that was produced. Greater brewery efficiency also kept porter's prices low, which in turn spurred more demand, and so on.

Industrialization did bring its own problems, though. The big London breweries were growing sources of air pollution from the fuels burned to drive their machines and run the boilers. Meanwhile, huge amounts of brewery wastewater often ended up in the Thames. Working conditions were noisy and hot, with long hours and often low pay, and the ever-growing scale of breweries brought unique safety risks.

Though porters and various descendants of the style remain popular, the international porter craze started to die down in the mid-19th century—particularly in the United States, where porters and English-style ales had been very popular since the colonial era but were now being challenged by Bavarian-inspired lagers. However, the technologies that made porter an international bestseller continued to grow and evolve in the hands of lager brewers, who would eventually become the multinational beer corporations of today.

Distributing, Transporting, and Bottling

With breweries in the UK, across continental Europe, and in North America making beer at exponentially larger volumes than ever before, another aspect of the brewing business would get a massive overhaul: distribution. Since the beginning, shelf life has been a limitation to how widely beer could be transported and sold. At the start of the 1700s, brewing was still a predominantly local and regional affair. Horse-drawn drays distributed casks and kegs of beer, sometimes atop elaborately painted wagons. These were once a very visible fixture in the brewing trade, but their reach was naturally pretty limited. Sending beer further afield was a more complex and costly exercise and, for many breweries, not very profitable. But the Industrial Revolution brought technologies that progressively made it cheaper, easier, and more practical to distribute beer nationally and even internationally, allowing breweries to become major corporations with truly global reach.

Adolphus Busch, who cofounded Anheuser-Busch, was one of the most significant pioneers in this area, drawing together several new technologies to make widespread beer distribution a reality. Busch had married the daughter of a prosperous German soap maker, Eberhard Anheuser, and in the 1860s went into business with his father-in-law after purchasing a failing brewery in St. Louis, Missouri. At that time,

St. Louis was a natural place to run a brewery due to its large German immigrant population and ample clean water supplies. St. Louis is also home to numerous underground caves, which early German brewers used to store and mature their lagers in cool temperatures, much as they had in Germany.

Styles that were stronger or more heavily hopped, such as porters and pale ales, were naturally more shelf stable. But the German-style lagers, which were booming in popularity, tended to go flat and sour quickly when not refrigerated. So, like most brewers of the early 18th century, Anheuser-Busch was limited to selling their beer locally, since it was very difficult to ship it far without it spoiling. But Busch saw new technologies as the solution to the problem. The global ice trade blossomed during the Industrial Revolution, and early refrigeration technologies like iceboxes had become a reality for the wealthy and large businesses. In fact, German brewers were some of the first major consumers of commercial ice, because it allowed them to make and store their increasingly popular lagers year-round without the use of caves or excavated cellars.

At the same time, by the 1860s, America was experiencing a railway boom. New links crisscrossed the nation, moving people and products farther and faster than ever before. Busch put the two together and in 1874 helped drive the development of a refrigerated boxcar to transport beer. It featured large tanks for ice slabs built into its walls. These early cars needed their ice replenished about every 250 miles, so Busch built a network of ice depots across the South and West. Anheuser-Busch was one of the first companies to use refrigerated rail transportation, which eventually revolutionized the world by creating national markets for perishable products like fruit, meat, and dairy.

Busch also tackled another well-known issue with beer: spoilage caused by bacterial contaminants. On one of his trips to Europe to study beer, he encountered Louis Pasteur's experiments in heat-treating wine to kill off harmful bacteria. And when he returned to St Louis, he became the first American brewer to start pasteurizing beer in 1872, four years before Pasteur's studies on beer were even published. Anheuser-Busch's brews, which weren't as susceptible to heat degradation because they used a considerable amount of rice in place of malted barley, could now last several months with refrigeration, rather than just a few weeks.

A growler today refers to a refillable jug or bottle for take-home draft beer, and the concept has become popular with some craft breweries.

Another piece of the distribution puzzle that Busch had to contend with was what to ship his beer in. For centuries, beer had been stored and distributed in wooden barrels and casks and then served on draft in glasses at taverns and pubs. So nearly all beer was draft beer. And if someone wanted to buy beer to take home with them, it was customary to take a bucket called a growler to be filled at the local pub.

As you can imagine, open buckets weren't particularly good at keeping beer carbonated. Traditionally, ales were lightly carbonated, but the lager boom had made effervescence a highly desirable beer quality that customers of beer gardens, pubs, and saloons came to expect. The solution, Busch recognized, was to bottle beer in individual portions that preserved carbonation right up until the point it was served. Bottling beer was not a new concept, but the high cost of glass had meant it wasn't common, and cheaper ceramic bottles were not sufficiently airtight to keep beer carbonated. But 19th-century mass production could make glass much cheaper, and Busch used bottles designed to hold soda and sparkling water for his beer in 1872. Anheuser-Busch could now produce and package effervescent lagers that stayed fresh and cold in the bottles that were transported across the country, becoming one of America's first truly national brands.

Other breweries were very quick to catch on. The Blatz Brewery in Milwaukee started producing its own beer bottles the following year, in a shape that has come to be known as the export bottle, which was the forerunner of the classic beer bottle shape recognized today.

The crown cap revolutionized beer packaging in the past century, but it's a pretty simple device. The crown cap has ridges almost like the crown on a monarch's head, and all you need is a device to crimp the ridges around the lip of the bottle, thereby sealing it from air and keeping the beer protected.

Over the next few decades, manufacturers experimented with a dizzying array of bottle closures. Corks were originally used, and then there were flip-tops or lighting stoppers. In 1892, William Painter of Baltimore solved the problem for good with the iconic crown cork, or bottle cap, and pretty much the whole industry converted to it.

With the ability to mass-produce products and distribute to markets across the country—and even the globe—commercial beer production exploded. In 1865, about 4 million barrels of beer were produced in the United States. In just 10 years, that volume nearly tripled to 10 million barrels and nearly tripled again by 1890 to 28 million barrels. By the start of Prohibition, the industry had nearly hit 60 million barrels in production. Only part of this is due to population growth. The average American went from consuming 3.5 gallons of commercially produced beer annually in 1865 to 16 gallons in 1900.

The Pabst, Schlitz, Miller, and Blatz breweries turned Milwaukee into the beer capital of the world, with new industrial brewing facilities that took up whole city blocks. The Pabst Brewing Complex alone spanned some 30 buildings, with a 7-story malthouse and eventually even a visitors' center to accommodate brewery tours. And it wasn't just brewing—a resort, theater, restaurant, and hotel are some of the other ventures Pabst built in the city, some of which still stand today, as well as the incredible Gilded Age mansions of the brewers themselves, who became very wealthy.

Steam Beer

America's new industrial breweries became experts at taking the popular European lager styles and adapting them for the American market and local conditions. An interesting example is steam beer, which emerged in California in the mid-19th century. The California Gold Rush brought hundreds of thousands of fortune seekers to the West in the 1840s, with burgeoning cities like San Francisco springing

up almost overnight. Mining is thirsty work, and crisp, thirst-quenching lagers were an obvious choice to refresh under the hot California sun. The only problem was that, prior to refrigeration, it was hard to get the cool temperatures needed in this warm climate to ferment a lager.

Through trial and error, though, some California brewers discovered that they could push certain strains of lager used to ferment cleanly at higher temperatures. The resulting steam beer was quite distinctive, with features of both ale and lager. The reason for the name is obscure: One story is that, having no other way to cool the wort after boiling, brewers would pump it up to the roofs of their breweries and have it cool off in large, open-topped bins. As the wort was caressed by Pacific breezes, steam would naturally be produced—hence the name.

Steam beer was originally a cheap, low-quality lager brewed to serve the thirsty masses and was enormously popular and common in the West by the end of the 19th century, particularly San Francisco. Although steam beer is one of the many beer styles that would almost disappear with Prohibition, the Anchor Brewing Company, founded in 1896, still brews steam beer that can give you a taste of late-19th-century America.

Corporate Breweries and Beer Globalization

Using the same technologies and innovations developed in America, German breweries like Löwenbräu and Spaten became industrial giants, too, rivaling their American counterparts. In the 1870s, local inventor Carl von Linde perfected compressed-ammonia refrigeration, allowing the Munich brewers to forego their ancient caves and produce and sell lagers year-round. For some of these breweries, the transformation was dramatic. Augustiner-Bräu started life as an Augustinian monastery brewery on the outskirts of Munich in the 14th century. By the end of the 19th century, it was a huge factory brewery in the heart of industrial Munich and one of the biggest employers in the city, with not a monk in sight.

Corporations had not totally taken over the beer industry by this point; there were still thousands of local breweries still operating—and so were many regional-scale corporate breweries, such as Ballantine, Falstaff, and Duquesne. But the industrialization of beer had completely changed the game and, in the process, remade what the public expected of their beer. And by the late 19th century, the big brewers were exporting internationally and giving the world a taste for the same. German and

American lagers were appearing as far away as Brazil, South Africa, and China. Beer globalization was in full swing, which, for better or for worse, was opening up the next big era in the history of beer.

Tasting List

Style	Brand	Special Glassware
English porter The classic English porter, which tends to have restrained alcoholic content, is only going to be between 4% and 5.5% ABV.	Batemans Salem Porter Burton Bridge Brewery Burton Porter Fuller's London Porter Nethergate Stour Valley Brewery Old Growler RCH Old Slug Porter **Samuel Smith Taddy Porter**	
California common	**Anchor Steam Beer** Steamworks Steam Engine Lager	

Tasted in lesson!

A California common is a style of steam beer that came out of the San Francisco era in the US. The classic hop used for the California common is called Northern Brewer, a hop that was developed in the 1930s in England.

10

BEER POLITICS: PURITY LAWS AND PROHIBITION

Beer, law, and politics have been mixed up together for millennia. The Code of Hammurabi from around 1750 BCE is one of the oldest legal codes preserved today. Half a dozen of its 300 decrees touch on the subject of beer or inns. And legal and political pressures have profoundly shaped beer culture, composition, and even styles.

International Temperance

Imagine this: You are enjoying a pint in a local pub in suburban Melbourne, Australia, in 1954. The pub is pretty quiet, with just a few locals wandering in and out during the day, with maybe a little surge at lunchtime. Then it strikes five o'clock. A stampede of men starts streaming out of nearby factories and offices and crowding into the pub. You are lucky you got a stool, because now it's standing room only. Barmaids, seemingly appearing from nowhere, rush to serve the sudden crowd. Everyone is ordering as many beers as they can and downing them as quickly as humanly possible, likely on an empty stomach. After just an hour, a bell rings out indicating the last call. It's noisy and rowdy, and the occasional fight breaks out, as the staff scrambles to pour as many drinks as possible.

A tourist witnessing this spectacle once called it "a glimpse into Hades." This was the six o'clock swill, so called because from the 1910s to the 1960s, across New Zealand and most of Australia, pubs were required by law to close at 6 pm. Inspired by a growing international temperance movement, Australian politicians introduced early closures as a temporary measure during the First World War. They argued that self-discipline and sacrifice were needed for the war effort. Sadly, a riot of drunken soldiers in 1916 helped to make the case. With the support of women's Christian societies, who hoped early closures were a stepping stone to full-scale prohibition, the Australian public voted to make early closing permanent even after the war had ended.

> The politics of beer production and consumption are often more about attempting to control the people who drink beer rather than the liquid itself.

But early closing didn't have the effect its promoters intended. With only an hour between the end of the workday and pub closing, patrons tried to drink as much as possible as quickly as possible. Rather than create a generation of men who spent evenings with their families instead of at the pub, it created a generation of binge drinkers who stumbled home to their families drunk before dinnertime. "Sly-grog" shops, illegally selling beer on the side, sprang up around the country. Alcohol consumption barely declined. And worst of all, drunk driving fatalities soared as men staggered out of the pubs and tried to drive home.

The laws even had an impact on the architecture of Australian pubs. To serve so many people so quickly, extremely long bars were installed. The Mildura Working Man's Social Club had a 300-foot-long bar with 32 beer taps. Claiming to have the longest bar in Australia was a popular marketing strategy to draw in patrons who didn't want long waits.

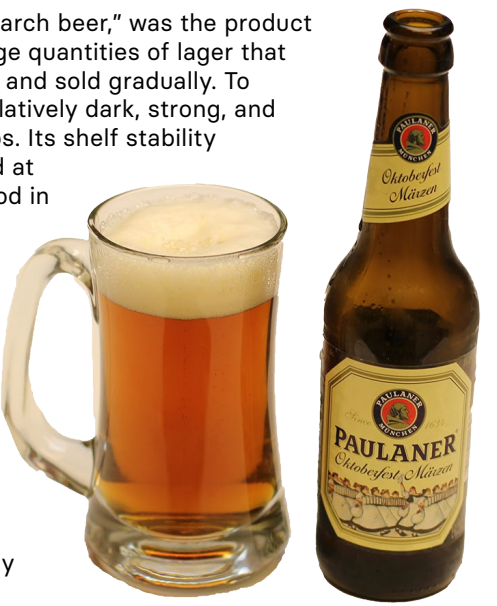
By the 1960s, the ineffectiveness of early closing couldn't be denied, and the practice was repealed. However, the iconic ringing of a bell and shouting "last orders" is still a part of beer culture in various parts of the Commonwealth.

The Märzen and the Reinheitsgebot

One of the most famous examples of a beer style that was developed specifically in response to a law is the Märzen.

As you might recall from lesson 5 on beer geography, one of the most influential laws on beer history was Albrecht V's decree of 1553 prohibiting the brewing of beer in Bavaria between April 23 and the fall equinox, in an attempt to prevent spoilage and contamination problems that were common in beer brewed in the warm summer months.

The Märzen, which means "March beer," was the product of a mad dash to produce large quantities of lager that could be stored over summer and sold gradually. To make it last, it was brewed relatively dark, strong, and full-bodied with plenty of hops. Its shelf stability meant that it was often saved at the end of the restricted period in early fall, making Märzen one of the world's most iconic harvest beers around fall time.



Albrecht V's ban of summer brewing wasn't the only attempt to legislate quality control and economic protections for Bavarian beer making. In 1516, his father, William IV, had passed what was arguably

the most important legislation in the history of modern beer. The Reinheitsgebot, or Bavaria "purity order," decreed that all beer brewed in Bavaria could only use three basic ingredients: water, hops, and barley. The Reinheitsgebot extended the reach of a Munich law passed in 1487 to apply to the whole of Bavaria. The motivation was to prevent excessive competition for supplies of wheat and rye. Bread was the key caloric staple for most Europeans in the Middle Ages, and high bread prices were a political headache, as bread riots and peasant rebellions might quickly follow. Wealthy brewers could often outbid bakers for grain supplies, but the new law ended the problem by forcing brewers to only use barley.

The forced use of hops also had political and economic consequences. Hops were popular in Bavaria before 1516. The region has an ideal climate for hop cultivation, and the Hallertau region is the largest continuous hop-planting area in the world. And even though Bavaria's rulers were staunchly Catholic and resisted the Protestant Reformation, gruits were increasingly being viewed with suspicion, particularly because of their use of herbs like henbane and wormwood. Though both were popular beer-flavoring agents, they also have psychoactive properties. Ironically, ingredients that may have been part of gruits sold by the church were demonized in the hands of peasants as tools of witches.

Whatever the real reasons, the Reinheitsgebot profoundly changed beer. Given the role that German brewers played in industrializing beer production and exporting beer to global markets, the law resulted in a level of standardization that served as the stylistic springboard for the vast majority of the beer that is brewed and consumed today.

Beer: A Politically Potent Topic

Beer was, and remains, a politically potent topic in Germany. The association of beer with German politics goes back to the tradition of the Ratskeller, a bar or tavern that was traditionally located underneath city halls, particularly the Hanseatic cities like Bremen. And the large cellars that spread around Bavaria in response to the brewing purity and seasonal laws also became fixtures of political culture in the region.

Beer halls, the indoor equivalent of beer gardens, opened at Bavarian breweries, and some made use of the vast underground spaces created to store beer to host the public during the colder months. Whether

aboveground or below, beer halls became incredibly popular as meeting places and public spaces in Bavaria—and often, in the process, popular sites for political speeches and organization. Adolf Hitler and the Nazi Party both rose to prominence in Bavaria through the beer halls in the 1920s. Hitler would regularly make speeches to spellbound crowds of hundreds, sometimes thousands, in the beer halls around Munich. And it was at one of the largest in the city, the Bürgerbräukeller, that Hitler attempted to overthrow the Bavarian state government in 1923—the so-called Beer Hall Putsch. (Ironically, Hitler himself rarely drank.)

And it was the beer culture of Germany that sowed the seeds of some of the most contentious political battles in 19th-century America. Germans were among the largest ethnic groups that emigrated to the United States throughout that century; in the 1850s alone, nearly a million Germans arrived, predominantly settling in Midwestern states like Pennsylvania and Ohio. German immigrants brought the best of German brewing traditions to the United States—specifically lager beer and the communal and family-inclusive atmosphere for beer gardens. With astonishing speed, the porters and wheat beers that were popular in the colonial United States were challenged and then overtaken by

lager. German-owned breweries—Anheuser-Busch in St. Louis; Pabst, Schlitz, and Miller in Milwaukee; and others in Cincinnati and New York—introduced a new class of "beer barons" to the United States. These men and their descendants would become some of the richest, most influential men in the nation.

By the second half of the century, America had been fundamentally changed by the arrival of millions of European immigrants as well as the end of slavery and the Great Migration, when some 4 million formerly enslaved Americans relocated North, fleeing the horrors of the Reconstruction and the Jim Crow–era South. Saloons, what might be thought of as dive bars today, became, for many land-owning white Anglo Saxon Protestant Americans, powerful symbols of what they perceived to be dangerous and insidious cultural forces. Immigrants, Blacks, Catholics, and the working poor congregated in saloons not only to carouse but to find work and lodging and establish social networks.

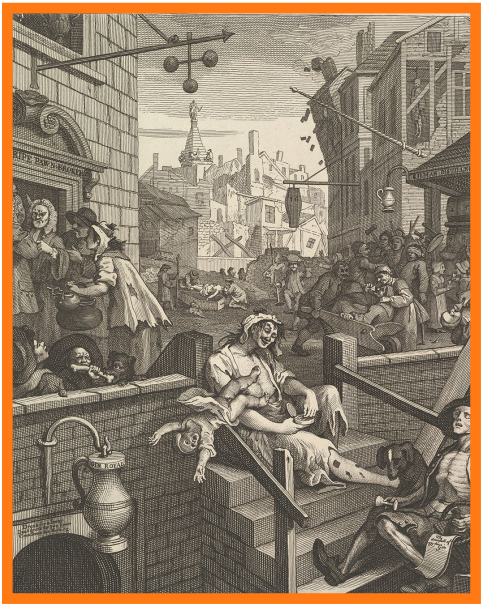
All of this was being fueled by large German-owned breweries, which operated many saloons via what was known as the tied house system. Tied houses would have exclusive contracts to supply beer from a particular major brewery. And because competition was fierce, the opening of a Pabst saloon in a neighborhood would often lead to a Schlitz, Blatz, or Coors saloon opening nearby and usually trying to undercut the other on price. The explosion of the brewery-tied saloons created not only a lot of often very cheap drinking establishments but also a very visible German presence in many American cities and towns. Anti-immigrant fears ran rampant, and soon the German breweries and saloons came into the political crosshairs.

The Know-Nothings, a populist anti-immigration party, emerged in the 1840s. Their most virulent opposition was to Catholicism, but because they were a largely white Protestant party, they also increasingly flirted with the growing temperance movement, which sought to curtail or even prohibit the consumption of alcohol. For instance, in 1855, a Know-Nothing was elected mayor of Chicago, and though not a teetotaler himself, he began trying to shut down the saloons of the city to curb Irish and German influence, triggering riots.

Complicating matters, alcohol abuse was a serious problem in 19th-century America. Many factors contributed. Urbanization and industrialization upended social structures and created a new class of working poor who labored in dangerous, back-breaking conditions.

Americans also gained unprecedented access to spirits at this time. Hard liquor was introduced to a country of people whose drinking habits were formed around quaffing session-strength beer throughout the day. Quaffing spirits in the same way produced very different results. Per capita liquor consumption more than doubled in the 19th century, and in some places quadrupled. Growing alcohol abuse fueled public disorder and impoverishment but also domestic violence—particularly against women and children.

At first it was just hard liquor, rather than beer, that was seen as the culprit for all these newfound social problems. The problem of hard liquor had been growing since the 18th century, when the gin craze gripped England. Gin was a relatively new import to England in this period, and it and other cheaply available distilled liquors were widely blamed for an explosion of alcohol abuse among the poor, and it was also a convenient scapegoat for the systemic issues of poverty and inequality in 18th-century England. Meanwhile, beer was seen as a much safer and more sensible drink that had far fewer issues. Early temperance societies tended to focus on restricting only hard liquor, while beer was often considered acceptable.



Numerous laws were passed in England to try and deal with the gin craze, though traditional measures, such as putting a large tax on gin, didn't solve the issue and sparked riots. But the Gin Act of 1751 created a new system of liquor licenses that prohibited unlicensed venues from selling gin, and it was considered more successful. The concept of liquor licenses grew over time to become one of the major ways governments could

regulate the sale of alcohol. But it didn't really solve the issues of alcohol consumption, and as the societal problems of alcoholism deepened throughout the 19th century, middle-class reformers and Protestant churches began to make a much louder moral argument for prohibition, and beer was increasingly caught up in the political maelstrom.

The moral champions of the temperance movement and those who held political attitudes like anti-Catholic bias, anti-immigrant resentment, and anti-Black racism found a common enemy in saloons. The Woman's Christian Temperance Union; the Prohibition Party, a political party that supported political candidates running on a prohibition platform; and the Anti-Saloon League, the country's first modern single-issue political pressure group, all became powerful political influences.

Some of the efforts of the temperance reformers had positive and enduring effects. For example, the temperance reformers played a major role in the spread of public drinking fountains to give clean water access to the poor and working classes and encourage them out of the saloons and into parks. Elaborate temperance fountains can still be found around the United States today. And, as women were active members of the moral front of the temperance movement, it became increasingly linked with women's suffrage. Women's political groups were often the most vociferous advocates of total prohibition, and the political victories won by women advocating for temperance—federal prohibition being the biggest example—provided considerable momentum for women getting the vote.

Sadly, though, temperance was promoted as a catchall solution for the problems, real and perceived, of the industrial era: crime, sexual deviance, workplace accidents, domestic abuse, poverty, and the encroachment on polite society by "unsavory" cultural elements. According to proponents of prohibition, all of these problems would disappear with the banning of alcohol.

Prohibition advocates would eventually triumph in the United States with the passage of the Eighteenth Amendment. America was not alone, however. Temperance was an international movement, particularly across the Commonwealth and Scandinavia. National prohibition laws were also ratified in Canada, Finland, and Norway. And some countries experimented with other, novel ways of severely restricting alcohol consumption.

In Sweden, temperance became a hot-button political issue, too, in the 1920s—but in a 1922 referendum, the public narrowly rejected introducing outright prohibition. As in the other countries, the issue was strongly split down gender lines, with a majority of women supporting and a majority of men opposing the proposal. But the government did run a national rationing system for alcohol until 1955. Every citizen was given a ration book, or *motbok*, in which alcohol purchases had to be recorded by licensed sellers. Once you bought a certain amount, you were banned from buying more until the next month. It became not uncommon for men to take women—sometimes total strangers they met in the street—out for a free dinner or date at a bar in exchange for being able to use their *motboks* to buy the alcohol.

The Aftermath of Prohibition

Large-scale prohibition didn't work anywhere it was tried and was eventually repealed everywhere. But it had a huge impact on the beer industry, particularly in the United States, where it radically shifted the brewing landscape. Beer drinking plummeted in the US during Prohibition. For a bootlegger, making illegal alcohol, or moonshine, was quicker and simpler than trying to brew beer. And when you're risking arrest and incarceration for every ounce you sell, stronger liquors were much more profitable. Moreover, the increasing numbers of lawbreaking Americans flocking to speakeasies and other illicit purveyors of booze preferred something they could get a buzz from quickly.

American breweries attempted to find legal ways to operate during Prohibition. One solution was the creation of so-called near beers: fermented malt beverages with an alcohol by volume of less than half a percent, the legal limit during Prohibition. Bevo, by Anheuser-Busch, was the most popular variant and was heavily promoted through advertising, but it never really caught on. Malt-Nutrine was a similar product, marketed to nursing mothers as a nutritional supplement. Some large breweries were able to diversify into other products: Yuengling sold ice cream, while Coors survived by expanding its ceramic subsidiary into a cookware and porcelain business. But most couldn't survive, and when Prohibition finally ended in 1933, only brewers with deep enough pockets to endure the 13-year drought reemerged.

Prohibition permanently changed the legal and political landscape of beer as well. It introduced an era of heavy excise taxation for brewers that was uncontested for fear of a return to federal prohibition. In

response, manufacturers of beer quickly positioned themselves as some of the country's great patriots, quietly shouldering a mounting tax burden that at the end of the Great Depression provided more than half of the country's internal revenue.

The system of tied saloons never returned, with post-Prohibition alcohol laws requiring wholesalers to act as middlemen between bars and breweries. And low-point beer, at 3.2% alcohol by weight, still lingers today in places whose alcohol sale and distribution laws have not changed much since Prohibition. The Cullen-Harrison Act legalized 3.2% beer in the months leading up to the passage of the Twenty-first Amendment, which repealed the Eighteenth.

Prohibition also had a lasting impact on the styles of beer Americans drink. Though German-style beers were already very popular and widespread when Prohibition began, the pre-Prohibition beer landscape was more diverse, owing to the many regional beer traditions that had emerged in the United States. Darker and maltier lager styles with corn adjuncts were popular, as were English-style porters, stouts, and brown ales that had come to America during the colonial period. There are also homegrown American beer styles that were pushed into the margins by Prohibition but have still survived into the present day that offer a taste of earlier eras.

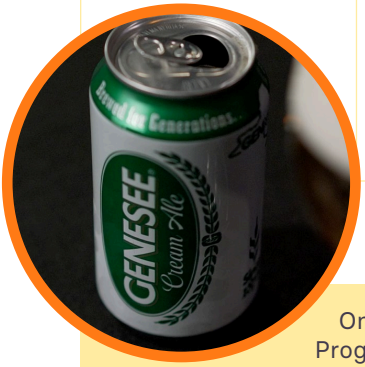
Cream ale is kind of the opposite of steam beer. While steam beer uses lager yeast to ferment like an ale, cream ale uses ale yeast but undergoes an extended period of conditioning and lingering after fermentation, giving this ale a very clean, lager-like flavor profile.

One of the most interesting survival stories is the cream ale, an unusual American beer style that emerged in the 19th century as a domestic response to the challenge presented by the new German breweries, combining established English ale traditions with the crispness and lightness of the new lager craze. It was a competitive alternative to the German lagers but was almost wiped out by Prohibition. Genesee, one of the smaller American breweries that managed to survive the apocalypse, sparked a minor revival of the style with its own version in 1960, which maintains a niche popularity today.

Tasting List

Style	Brand	Special Glassware
festbier	Augustiner Oktoberfest Hacker-Pschorr Festbier Hofbräu Oktoberfestbier Löwenbräu Oktoberfestbier Paulaner Oktoberfest Bier **Weihenstephaner Festbier**	mug or stein
cream ale	**Genesee Cream Ale** Kiwanda Pre-Prohibition Cream Ale Liebotschaner Cream Ale Little Kings Cream Ale Sleeman Cream Ale Sun King Sunlight Cream Ale	

Historically, Märzen was brewed for Oktoberfest, but since about 1990, the beer that's most likely served at Oktoberfest is a festbier.



Tasted in lesson!

Only one beer in the Beer Judge Certification Program guidelines has the descriptor *lawnmower beer* in it: the cream ale. It's meant to be a refreshing beer that's great for doing yard work or just sipping after a long day of work.

11

BEER MARKETING: ADVERTISING AND LIGHT LAGER

In the small village of Phillack in Cornwall, there's a pub that dates back at least to the 1700s, if not centuries before, with an unusual name on its sign: The Bucket of Blood. According to local legend, the publican went to draw from a well one day, but when he winched it up, there was blood in his bucket instead of water. A murdered customs officer had been dumped in the well, tainting the water—or so the story goes. Weird and wonderful pub names and signs are an iconic part of British beer culture. Many pubs predate widespread literacy among drinkers, so a distinctive signboard was the way to market your establishment to the public.

Advertising Beer

Pub signs and names developed over the centuries into something of a tradition. Animals, trees, or mythical creatures were popular and memorable themes. Some publicans chose names to appeal to specific groups; others would try to appeal to a customer's patriotism by naming themselves after British heroes or historic events.

But pub signs aren't a contemporary phenomenon. They date back all the way back to Sumeria. Brewers would hang a bush or sheaf over their doors to let potential customers know they had beer for sale. Alewives throughout the medieval period adopted a similar practice, mounting brooms above their doors when beer was available. And before elaborately painted signboards, some English publicans hung distinctive objects above their doorways to identify themselves; the Crossed Keys Inn, for example, likely once had an actual pair of crossed keys hung outside.

So there is nothing new about marketing beer—brewers have been doing it as long as beer has been sold to the public. But the practices reached new heights in the 20th century. The brewing powerhouses that first brewed industrial-scale porter in 18th-century London would be selling beer in every corner of the world by the middle of the 20th century, and plucky North American startups would come to rival the European giants in their quest for world domination. And not long after, industrialized brewing would return to Asia with the rise of multinational brewing corporations, or "macrobrewers."

Prior to industrial-scale production and modern beer transportation, beer wasn't really branded. Pubs and taverns would buy beer from a brewery, which would be delivered in kegs or casks, and then potentially serve a mix of different beers to their customers to suit their tastes. And prior to industrialization and its focus on consistency, the taste of beer from a brewery might vary a lot from batch to batch.

Much of the earliest beer advertising is generic, promoting a particular style of beer rather than an individual brand or brewery. A famous American poster from the 1870s doesn't name a specific brewery; it just promotes the German lagers that were taking the country by storm. Interestingly, it plays into several popular themes for beer advertisers throughout the ages, promoting lager as a patriotic drink, a healthy

drink, and a drink you have with your friends. And given the rising temperance movement in the United States, it's also careful promotion of lager as a family-friendly drink.

But around the middle of the 19th century, American, German, and British breweries began to precisely control the taste of their products and ship them across the country or even the world. So, individual beer brands begin to emerge, and the breweries, rather than the taverns, become the main factor that motivated a customer's drinking behavior. But soon breweries were marketing their products directly.

Probably the earliest form of brewery advertising was beer packaging. Beer bottles could be embossed to show the brewery of origin, and paper labels started to appear in the mid-1800s. The practicalities of stamping your brewery mark into a bottle or onto a key meant that the earliest brewery logos were very simple. One of the first was developed by the Bass Brewery of Burton-on-Trent. As you learned in lesson 5, Burton-on-Trent already had a strong reputation in England due to the

properties of the water used by brewers there. Bass, however, was also a pioneer of branding, looking for ways to distinguish its beer even from other Burton beers.

Though its origins are obscure, Bass began marking its casks with a red triangle, and by 1855, their bottled beer featured paper labels with it. About 20 years later, a very loyal Bass employee spent a bitterly cold New Year's Eve camping outside government offices to ensure that the Bass triangle would be the first registered trademark in the UK when they went into effect in 1876. The Bass triangle has all the features of a modern logo: It's distinctive and instantly recognizable.

The development of commercial color lithography in the late 19th century changed the game for advertising, as brewers could mass-produce eye-catching advertisements easily. Brightly colored beer labels became the fashion. Beer posters also followed and were particularly popular in Europe. Paris in the belle epoque was famous for its bright, colorful posters on public poles around the city, often advertising the city's nightlife, of which beer was a growing part. Once you got into the bar, you'd see plenty of advertising at the point of sale, from the tray the barmaid brought your drinks over on to the coasters you sat your drink on.

The use of "breweriana" intensified within the tied house system, which, as discussed in the previous lesson, made taverns and bars exclusive to a single brewer. Pub signs in the UK began to feature the names and logos of the breweries they were tied to. Those who remained unaffiliated would advertise themselves as free houses. But it was Adolphus Busch, the German-born cofounder of St. Louis–based Anheuser-Busch, who, having revolutionized beer distribution, took beer marketing to the next level.

Anheuser-Busch

When German brewers first began operating in the United States, they soon encountered a problem. Barley comes in two commonly used varieties, known as two-row barley and six-row barley. Two-row barley is the type that predominates in Europe and produces a subtle and flavorful base malt for high-quality lagers. But it prefers lengthy seasons of cool growing conditions, which aren't commonly achievable in much of the United States. American growing conditions are more suited to growing the six-row variety, so this is mostly what the German brewers coming to America could get.

But with a grist chiefly composed of six-row barley, Busch and his contemporaries couldn't quite reproduce the taste of home, as it produces a different malt profile. And six-row barley has a relatively high protein content, which produces a haze in the finished product—something that would have considerably missed the mark, as one of the most desirable features of German and Czech lagers was their brilliant clarity. However, six-row barley does have more diastatic power than two-row barley, which allows it to power starch conversion in non-barley adjuncts that don't have enough enzymes of their own to do the job.

American lager brewers frequently added corn to the grist to complement the six-row barley. This didn't really reproduce the authentic German lager taste either, but the public loved it. In fact, American-style lagers are still defined by the inclusion of corn. But in the mid-1870s, Busch and his brewmaster Irwin Spule were experimenting with various adjuncts that might allow them to recreate the popular Bohemian pilsner-style lager variations that were very popular in Europe at the time using six-row barley.

Budweiser was the first mass-marketed beer brand.

So Spule tried using rice instead of corn, and it worked: The rice gave a very light and crisp edge to the beer that was similar to the pilsner. The new formulation went on sale in 1876 and quickly became a classic. Today, nearly 150 years later, the Anheuser-Busch company (now called AB InBev) is the largest end user of American grown rice, spending a whopping $120 million with US rice farmers annually.

Busch decided to give the beer a brand name: Budweiser. The name wasn't original. It was deliberately copied from the Budweis Brewery in Bohemia, which made the pilsner they were trying to imitate. The brewery still runs today in Czechia and has been in a legal battle over the name with Anheuser-Busch since 1907.

From the outset, Budweiser was different. It started life primarily in a package—as an individually bottled beer, rather than in kegs and served on draft. Drinkers saw the iconic Budweiser name and label on the bottle and, more importantly, could take it home with them. Busch went further, aggressively marketing his brewery and his flagship brand across America. Anheuser-Busch saloons were filled with promotional material: coasters, glassware, bar mirrors, light fixtures, trays. And there were marketing giveaways. Bottle openers, corkscrews, calendars, napkins, and postcards plastered with the Budweiser name were circulating everywhere by the 1890s.

Newspapers and magazines featured full-page Budweiser advertisements that would engage in niche marketing. Budweiser was marketed to women, for instance, on the basis of its moderate alcohol content, family friendliness, and supposedly beneficial health effects. This wasn't in the expectation that women would go out and buy Budweiser themselves, but rather it was to soften the beer's image to temperance-leaning wives whose husbands were likely their biggest customers.

But the biggest successes came with promotional lithographs. These often depicted beautiful women drinking or serving Budweiser or fanciful and patriotic scenes from American history. One of the most popular lithographs was *Custer's Last Fight*. Busch bought the rights to a painting

of the Battle of Little Bighorn in 1892 and had a printer modify the painting so it was more sensational, throwing in a few more scalpings and a bit more blood for good measure. It was then sent to saloons and restaurants as a promotional poster—and it was a hit. More than 150,000 copies were printed in the first few decades, and it was seen everywhere from Maine to California. The collector's market for Anheuser-Busch breweriana is still very active. You can find examples on any online reselling platform.

When you think of beer in the United States, you probably think of Budweiser's Bud Light—and that's because of the marketing and branding genius of its developers.

Busch's genius for marketing paid off. By 1901, Budweiser was selling 650,000 barrels a year. The branding strategy had been so successful that Busch created another brand, Michelob, in 1896, which was initially promoted as a "draft beer for connoisseurs" and was ever so slightly upmarket and more expensive than the Budweiser brand. Soon, many other breweries followed suit.

Industry Consolidation

The transformation of beer marketing and culture wasn't limited to the rapidly industrializing United States. Breweries became the new powerhouses of drinking culture around the world. For example, Oktoberfest, the most iconic of all beer festivals, is not all that old. Its origins are in a fair that was held to celebrate the wedding of King Ludwig I in 1810. And at first, the focus was not beer at all—there were horse races and pavilions promoting Bavarian culture as well as carnival booths, agricultural displays, music, and dancing. Beer and snacks were only served at small booths or kiosks.

It wasn't until 1896 that Michael Schottenhamel decided to turn his family's beer booth into a massive beer tent capable of holding thousands of drinkers. A few years later, another innkeeper set up his own tent, sponsored by a local brewery and featuring traditional Bavarian music and singing. The new tents, called *festhalles*, were huge hits, and soon just about every Bavarian brewery wanted one, and they made them permanent structures with elaborate advertising and traditional Bavarian architecture. Within a few decades, the original character of the festival largely disappeared, completely replaced by the brewery beer

tents, which now open the festival with a parade of the brewers. In 2010, the city of Munich began running a separate, historic Oktoberfest event that tries to recreate the earlier character of the festival.

Prohibition and two world wars radically changed the American beer industry in the 20th century. And these challenges set the stage for a handful of the largest breweries to seize control of the American marketplace and redefine beer for multiple generations of drinkers. The United States Brewers Association, a trade group that was formed in 1862, known today as the Beer Institute, was eager to rehabilitate the image of beer to the American public after the tumultuous decades of temperance and war. The major brewers behind the new association (Anheuser-Busch, Miller, Pabst, and Schlitz) were run by German families, and anti-German sentiment had run high during both world wars. So the trade group ran a famous series of full-page color advertisements in magazines throughout the late 1940s and 1950s called *Beer Belongs*. Far from the lascivious or heroic lithographs of Anheuser-Busch or the hard-drinking revelry of an Oktoberfest hall, beer is depicted in gatherings of friends, family, and work colleagues.

In an even more deliberate attempt to win American hearts and minds, the USBA produced a 10-minute promotional film called *As We Like It*. It was released in 1952, during a postwar slump in beer sales and only 20 years removed from Prohibition. Though relatively short, the film works hard to portray beer as patriotic. In fact, the words *America*, *American*, *citizen*, and *citizenship* are used 26 times—roughly once every 25 seconds. The film also connects beer (sometimes a bit clumsily) with some of the most fundamental facets of American life, its history, its agricultural production, its economy, and a very specific version of wholesome family life.

This association was further cultivated as beer companies increasingly began to sponsor sporting events, particularly baseball. Beer had once been strictly kept out of many league games, but in the 1940s, sponsorship deals provided much-needed income to the teams, and beer became a major attraction at ballparks. Baseball announcers began to broadcast promotional messages for breweries over the radio. Several brewers bought teams themselves. By the 1950s, beer signboards were appearing at many sports stadiums, and breweries were striking huge deals for the concession to sell beer there—which, with sports games soon to appear on television, helped get beer brands into the homes of millions of Americans.

This postwar period coincides with the most dramatic period of industry consolidation to date. In 1947, even after the extreme challenges presented by two world wars and Prohibition, the 10 largest breweries in the United States only commanded about 28% of the total market share for beer. Within two decades, it had more than doubled to 63%, and it grew to a whopping 94% of the market by 1981. And the more than 2,000 breweries that served neighborhoods and towns across the US before Prohibition dropped to approximately 90 in 1980.

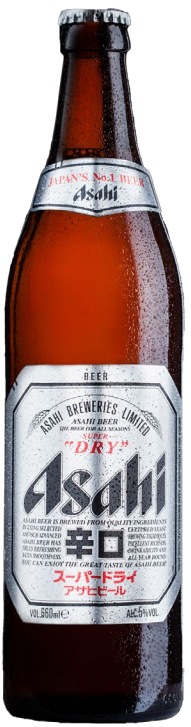
Part of the reason is that the way Americans drank beer had been completely transformed. For centuries, people drank beer socially, and the tavern, saloon, pub, bar, or beer garden was a local institution in every community, like the town hall or the church. Even in 1935, 70% of beer sold in the United States was still served on draft. But big beer's pivot to individual packaging and marketing to middle-class families meant that beer moved out of the bars and onto La-Z-Boys. And after beer started being packaged in aluminum, it became cheaper and easier than ever to grab a six-pack and take it home with you. By 1960, the numbers had dramatically reversed: 81% of all beer was sold in individual serving-sized packages, and just 19% was sold to be served on draft. Breweries developed sophisticated bottling, canning, and distribution networks as well as powerful marketing and brand presence.

The Rise of Light Beer

The mid-century consolidation didn't just change where beer was drunk; it also affected styles. Beer in the colonial United States up through the 19th century would have been a diverse affair. Thomas Jefferson's personal notes reveal that porter and a wheat beer were brewed on-site and commonly served at Monticello, his Virginia estate. But over the 20th century, many of America's regional styles all but disappeared in favor of the hyper-palatable American adjunct lager. Case in point: That promotional film, *As We Like It*, described the beer made by the American brewing industry as "beer: sparkling, golden, pure, refreshing." There's not a lot of room for variation with a description like that. On top of that, the purchasing power of the macrobrewers meant that they could command the best prices and first dibs on raw ingredients, particularly hops. Brewing on a local scale was all but unheard of in the American mid-century years. Even home brewing was illegal at the time.

By the 1980s, the biggest brewers in the US competed to find the beer taste that would suit the broadest swath of the massive international market—something of an arms race to see who could create the most inoffensive product. And, significantly, it was this impulse that fueled the invention of light beer in 1967 by Joseph Owades. Americans could now enjoy a crisp, light-colored, light-bodied, lower-alcohol refresher with significantly fewer calories. As the classic Miller Lite ads proclaimed, "Tastes great! Less filling!"

Some of the biggest growth markets for large brewers were now international. The lager boom enabled German and American companies to export their beers overseas. This quickly prompted a raft of new breweries to open around the world, even in countries that had far smaller beer cultures. From the 1840s to the 1920s, iconic international beer brands launched around the world, emulating the lagers that had roots in Germany and mass-marketing tactics innovated in the US. Peroni opened in Italy in 1846, Carlsberg in Denmark in 1847, Heineken in the Netherlands in 1886, and Stella Artois in Belgium and Corona in Mexico, both in 1926. All emerged as industry leaders on a wave of slickly marketed adjunct lagers.



The Asahi Super Dry

Some of the most successful new entrants to the global beer market were in Japan, where a series of lager breweries opened in the late 19th century. Not only did Japan represent a huge untapped population, but in the 1960s, the Japanese breweries, like many Japanese corporations, began using advanced manufacturing to mass-produce export products that could aggressively challenge their international competitors on price. The competition came to a head in 1987, when Asahi released their Super Dry beer.

The Asahi Super Dry is in many ways the ultimate mass-market beer. It was produced after extensive market research and consumer group testing, which found that consumers preferred a highly attenuated lager, in which most of the sugar has been fermented away, leaving little sweetness or aftertaste. A proprietary yeast, Asahi No. 318, is used to achieve this high level of attenuation. They also found that

the typical customer preferred less malt character in their beer. So, in addition to using rice as an adjunct to moderate the malt's flavor, Asahi's barley-milling equipment and mashing schedule was calibrated to minimize contributions of malt flavor. And exacting control over carbonation provided a crisp fizz in every bottle.

Asahi's research and precision engineering paid off: The beer was a huge success in Japan—so much so that it triggered a brief period known as the dry wars in Japan, where competing breweries like Sapporo and Kirin attempted to emulate the Asahi Super Dry. Asahi wasn't to be outdone, though, and the Super Dry quickly became one of the best-selling beers in the world, thanks to its continuing popularity in East Asia. It remains one of the world's top beers today.

Tasting List

Style	Brand	Special Glassware
American lager	**Budweiser Lager**	
	Coors Original	
	Grain Belt American Lager	
	Michelob Original Lager	
	Miller High Life	
	Pabst Blue Ribbon	
international pale lager	**Asahi Super Dry**	
	Birra Moretti	
	Corona Extra	
	Heineken	
	Red Stripe	
	Singha	

Incredibly, a Budweiser tastes the same no matter where you get it around the world. That level of quality control is remarkable, but it's sad that the Anheuser-Busch breweries throw away more beer in pursuit of that quality than most other breweries produce.

The Asahi Super Dry is an industrial rice lager that's all about highlighting the qualities of the rice and allowing that to drive the sensory experience of the beer.

Tasted in lesson!

12

BEER'S FUTURE: CRAFT BREWS AND NEW STYLES

The year 1980 is a touchpoint in beer culture, not just in the United States but around the world, because that's when the American craft brewing movement emerged. The roots of the craft beer movement go back to the 1960s and 1970s and a few major players—such as Fritz Maytag of the Anchor Brewery in San Francisco and Ken Grossman of Sierra Nevada in Chico, California—who pioneered a new industry in the United States. The macrobrewing movement had created a beer market that had to work on gigantic economies of scale. The equipment and the distribution networks were huge, and brewing on a smaller scale was virtually unheard of—so much so that the equipment for smaller brewing didn't even exist. Because of this, the first generation of craft brewers in the United States were welding together their fermenting tanks out of old dairy tanks. In 1980, the number of breweries in the US was only about 90—and that's a highly consolidated market after Prohibition. About 40 years later, the US had about 9,000 breweries. That's a remarkably short time to have seen that much growth.

From Macrobrewing to Craft Brewing

The craft brewing movement really started to take off in the 1990s and into the 2000s. That's when some of the major players hit the stage, such as Sierra Nevada, New Belgium, and Boston Beer Company, which makes Samuel Adams beers. Certain cities, such as San Diego and Portland, became hubs for the early days of the craft brewing movement. And for the first time, US brewers were starting to become trendsetters and not just copiers of styles that they were importing from other places.

The US really landed on the map when the traditional British IPA was starting to be adapted to become a style that was reflective of American hops and American hop styles. And the hazy IPA in particular is an incredible example of what's happened in the US. The hazy IPA developed in New England, sometimes called a New England IPA, was probably the first beer style that the United States exported. Prior to this, all of the beer styles that have been the center of US inspiration came from Belgium, Germany, and the UK. And for the first time, the US made a style that became a hit worldwide. Now breweries all over the world make American hazy-style IPAs.

So, with more than 9,000 craft breweries in the US and seemingly a small brewery on every street corner, you may assume that the craft beer market has overtaken the industrial light lager or macrobrew market. But even currently, craft

The Brewers Association, the not-for-profit trade association for craft brewers in the United States, defines a craft brewery as a brewery that is small—meaning it makes less than 6 million barrels of beer per year—and independent, which means it's not more than 25% owned by a non-craft brewer. And under that definition, anything that a craft brewer makes is craft beer. But more loosely and colloquially, people define craft beer as beer that pays attention to high-quality ingredients, traditional styles, and innovative methods.

Microbrewery is often used synonymously with *craft brewery*, but *microbrewery* really refers to size: It's a brewery that makes less than 15,000 barrels a year. And microbreweries come in two different flavors: taprooms and brewpubs. Taprooms are microbreweries that don't sell food, and brewpubs are microbreweries that do sell food.

The hazy IPA was developed by a small brewery in Vermont called The Alchemist, which made a beer called Heady Topper. It was legendary with locals and beer enthusiasts all over the country. There was no distribution for Heady Topper—you had to get it at the brewery's taproom—and people notoriously lined up for hours to get a case of the beer.

beer only accounts for about 20% of beer sales in the US, and craft brewers only brew about 13% of the beer sold in the US by volume. That number actually reflects a massive amount of growth over the last 20 years. And despite challenges with the COVID-19 epidemic and supply chain, the craft beer market is still growing. It's just growing at a slightly more reserved pace, which reflects a more mature market. After 40 years, this is what's expected.

What's interesting is that the US has exported not just American beer styles but the craft brewing model around the world. So American-style craft breweries can be found in countries around the world—in particular, the UK, Australia, and Canada. The US beer scene hasn't had quite as much influence on countries in Asia, Africa, and South America, but that's pretty consistent with the development of beer historically.

IPAs are one of the most popular beers and one of the most widely produced in the United States and worldwide.

Challenges to the Contemporary Beer Scene

The contemporary beer scene is currently undergoing an interesting time of challenge. A lot of other fermented beverages are hitting the market. Things like hard seltzer and hard teas or other types of malt

beverages constitute a new category that brewers, whether they are large macrobrewers or smaller craft brewers, are having to contend with. And different brewers are taking different tactics to embrace this challenge. You might find that your local brewery is now brewing a hard cider and is embracing for a segment and diversifying its offerings. Other brewers are digging in and getting serious about pushing the boundaries of beer styles to keep beer new, fresh, and innovative.

Another challenge is the cost and complexity of the supply chain. And this is absolutely being impacted by climate change. The hop crop is a great example: Hops really only grow in some very specific ecologies on the planet, and even minor changes to climate, average temperature, and rainfall in those locations can disrupt the global hop market.

What's even more interesting is that hops are on a delayed cycle. It's a rhizomatous line, and hops take years to become established in a hopyard. There's also limited acreage of each hop genetic. So brewers do contracts for future years' allotment of hops. So if there is a climate disaster—for example, the fires that ravaged Australia years ago—that can affect the availability of some of the most popular hops that brewers are using to build their recipes around. So climate change poses an interesting challenge to the supply chain, not just for hops but for barley cultivation and even yeast development.

Some breweries are taking this challenge head-on and looking for ways to continue producing their signature brands and products in more climate-responsible ways. What's interesting about the future of beer is that it's reminiscent of the past. The number of breweries has drastically changed in the United States since Prohibition, with anywhere between 2,000 and 4,000 breweries in the United States pre-Prohibition down to just 90 in the 1980s, and now back up to more than 9,000.

This is a return to some of the ways that people engaged with beer socially in the past. The average brewery makes much less beer, and many are hyperlocal. Some of them don't even distribute. Many of them don't even put their beer into packages—so no canning or bottling. They just serve their beer in a taproom to their local community. And that's changing the balance of home and on-premise consumption. After the rise of the macrobrewers, almost 80% of beer was consumed at home from a single-serving package, and that number equalized as the 21st century began.

The COVID-19 epidemic was another major disruption, and it tipped the scales back to home consumption again because it wasn't safe for people to get together and drink. But as the world has learned to live with the COVID-19 epidemic, on-premise communal consumption is starting to go back up in numbers, which for many people is an important step. Breweries in many ways have become the centers of communal and local life, and people seem like they really needed to find a place to get together and share a pint with their neighbors after such a trying time in not just American history but world history.

Innovations and Trends

Another change that's happening in the craft and small brewery market is more accessibility to people who have not traditionally been owners or entrepreneurs in the beer space. Historically, women were in the forefront of brewing; alewives brewed beer for not just the home but also social occasions and special moments in community life. With the industrialization of beer came a heavy shift to men dominating the industry. And during the 1980s in particular, lots of the marketing was very masculine in nature.

Today, there is still a glaring disparity with women working in the industry, but that's changing with organizations like the Pink Boots Society, which is a professional association for women who work in the fermented beverage industries. And more women are moving into ownership of small and independent craft breweries around the US. The same can be said for other traditionally marginalized or underrepresented groups, such as people of color, people with disabilities, LGBTQ+ people, and veterans.

> Brewers in the world work with their creative products and want to share their creativity and passion with everyone—so it's challenging when there are entire groups of people who don't have as much access, both as consumers and owners in the industry.

Craft brewing is a notoriously capital-intensive business. To start even a tiny brewery, you need to invest in six figures' worth of stainless-steel equipment, and many brewery buildings have to be retrofitted or built out in specific ways to meet municipal, state, and federal codes. So there are some significant barriers to entry for people getting in. Today, there are excited and passionate advocates in both the consumer and

the business-to-business space who are dedicated to removing barriers to access and advancement in the brewing profession, whether that's with mentoring and scholarship programs or lending and purchasing programs. And the hope is that with so many new people coming to beer and brewing with new perspectives and new ideas, there are new technologies and new directions to support them.

Currently, lots of brewers are pushing the boundaries with raw ingredients, whether that means putting things in beer that you don't expect, such as cereal or marshmallows, or digging into the local nature of ingredients and making beers that are sourced with materials that are only grown in a 50-mile radius.

One of the greatest innovations in beer today is the trend toward no-alcohol or very-low-alcohol beers. We are becoming a more responsible and health-conscious society, and no- and low-alcohol options are great to have—not just for health but also to make bars, taprooms, and breweries more inclusive spaces where everyone feels welcome to go and have a beverage.

Another trend that's gaining legs is minimally invasive fermentations, which is about going back to ancient roots and letting the microbes and microbiomes in our ecologies do the fermenting. Many small breweries are adopting coolships, which are shallow tubs that they're allowing their hot gruits to cool in, thereby inoculating the beer with the ambient yeast and microflora. These beers are generally referred to as wild ales, and they are opening up the possibilities with different styles of fermentation and flavor profiles that people haven't been used to tasting for hundreds of years.

One of the more interesting things that's happening is breweries are taking classic styles from Bavaria, Bohemia, the UK, Belgium, and France and doing new takes on them with ingredients that have been innovated in the last few decades—in particular, hops.

One small craft brewery that's connecting the dots between all of these new trends is Denizens Brewery, which not only strives to be socially conscious as a woman-, Hispanic-, and LGBTQ+-owned brewery, but is also taking old styles and reinvigorating them with new ingredients and the technologies that are shaping American craft beer today.

Tasting List

Style	Brand	Special Glassware
hazy IPA	Belching Beaver Hazers Gonna Haze IPA Hill Farmstead Susan Pinthouse Electric Jellyfish **Sierra Nevada Hazy Little Thing** Tree House Brewing Company Julius WeldWerks Juicy Bits	
helles bock	Altenmünster Maibock Ayinger Maibock Chuckanut Maibock **Denizens Brewing Company Macadocious Maibock** Hofbräu Maibock Mahrs Bräu Heller Bock	pilsner glass

Sierra Nevada was one of the first craft breweries in the United States, and they helped develop the American palate for hops.

Tasted in lesson!

Bocks come from the Einbecker region of Germany and are malty and strong. A Maibock is a May bock, which is a helles that's brewed to bock strength. While Märzen is a harvest beer that's brewed in the spring and lagered over the summer and then is broken out for harvest around Oktoberfest, the Maibock is the partner to this beer: It's brewed in the fall at harvest time, when the grain and hops are plentiful, and it's lagered over the winter months and then broken out in the spring.

Tasting List

Below is a list of the beer styles that are tasted in the course as well as some of the more popular commercial examples of that style if you want to taste along. Alcohol laws and importation rules vary widely across the world; some styles may be harder to find than others.

For more information about the defining characteristics of various beer styles, see the Beer Judge Certification Program (BJCP) Style Guidelines: https://www.bjcp.org/bjcp-style-guidelines/.

 **Tasted in lesson!**

Lesson	Style	Brand	Special Glassware
1	Munich helles	Augustiner Lagerbier Hell Hacker-Pschorr Münchner Gold Löwenbraü Original Paulaner Münchner Lager Schönramer Hell Spaten Münchner Hell  **Weihenstephaner Original Helles**	pilsner glass
	fruit lambic	3 Fonteinen Schaerbeekse Kriek Cantillon Fou' Foune Cantillon Lou Pepe Framboise Hanssens Oude Kriek  **Lindemans Framboise** Oude Kriek Boon	

Lesson	Style	Brand	Special Glassware
2	ancient ale	**Midas Touch** is an ancient ale produced by **Dogfish Head Brewery**. Historical recreations may not conform to a particular style. Commercial examples can be hard to find. Microbreweries sometimes produce historical beers as specialty offerings.	
	Ethiopian *tej*	Commercial examples of *tej* may be available in international supermarkets, but it is easiest to obtain from Ethiopian restaurants, where it may be sold under names like "honey wine."	white wine glass
3	saison	Boulevard Tank 7 Ellezelloise Saison 2000 Lefebvre Saison 1900 Saison de Pipaix **Saison Dupont** Saison Voisin	
	oud bruin	Ichtegem's Oud Bruin Liefmans Goudenband **Liefmans Oud Bruin** Petrus Roodbruin pFriem Oud Bruin VanderGhinste Roodbruin	

Lesson	Style	Brand	Special Glassware
4	Munich dunkel	**Ayinger Altbairisch Dunkel** Eittinger Urtyp Dunkel Ettaler Kloster-Dunkel Hacker-Pschorr Münchner Dunkel Hofbräu Dunkel Weltenburger Kloster Barock Dunkel	
	English IPA	Fuller's Bengal Lancer Marston's Old Empire IPA Meantime London IPA **Samuel Smith's India Ale** Thornbridge Jaipur Worthington's White Shield	
	American IPA	**Bell's Two Hearted Ale** Cigar City Brewing Jai Alai Fat Head's Head Hunter IPA Firestone Walker Union Jack Maine Beer Company Lunch Russian River Blind Pig IPA	

Lesson	Style	Brand	Special Glassware
5	rauchbier	**Aecht Schlenkerla Oak Smoke Doppelbock** **Aecht Schlenkerla Rauchbier Märzen** Cerveja Bamberg Rauchbier Göller Rauchbier Rittmayer Rauchbier Spezial Rauchbier Märzen	
	Irish stout	Beamish Irish Stout Belhaven Black Scottish Stout **Guinness Draught** Murphy's Irish Stout O'Hara's Irish Stout Porterhouse Brewing Company Irish Stout	
6	doppelbock	Andechs Andechser Doppelbock Dunkel **Ayinger Celebrator** Paulaner Salvator Spaten Optimator Tröegs Troegenator Weihenstephaner Korbinian	snifter
	Belgian tripel	Chimay Tripel La Rulles Triple La Trappe Tripel St. Bernardus Tripel Val-Dieu Triple **Westmalle Tripel**	

Lesson	Style	Brand	Special Glassware
7	wee heavy	**Belhaven Wee Heavy** Broughton Old Jock Ale McEwan's Scotch Ale The Duck-Rabbit Wee Heavy The Orkney Brewery Skull Splitter Traquair House Ale	snifter
	ancient ale	**Kvasir** is an ancient ale produced by **Dogfish Head Brewery**. Historical recreations may not conform to a particular style. Commercial examples can be hard to find. Microbreweries sometimes produce historical beers as specialty offerings.	
8	weissbier	Ayinger Bräuweisse Distelhäuser Weizen Hell Hacker-Pschorr Hefe-Weissbier Hofbräu Münchner Weisse Schneider Weisse Weissbier **Weihenstephaner Hefe Weissbier**	
	best bitter	Adnams Southwold Bitter **Fuller's London Pride** Harvey's Sussex Best Bitter Salopian Brewery Darwin's Origin Surrey Hills Brewery Shere Drop Timothy Taylor's Landlord	

Lesson	Style	Brand	Special Glassware
9	English porter	Batemans Salem Porter	
		Burton Bridge Brewery Burton Porter	
		Fuller's London Porter	
		Nethergate Stour Valley Brewery Old Growler	
		RCH Old Slug Porter	
		 **Samuel Smith Taddy Porter**	
	California common	 **Anchor Steam Beer**	
		Steamworks Steam Engine Lager	
10	festbier	Augustiner Oktoberfest	mug or stein
		Hacker-Pschorr Festbier	
		Hofbräu Oktoberfestbier	
		Löwenbräu Oktoberfestbier	
		Paulaner Oktoberfest Bier	
		 **Weihenstephaner Festbier**	
	cream ale	 **Genesee Cream Ale**	
		Kiwanda Pre-Prohibition Cream Ale	
		Liebotschaner Cream Ale	
		Little Kings Cream Ale	
		Sleeman Cream Ale	
		Sun King Sunlight Cream Ale	

Lesson	Style	Brand	Special Glassware
11	American lager	**Budweiser Lager** Coors Original Grain Belt American Lager Michelob Original Lager Miller High Life Pabst Blue Ribbon	
	international pale lager	**Asahi Super Dry** Birra Moretti Corona Extra Heineken Red Stripe Singha	
12	hazy IPA	Belching Beaver Hazers Gonna Haze IPA Hill Farmstead Susan Pinthouse Electric Jellyfish **Sierra Nevada Hazy Little Thing** Tree House Brewing Company Julius WeldWerks Juicy Bits	
	helles bock	Altenmünster Maibock Ayinger Maibock Chuckanut Maibock **Denizens Brewing Company Macadocious Maibock** Hofbräu Maibock Mahrs Bräu Heller Bock	pilsner glass

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