



Topic
Better Living

Subtopic
Food and Wine

The Everyday Guide to Beer

Course Guidebook

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THE EVERYDAY GUIDE TO BEER

Charles W. Bamforth is a Distinguished Professor Emeritus at the University of California, Davis. He received his PhD in Biochemistry from the University of Hull. He is also a senior quality advisor to Sierra Nevada Brewing Company and an Honorary Professor in the School of Biosciences at the University of Nottingham. He has been part of the brewing industry since 1978, holding such positions as deputy director-general of Brewing Research International as well as quality assurance manager and research manager at Bass Brewers.

Professor Bamforth's many academic and professional honors include the Award of Distinction from the American Society of Brewing Chemists, the Faculty Stewardship Award from the UC Davis Foundation, and the Brewers Association Recognition Award. He was also awarded the Horace Brown Medal, the highest accolade of the Institute of Brewing and Distilling; the Award of Honor by the Master Brewers Association of the Americas; and the Award of Distinction by the College of Agricultural and Environmental Sciences at UC Davis.

Professor Bamforth has published numerous books and articles about beer throughout his career. Since 1985, he has also written prolifically about soccer. He has appeared extensively in the media, including on the BBC, Discovery Channel, NPR's *Science Friday*, and PBS. His video credits include "The Art & Science of Beer," *Brew Dogs*, *How Beer Saved the World*, *How Stuff Works*, and *Ultimate Factories*.

Professor Bamforth has presented lessons at numerous venues, including Google, the New York Academy of Sciences, the Smithsonian, and the National Press Club. ■

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BEEER

Over the course of millennia, the brewing of beer has developed into a complex process that is fundamentally unchanged yet highly refined. Beer is a beverage that has delighted and sustained drinkers through the ages. It is an undisputed fact that the survival of communities in years gone by could be traced to the fact that they drank beer rather than water, which was contaminated with pathogens. The brewing of beer includes a boiling stage that destroys harmful organisms.

To use only the term *beer* is to underestimate the vast range of styles across the globe. There are many types of ales, diverse lagers, and other beers that don't fit into easy classifications. For all beers, we can consider their quality, their color, whether they are hazy or not, their foam, and their flavor.

The many attributes of beer depend on the palette of malted grains and hops that are used to make them, as well as the yeast and water used. The process employed to transform these and other raw materials has a definitive role to play in ensuring that the drinker is satisfied.

In this course, you will discover the true wonder of beer and emerge with a genuine knowledge of—and appreciation for—this incredible drink. Topics covered in this course include the production of beer, different types of beer, and what you look for in buying a beer. The course also looks at how to best store beer, how to set up a successful beer dinner, and more. Enjoy the journey! ■



Lesson 1

8,000 YEARS OF BEER

On the upper end of estimates, it is thought that beer has been drunk for 8,000 years. It is possible to trace that history back, at least in part, to the Fertile Crescent, which is the Mediterranean region that is around modern-day Iraq. However, beer probably emerged and evolved separately in different parts of the world.

The Roots of Beer

Ancient Egyptians inherited the brewing traditions from Samaria. Beer, onions, and bread were the most important items in the Egyptian diet. The Egyptians passed on the brewing knowledge to the Greeks and the Romans. However, in ancient Greece and ancient Rome, the higher classes drank wine. Beer was for the rest.

Moving forward in history, by the year 1086 in England, the monks at St. Paul's monastery were brewing 70,000 gallons of beer annually. In many ways, monasteries perfected the technology of brewing beer.

The monasteries then passed on that knowledge to people brewing for themselves at home.

Beer—or ale, as it would have been in those days—was the drink for all times of day, including breakfast, lunch, and dinner. Everybody in the home drank beer, even the younger people. People brewing at home eventually began start to sell their beer to other people. They would have the brewery in a back room, and they would open the front room up to people to drink beer.

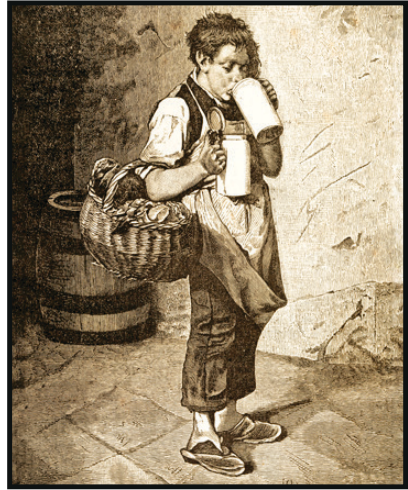


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They made two types of beer. When they first extracted the grain, it produced a very strong liquid that, when fermented, produced high levels of alcohol. At the end of that extraction, the grains were extracted a second time in a process called mashing. This created a product with a lower level of alcohol, which was known as small beer.

The Mid-18th Century

The mid-18th century saw the Industrial Revolution, which brought about big factories that were powered by engines. Instead of leading agrarian, domestic lifestyles in which people grew crops and brewed their own beer, people now went to work in the factories.



Brewing was carried out by common brewers—that is, people whose business was brewing beer on a large scale. There were several such examples in England, including Whitbread, beginning in 1742, and Bass, in 1777. Ireland first began producing Guinness in 1759.

OTHER SOURCES OF BEER

Much of the history of brewing started in the British Isles, but Germany and other countries in Europe also have very proud brewing histories.

Rising Concerns

By 1810, there were 48,000 alehouses for 8 million people in Great Britain. All of this drinking was starting to register concerns with people, resulting in the

first types of temperance movements. All the way through to the war years in the early 20th century, people raised concerns about alcohol, including beer.

Beer in America

This lesson turns now to America. The *Mayflower* left Plymouth, England, on September 6, 1620, and the passengers disembarked at

Plymouth Rock on December 26, 1620. The settlers soon started to build breweries, and the tavern became the center of the community.



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Earlier, Adrian Bloch, a Dutchman, opened the first brewery in North America in 1613. It was a log hut in New Amsterdam, which later became New York City. The Dutch West India Company opened the first public brewery in North America in lower Manhattan in 1632, and the beer was primarily made out of oats.

Beer was considered to be the drink of moderation and preferable to distilled

beverages, which were of dubious repute. William Penn, founder of Pennsylvania, started the first commercial brewery in his new colony in 1663. Additionally, Samuel Adams was a brewer by trade.

Then, the English introduced the Stamp Act in 1765—a fee for taverns in the form of special stamps. The people of the colony rebelled. In due course, war came, and beer helped recruit an army.

American Juggernauts

The United States eventually produced some great brewing companies. One began in 1829 with David Yuengling in Pennsylvania. Today, Yuengling is the biggest craft brewer in the country.

Additionally, four other big names, all from Germany, arrived on the scene in the 1800s. In 1850, Bernard Stroh set up his brewery in Detroit. In 1855, Frederick Miller set up in Milwaukee. In 1860, Eberhard Anheuser bought a brewery in St. Louis. In 1861, Lilly Anheuser, his daughter, married

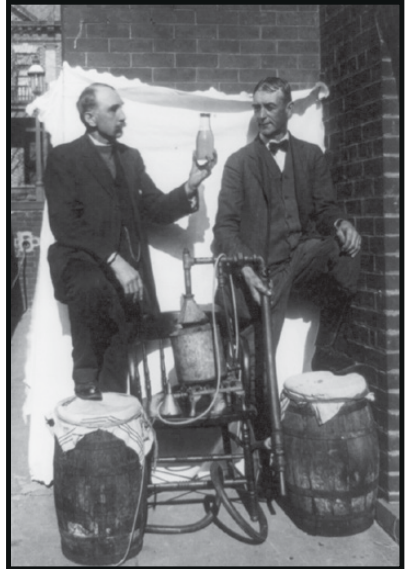
Adolphus Busch, and the rest is history. Finally, in 1873, Adolph Coors found his way to Golden, Colorado, to create the Coors Brewing Company.

In 1800, there were 150 breweries across the country, brewing a total of 230,000 barrels. By 1873, there were 4,000 breweries, and each of them averaged 2,800 barrels. By 1918, there were half as many breweries, and each of them produced 20 times the amount of beer. This was the result of consolidation and acquisitions.

Prohibition and the Following Years

Eventually, America went through the unfortunate episode of Prohibition. Before that, 13 states became dry between 1846 and 1855. Later, building concerns about productivity in World War I led to the Eighteenth Amendment to the Constitution, the Volstead Act in January 1920, and Prohibition. Prohibition led to illegal home brewing, bootlegging, and the creation of speakeasies. In 1933, however, the Twenty-first Amendment made Prohibition a state issue. The last state to emerge from dryness was Mississippi in 1966.

By 1945, there were 465 breweries in the United States. The brewing business had recovered, and the breweries were averaging 190,000 barrels of beer annually. Additionally, a man named Karl von Linder developed artificial refrigeration, allowing for the storage of cold beer in a brewery and for distribution in refrigerated railcars.



Breweries thus became larger and larger, and they were able to serve wider and wider areas. Additionally, in 1978, US president Jimmy Carter signed legislation to make homebrewing legal on the federal level in the United States.



Lesson 2

MALT, HOPS, YEAST, WATER: HOW BEER IS MADE

Beer is made from four main raw materials: grain, hops, yeast, and water. This lesson looks at the traits of those ingredients and how variations in the ingredients can lead to variations in beer.

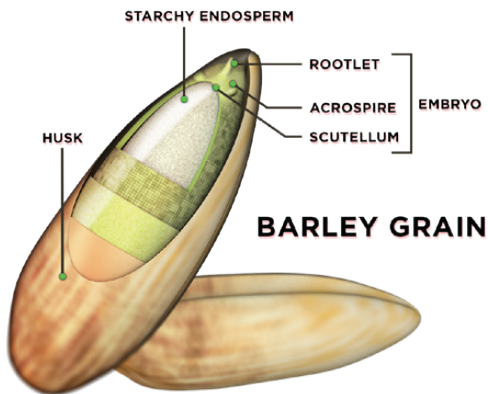
The Grain

The main grain that is used worldwide is barley, and that has been the case for thousands of years.

For the purposes of beer making, barley seeds—called kernels or corn—are used. It is necessary to malt the barley, which happens in a malt house.

There are three basic stages to this. The first stage is called steeping. Water is added to the grain to soak the barley embryo, beginning the process in which the grain breaks down and softens. Steeping takes about two days.

Next, the grain is left to germinate and partially sprout for about four days. After that, the process is stopped through a procedure known as kilning. This takes about a day, and it involves bringing warm air through the grain to drive off the water, stopping germination. It is necessary to be careful because the enzymes are sensitive to heat.



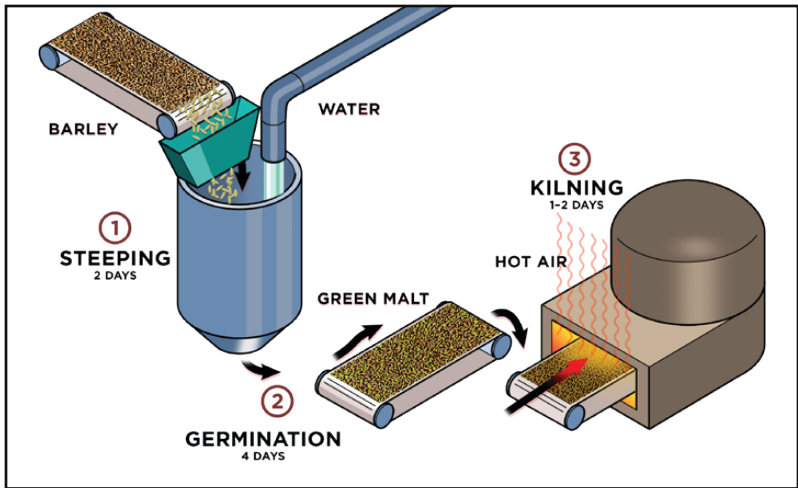
It is possible to produce different types of malt. For example, drying gently produces a pale malt. Drying very gently produces a pilsner malt. Heating more intensely produces more color and more flavor, producing malts such as caramel malts. Even more intense heat produces chocolate malts.



ADJUNCTS

Some brewers use adjuncts—that is, alternative sources of carbohydrates. One of the most widely used cereal adjuncts in North America is rice, which is prominent in Budweiser and Bud Light.

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Hops

There are male and female hop plants. In the world of brewing, the female hop plants are the important ones.

The flowering body on the female hop plant is known as a comb, and that comb contains all the materials needed for brewing: resins, which provide the bitterness, and oils, which provide the aroma.

The hops are quite wet when they're harvested, so they have to be dried for any long-term storage. This is done on a hop

kiln. Then, they are stored in a cold, airtight manner. One way of storing them is in large sacks. Another is in bales.



THE SOURCE OF HOPS

The biggest growth location for hops in the world is the United States, and within the United States, the biggest growth location is Yakima in the state of Washington.

Two important types of hops are bittering hops and aroma hops. Bittering hops have very high levels of resins, so they give a very high bitterness potential. The oils do not smell

good. The aroma hops usually have much less bitterness potential, but they have great aromas. Beyond that, there are many hops varieties that feature different traits.

Water

The main component of the vast majority of beers is water.

Waters can be classified in terms of their hardness. Soft water contains very low levels of salts, and hard water contains very high levels of calcium. Water with permanent hardness is produced by primarily calcium sulfate, and temporary hardness is from primarily calcium bicarbonate.

For example, water from a region that is rich in gypsum will feature high levels

of permanent hardness. Water from a region of limestone or chalk will have a very high level of temporary hardness. The softest water in the world is from Pilsen in the Czech Republic, the home of the great pilsner beer. The hardest water is in Burton-on-Trent England. For consistency, brewers must make sure that the level of the salts is the same from batch to batch.

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Yeast

Brewing yeast is a single-celled fungus that grows by budding. There are two types of brewing yeast. The first is called ale yeast,

and it goes by the Latin name *Saccharomyces cerevisiae*. The second is lager yeast, or *Saccharomyces pastorianus*.

Fermentation

Brewers monitor fermentation by measuring the decrease in specific gravity. At the start of any fermentation, the liquid extract from the malt—called wort—has many sugars in it and a high specific gravity. When the sugars are removed, the specific

gravity goes down. Another contributing factor is the alcohol. Alcohol has a very low specific gravity. The other trait that goes down is the pH—that is, the acidity. Additionally, fermentation produces carbon dioxide and yeast cells.



Lesson 3

A GRAND TOUR OF BEER STYLES

This lesson provides a general look at beer styles. It goes over some broad differences between ales and lagers, and then it takes a dive into other types of beer. The lesson also provides some information on beer production, including the creation of beers with different levels of alcohol.

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The Basics

As a reminder, ales are products made with

Saccharomyces cerevisiae,

and lagers are made with *Saccharomyces pastorianus*. Ale yeasts are top-fermenting yeasts, while lager yeasts are bottom-fermenting yeasts.

Additionally, ale yeasts tend to prefer higher temperatures than lager yeasts: Ales

tend to be fermented at up to 80 degrees Fahrenheit, whereas lagers tend to max out at 59–60 degrees.



Another difference sometimes

prevalent between ales and lagers

is the way in which they are

hopped. Most

hops are put in at the boiling stage,

but if the brewer wants some of the aroma and oils

to survive, it is necessary to add the hops somewhat later

in the process. For instance, to produce a very intense hop

aroma, brewers add hops at the very end.



Lambic Beers

Lambic beers are a famous Belgian-style product.

These types of beers are made with different types of microorganisms. Lambics are produced by cooling the wort slowly in a vessel called a coolship. Steam comes off through holes in the roof, and microorganisms enter the mix. They introduce interesting flavors to the beer. Typically, lambics are on the sour end.

Some people add fruit to this type of beer.

For example, using cherries produces a beer style called krielk.

Raspberries create framboise.

Peaches produce the pèche style,

and blackcurrant produces the

cassis style.



MODERN FERMENTERS

In modern fermenters, which are huge vessels, all yeast tends to go south. The differentiation between top-fermenting and bottom-fermenting yeast is not quite as meaningful as it used to be.

Shandies

Generally speaking, a shandy is made with a half a pint of ale mixed with a half a pint of lemonade. This creates a very refreshing product that is lower in alcohol and delicious. In breweries, various ingredients might be used for

these types of beer. There is a longstanding tradition of putting oysters into beer and holding beer on top of oyster shells.



Other Flavors

There are also chocolate-flavored beers. Some of the chocolate-flavored beers contain chocolate malt, ingredients like cocoa nibs, and so on. Another option is chocolate essence.

Coriander also finds its way into certain types of beer, as do chilies. There is probably no limit to what brewers are able to use.



Malternatives and Happoshu

Malternatives are an additional interesting category. These are products that are basically beers, but they are often unrecognizable from more traditional beers. Many of them

are fruit-flavored drinks, but some use other flavors as well. They are classified as beer for taxation reasons. To make them, a brewer makes a bland beer, then adds flavors.

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Japan is home to a drink called happoshu. Happoshu is a product made out of any grist—that is, grain. If there is less than 25 percent malt in that grist, the taxation rate is

Light Beer

In terms of sales, the biggest style of beer in the United States is light beer. These are beers that contain fewer calories. There are various ways to make a light beer. One is to add a bit more water. Another way is to experiment with the mashing to make the carbohydrates more fermentable and therefore easier to get rid of.

An additional method is to use extra enzymes that break all of the starch down. In a regular brewing process, about 80 percent of the starch is converted into fermentable

much less than if there is 80 percent or 100 percent malt. The producers of happoshu use a large amount of corn, rice, and so on.

sugars, leaving about 20 percent of the partially broken-down starch left behind. Brewers call this substance dextrin. Brewers can add an extra enzyme to the fermentation to allow all of that starch to be converted into alcohol.

However, the main source of calories in any beer is alcohol. To lower the alcohol content, it is necessary to thin these beers out at the end by adding water.



Unusual ABV Beers

Most beers are relatively modest in alcohol, featuring an alcohol by volume (ABV) of 4 to 5 percent in most parts of the world. However, brewers are now in a de facto competition to see who come up with the most alcoholic beer.

This started in Boston with a beer that was 25.5 percent ABV. Next, a brewing company in Germany came out with a product featuring 31 percent alcohol by volume. After that, a Scottish company produced a beer called Tactical Nuclear

Penguin, which clocked in at 32 percent ABV. This competition escalated back and forth, and now there is a product that is 67 percent ABV.

At the other extreme are non- and low-alcohol products. Some brewers make this by stripping alcohol from regular beer. Another method is to use a very high temperature when extracting the malt in the mashing, which makes it possible to make a low-alcohol-content beer. A third method is to blend a regular beer and a de-alcoholized beer.





Lesson 4

ALL ABOUT ALES

This lesson focuses on top-fermentation beers: ales. The lesson starts out in England with English pale ales. Then, it moves on to North American and Indian pale ales. Then, the lesson turns to darker ales, including porters, red ales, and more. Additionally, the lesson discusses Trappist beers and German offerings.

English Pale Ales

English pale ales are produced with a pale malt, so they tend to have a coppery color. They are quite malty. The classic cellar temperature for these beers is 55 degrees Fahrenheit. Traditionally, they are not served exceedingly

cold, but they aren't served warm, either. Additionally, these beers are not particularly fizzy, and they historically have a dry-hop character.



North American and Indian Pale Ales

A good example of North American pale ales is Sierra Nevada Pale Ale. It is much more alcoholic than pale ales found in England, clocking in at 5.6 percent ABV. It has a very pronounced bitterness, and the beer is known for its hoppy nose.

India pale ales (IPAs) were originally made with a high amount of alcohol and bitterness. Modern IPAs feature extra hops. Sierra Nevada's Torpedo is an example of an IPA, and its alcohol content is even higher than the Sierra Nevada Pale Ale.

Special Pale Ales

A black IPA is essentially a meeting between a stout and an IPA. Its flavor comes from heavily roasted grains, including black malts and roasted barley. Black IPAs also have a big, hoppy nose.

Brut IPAs are a relatively recent innovation. The term *brut* refers to dryness, and these are relatively dry IPAs. They are developed in a way that ferments out as much sugar as possible.



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Barley Wines, Mild Ales, Amber Ales, and Blonde Ales

Barley wines feature ABVs comparable with those of some wines. These use yeast with a very strong wort, featuring lots of sugar. The yeast ferments those plentiful sugars into alcohol and carbon dioxide, making for a strong beer. The Sierra Nevada take on barley wine is Bigfoot, which is around 10 percent ABV.

In contrast, mild ales feature a low ABV. Mild ale is draft beer that is called brown ale when it's in a bottle. This is old-fashioned English beer.



Traditionally, these beers featured roughly 3–3.5 percent ABV. They are not particularly bitter, and they are very drinkable.

Amber ales are somewhat related to this style. Their ABV is in the range of 4.5 percent. These beers are made with significant amounts of caramel and crystal malts to give extra color and flavor.

The other extreme—very pale malts—produces a blonde ale. These are gentle beers.



Scotch Ales, Porters, Stouts, and Winter Ales

The ales found in Scotland—Scotch ales—are usually more malty and less hoppy, and they may be darker than those ales found further to the south in England. In Scotland, beers on the low end in terms of ABV are called light beers, and those at the high end are called heavy beers.



Porters are a famous English style of beer. Porters are made with substantial amounts of pale malt, but they also feature a substantial amount of other, darker malts—like chocolate malts—to give a stronger flavor and stronger color.





The brewer Arthur Guinness made an extra-stout porter, which featured a greater degree of roasting character. Over time, people dropped the words *extra* and *porter*, so the beer eventually became known as stout.

There are different types of stouts, including imperial stouts. Imperial stouts were first designed and brewed



for the courts of the czars and czarinas of Russia, and they were exported to the crown courts of Russia. The word *imperial* is invariably associated with a high alcohol content.

Trappist Beers and Belgian Reds

Trappist beers are brewed by Trappist monks in Trappist monasteries. If this style of beer is brewed in any other type of monastery, it is called an abbey ale. Belgium features the largest number of Trappist breweries, but there are

Sweet stouts, meanwhile, have a lower alcohol content. These are sometimes called milk stouts, because brewers add lactose (or milk sugar) during the brewing process. Lactose is not fermentable by yeast, so it survives the fermentation and gives residual sweetness and body to this style of beer.



Oatmeal stouts are another variety. They feature a proportion of oatmeal, which tends to give a drier character.

Winter ales are another notable species of ale. Historically, these were beers that were served in the winter months of England, and they contain spices.

some in the Netherlands and one in each of Austria, France, Italy, Spain, the United States, and the United Kingdom



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These can be fairly alcoholic, up to roughly 12.5 percent ABV. The brewers achieve this by adding extra sugar during the boiling stage. There are different classifications depending on the strength, including enkel, dubbel, tripel, and quadrupel.

There is no simple relationship between alcoholic strength and color. A dubbel tends to be a darker product with a greater degree of color than a tripel. Regardless, all of these beers are relatively alcoholic.

Another style associated with Belgium is called red ale or Belgian red. The extra color is produced from heavily roasted grain. These are frequently soured with bacteria that produce lactic acid. Additionally, they are often aged in oak barrels to develop a mature flavor.



WHEAT BEER

Wit beer is wheat beer. The primary grist in these beers is wheat. Two other interesting ingredients are included in a traditional wit beer: coriander and citrus.



German Products

This lesson concludes with German beers, starting with altbiers. The word *alt* in German means “old,” so altbiers are brewed in the old way. They’re somewhat similar to the English pale ale, but

they are a bit more alcoholic, with roughly 5 percent ABV. They are often darker, and they include a malt style called Vienna malt, which is more intensely dried than the pale malt.



Kolsch is a beer style that comes from Cologne, and it is almost a hybrid. It is made with an ale yeast, *Saccharomyces cerevisiae*. However, the conditions under which it is made are lager-type conditions with much lower

temperatures. These beers are much lighter than altbiers with a similar alcohol concentration, but they use paler malts.

Weizenbiers are primarily wheat, and they contain at least 50 percent malted wheat.

These are light in color, but usually very cloudy. An authentic weizenbier has two characteristics. The first is that it smells of cloves. That's because the ale yeast that makes weizenbier produces a clove-like aroma.



The second characteristic is owed to the fact that the yeast also makes a large amount of isoamyl acetate. This produces a banana or bubblegum aroma.

Most weizenbiers still have yeast in them and are called hefeweizens. The *hefe* in the term *hefeweizen* refers to the yeast.

Goses are another product from the wheat beer stable.

Goses are deliberately quite salty. However, the salt is not overwhelming, and this type of beer can be very refreshing.

Weiss beer is a final type of wheat beer. This beer style comes from the north of Germany. Weiss beers are much weaker than hefeweizens, with an ABV hovering around 2.8 percent. They have a fairly strong sour character.





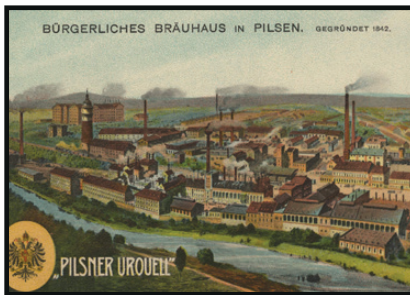
Lesson 5

ALL ABOUT LAGERS

This lesson covers lagers, which are bottom-fermentation beers. In particular, the lesson focuses on pilsners and different variations of bocks. Then, it moves on to discuss Märzens, Oktoberfest-style beers, kellerbiers, and other classic German offerings. The lesson closes with a look at rauchbiers and malt liquor.

Pilsners and Bock Beers

The classic lager style—pilsner beer—originated in the mid-19th century in Bohemia, which today is the western Czech Republic. Pilsners were birthed in the Pilsen city brewhouse.



Pilsners are golden, lightly colored lagers with an ABV typically in the range of 4.8 to 5.1 percent.



If you go to the Czech Republic, you will find that this beer can have a slight butterscotch or popcorn character. Across the world of brewing, this character—which comes from a substance called diacetyl—is frowned upon. It is generally undesired in beer, but it is desired in the Czech pilsner-style beer.

Bock beers are relatively stronger in terms of alcohol. They may be 6–8 percent ABV.

Bock labels often feature a goat. That is a symbol of strength. Bock beers tend to be relatively malty, and they often feature a sulfur-like flavor. They can be of a range of colors, from a gentle straw-like color to dark brown.



Double bocks contain substantially more alcohol, clocking in as high as 12 percent ABV. Meanwhile, maibocks often have a more golden, refreshing appearance. Their ABV is usually in the region of 6.8 or 7 percent. They are meant for the spring. Winter bocks are often somewhat darker in appearance, with a similar alcohol content.



Märzens, Oktoberfest, and Kellerbier

At one point, German brewers were forbidden to brew in the summer months, so they brewed up until March. They wanted a beer that was able to be stored through the summer months, progressively consumed, and then finished off around the time they could start brewing again in September. **The Märzen style of beer was the result.** (Its name comes from the German word for the month of March.)

To allow it to have a long shelf life, it was brewed to a relatively high alcohol content, around 6.5 percent ABV. There were pale and dark versions. Sometimes, people refer to the dark versions as Vienna lagers because they are made with Vienna malt. It is a fairly heavily heated malt. It still has enzymes, but it is heated sufficiently strongly to get better color and some interesting, stronger flavors.

Related to this is a beer style called Oktoberfest. The history of the Oktoberfest stems back to a marriage celebration for Crown Prince Ludwig of

Bavaria and Princess Teresa of Saxe-Hildburghausen, just outside the Munich city gates. They decided to throw a party, which lasted from October 12 to October 17. It was so successful they decided to have it every year.

The party became so popular in Munich that the city leaders pushed the starting date back to the middle of September because the weather was a bit better. Today, Oktoberfest begins the third weekend in September and ends the first Sunday in October.



Six breweries are permitted to sell their products at the festival in Munich: Paulaner, Augustiner, Löwenbräu, Hacker-Pschorr, Spaten, and Hofbräuhaus. However, Oktoberfest-style beers are brewed all over the world.

Oktoberfest beer is not especially bitter, but it has a good alcohol kick. This beer is much more focused on malt than hops.

Kellerbiers, Helles, Dunkels, and Schwartzbier

Kellerbiers are generally unfiltered. The name reflects that it is similar to a regular beer served in beer kellers in Germany. A related beer is helles. This is a relatively lightly colored lager-style beer, with an alcohol content somewhere between 4.5 to 5.5 percent ABV. These beers are very malty.



LAGERS: A HISTORY

The history of lager goes back to an edict in Germany in 1553, which said the brewers were forbidden to brew between St. George's Day (April 23) and Michaelmas (September 29). The edict meant that people had to brew at a certain time of year and store the beer for the summer months. The term *lagering* means "to store."

Dunkels are much darker. They are a copper-brown color. Schwartzbier is even darker, and its name means "black beer." This is a very dry beer. Generally speaking, its ABV on the low end is 3.8 percent, and it can go up to 5 percent.



A HYBRID: THE CALIFORNIA COMMON

A California common is a hybrid beer. This type of beer is produced with lager yeast operating under ale-fermentation conditions.

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Rauchbiers

Rauchbiers are made with smoked malt. When drying the malts to make rauchbier, brewers incorporate burning beechwood. This produces a smoky character, somewhat like smoked bacon.

Rauchbiers are wonderful for pairing with various types of cheeses. They are also a great addition if you are barbecuing meat.

Malt Liquor

In terms of classification, malt liquor fits best with the bottom-fermentation beers. Malt liquor is defined by the alcohol concentration. The classification of what a malt liquor is varies from state to state.

Many malt liquors are made with grists that are lower in malt. They often have high amounts of adjuncts, including sugars. This beverage tends to be lightly hopped, fairly sweet, and strong in terms of ABV.



Lesson 6

BEERS OF THE WORLD: WHO DRINKS WHAT

This lesson focuses on the business of beer. Topics covered in the lesson include who brews the most beer and who drinks the most beer globally. The lesson also discusses craft brewing companies as well as the world's largest beer producers.

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Global Leaders

China brews the most beer. The country currently produces around 500 million hectoliters of beer per year. So, a lot of beer. However, because of the country's large population, they don't drink huge amounts per capita. The United States is the next biggest producer of beer. Per capita, its population consumes around 75 liters of beer per person annually.








In terms of who consumes the most beer, the leader is the people of the Czech Republic. They currently consume around 140 liters of beer per person annually. They only produce about 19 million hectoliters. The next biggest consumers are Germany and Austria.

More than half of the beer in the world is made by five brewing companies. Recently, the largest company (Anheuser-Busch InBev) bought the second-largest company (SAB Miller), making for a truly gigantic operation. Brands often change hands through sales and mergers.


GERMANY'S BEER SCENE

Germany has an interesting beer scene, which is characterized by more than 1,200 relatively small brewing companies. The people have tremendous local loyalty to their nearby brewing companies.

TOP PRODUCERS OF BEER WORLDWIDE

	PRODUCTION (MILLION hl)	CONSUMPTION (l per head)
 CHINA	492	36
 UNITED STATES	226	76
 BRAZIL	141	68
 GERMANY	95	107
 RUSSIA	82	57
 MEXICO	82	45
 JAPAN	55	40

TOP CONSUMERS OF BEER WORLDWIDE

 CZECH REPUBLIC	19	144
 GERMANY	9	104
 AUSTRIA	9	104

Craft Brewing

Craft breweries are associated with being small and regional. There is an organization based in Boulder, Colorado, called the Brewers Association, which looks after the interests of the craft brewers. They classify a craft brewer as being “small, independent, and traditional.”

The Brewers Association’s definition of *small* is a brewing company that produces less than 6 million barrels of beer every year. Six million barrels is approximately the output of Ireland or Denmark. The output limit is set fairly high so that brewers can continue to expand but still be a member of the club. The three largest craft brewers are Yuengling, the Boston Beer Company, and Sierra Nevada.

To be independent, less than 25 percent of a craft brewing company’s stock can be owned by a larger brewing company that is not itself a craft brewing company. To meet the requirement of being traditional, the majority of their beer needs to be made with traditional brewing materials.

There are also some subsets. A regional brewery is one that produces between 15,000 barrels a year up to the limit of 6 million barrels per year. A microbrewery produces less than 15,000 barrels per year, and a pub brewery is one that brews and sells in its pub.

A MASSIVE INCREASE

In 1983, there were only 93 brewing companies in the whole United States of America. However, by 2018, there were 7,450 breweries.

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Best-Selling Brands

The world's top-selling brand is a beer called Snow from China. Some other remarkably prolific beers also hail from China: Tsingtao and Harbin. Other top-selling beers include Budweiser, Bud Light, Coors Light, Heineken, Skol, and Brahma.

The biggest brand in the US is Bud Light, followed by Coors Light and then Budweiser. After that comes Miller Lite, Michelob Ultra, Natural Light, Busch Light, Busch, Miller High Life, and Keystone Light.

Seven out of the 10 top selling brands of beer in the United States are light beers. In terms of imported beer to the United States, the top seller is Corona Extra, followed by Heineken and Modelo Especial.



WORLD'S LEADING BEER BRANDS

1	SNOW	5.4
2	TSINGTAO	2.8
3	BUD LIGHT	2.5
4	BUDWEISER	2.3
5	SKOL	2.1
6	YANJING	1.9
7	HEINEKEN	1.5
8	HARBIN	1.5
9	BRAHMA	1.5
10	COORS LIGHT	1.3

Taxation

Taxation is one of the biggest forces affecting beer prices, especially in Europe. There, taxation on alcohol can be rather high, and it varies from location to location. In France, the rate is roughly \$0.23 per pint, while in Ireland, it is \$0.83 per pint.

In the United States, there are three layers of government that levy taxes. The federal rate of taxation for the large brewers has been \$18

per barrel since 1990. There is a reduced rate of \$7 on the first 60,000 barrels for a brewer that produces less than 2 million barrels of beer per annum. That essentially covers the whole craft brewing sector.

State taxes vary tremendously. Then, a sales tax applies in most states as well. Even so, the taxation on beer in the United States is substantially less than it is in most countries in Europe.

A Three-Tier System

Since the days of Prohibition, there has been a three-tier system of beer production and distribution in United States.

The system involves producers (the brewers), distributors (who ship beer from place to place), and retailers (who sell the beer).

Control of beer occurs at the state level, and there are many particularities. For example, in Utah, no beer for sale can be in excess of 3.2 percent alcohol by weight, unless it is sold in a state-owned store. (That translates to 4 percent alcohol by volume.)

The Top and Bottom States

When it comes to American states, North Dakota's population consumes the most beer per person. That state is followed by New Hampshire,

Montana, South Dakota, and Vermont. Utah's population is at the bottom, followed by New York, Connecticut, New Jersey, and California.



Lesson 7

ENJOYING BEER I: THE PERFECT POUR

For a full appreciation of the flavor and appearance of beer, it is best to pour beer into a glass. Though pouring beer may sound like a simple task, there are actually many considerations and techniques to keep in mind. This lesson goes over those to help you get the most out of your pours.

Bubbles and Foam

Some glasses have deliberately etched bottoms to the glass, which are locations where the bubbles will be produced. These are called nucleation sites. The stream of bubbles rising through the beer replenishes the foam in a process known as beading.

Beer is able to produce stable foam at the top of the drink because there are materials in the beer that hold the bubble wall together. Proteins help with this, and they come from the cereal. Protein can come from barley, and wheat is an even better source. The bitter

molecules from the hops play a role as well: They stick to the protein in the bubble wall and hold it together.

Foam can have different textures.

Some beers have lacey foam, while others have foam that is denser. A classic example is Guinness foam, which has tiny white bubbles. The foam might pick up color as well. Some are very white, but others are darker.



Pouring a Beer and Caring for Glasses

When pouring a beer from a bottle, raise the glass and the bottle, put them at an angle, and pour with vigor. Allow the foam of beer to stream down the side of the glass. If you time it properly, the last drop will coincide with the foam at the top of the glass.

Be sure to use a clean glass. Avoid glasses that are contaminated with food or

kitchen material, such as leftover detergent, grease, oils, and fats. When washing glasses in a sink, wash them first so that other items don't leave any material that can contaminate the glasses.

Use hot water and detergent. Wash each glass inside and out, and then use slowly trickling water to wash away the detergent.

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It is best to let them drain dry, because drying them with a cloth may introduce grease if that is present on the cloth.

If somebody gives you a glass with beer in it, you might see ugly bubbles on the inside of the glass within the body of the beer. That indicates a greasy spot.

Sometimes, when a beer is opened, the beer rushes out quickly. That is called gushing, and it is highly undesirable. Gushing can be

The Appearance of Beer

Beers vary in color, from very light to very dark. For example, Sierra Nevada's Otra Vez, a gose, is very pale. It has that color because the beer is produced with a very lightly dried malt. By contrast, Sierra Nevada Pale Ale uses pale ale malt as well as caramelized malts. This give it a somewhat darker color.

Beers like stouts contain significant levels of more heavily roasted grain. They can include chocolate malt, black malt, and roasted

caused by a glass, bottle, or can being agitated. It can also be caused by materials that find their way into the beer.

The biggest problem is material that comes from contaminated grain. Barley that is grown in wet, cold places is at risk of being contaminated with a mold called fusarium. That mold produces a material that causes gushing. The chances of that happening in most parts of the world are remote, but it can happen.

barley. These ingredients produce intense darkness in the product.

Beers also vary in haze and clarity.

Some beers are relatively bright, featuring a clean, clear appearance.

Some beers are cloudy, with hefeweizen being an example.





Lesson 8

ENJOYING BEER II: MAXIMIZING FLAVOR

This lesson discusses the flavor of beer. That flavor comes from various sources, particularly the main ingredients of beer: malt, hops, yeast, and water. The lesson also looks at ways to maximize your enjoyment of a beer's flavor.

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Malt and Hops

Some malts will directly contribute to flavor. Some will tone down the flavor, which may be desirable. For example, it may ease back on certain drying characters. Hops can deliver different amounts of bitterness and aroma.

The yeast itself will also deliver substantial amounts of flavor. Sometimes, a beer is mostly about the malt and the hops. In some of the gently flavored beers, which are less hoppy and malty, the yeast will come forward much more.

Detecting Flavor

People use two main organs to detect flavor: the tongue and the nose. The flavors of sweet, salt, sour, and bitter are detected on the tongue, and the tongue possibly detects other factors as well.

You will detect most of the flavor of beer through the nose. This is why you should put beer into a glass: If you're drinking beer straight from a bottle or can, there will not be much space for the aroma to come out. When you swallow, the aroma comes up the back of the throat and into the nose a second time. This is called the retronasal effect.

MOUTHFEEL

Mouthfeel is the texture of the beer: How does it feel on the tongue? How does it feel on the palate? This is one of the most difficult-to-study areas for brewing scientists.



There is a third sense used when tasting beer: the trigeminal sense. This is how you detect carbon dioxide. The trigeminal sense measures pain, and carbon dioxide hurts. For example, the trigeminal sense is how you detect chili peppers in a spicy dish. **More carbon dioxide will produce more tingling and fizziness on the palate.**

At the other extreme is nitrogen gas. The use of this gas was first pioneered by the Guinness Brewing Company. **Nitrogen gas produces more stable foams with small, white bubbles.** It also smooths the palate and can temper harsh, roasted characters. The downside is that it suppresses hop aromas.



Sweetness in a beer occurs because of sugars. These sugars are present because they survived fermentation or because the brewer put them into the finished product to temper sourness or bitterness.

In terms of sourness, most beers have a pH in the region of 4 to 4.5. That means they are reasonably sour, but not as sour as lemon juice, which has a pH of about 2. Particularly sour beers, such as lambics, will be in the range of 3 to 3.2.

Beer contains salt, and salty flavor is produced by sodium and potassium.

All beer contains sodium and potassium, with more potassium than sodium. Gose is the most demonstrably salty style of beer.

LIGHT AND BITTERNESS

A beer's bitterness primarily comes from the hops. Boiling the hops extracts the bitterness in a process called isomerizing the alpha acids. The more isomerized alpha acids, the greater the bitterness of the product. The downside to these acids is that if they are exposed to light, they break down to produce a chemical that smells of skunks.



Aroma and Flavor

Oils provide the aroma from hops. There are many, many hop varieties, all of which give different aromas. There are at least 420 different chemical types that contribute to hop aroma. Brewers choose the hop varieties they want, make sure they're within the correct specification, and add them in certain amounts, all with the goal of delivering a specific level of intensity.

Esters and Sulfur

Esters are fruity-flavored materials that are produced by yeast. One is called ethyl acetate, which smells of pear. Another, isoamyl acetate, smells of banana. Phenylethyl acetate smells of roses. There are many other varieties of esters made by yeasts.

Different beers need different levels of esters. Stronger beers, like barley wines, tend to have very high levels of these esters. That is because when fermenting very strong sugar solutions, yeast produces a large amount of ester flavors.

The same applies to malt. There are many different chemical types that contribute to the flavor of malt, and those will differ from malt to malt. For example, a pale malt gives a biscuit-like flavor. More heavily heated malts in the crystal category give toffee, caramel, and nutty characters. Chocolate malts give mocha and treacle flavors, and black malts give smoky, coffee-like traits.

Additionally, many substances that contain sulfur atoms contribute to the flavor of beer. The simplest of these is hydrogen sulfide, which smells of rotten eggs. There are some beers that have an egg-like aroma.

Another material is called DMS, or dimethyl sulfide. A can of sweet corn, a peeled parsnip, and tomato ketchup all smell of DMS. There are certain lager beers that contain significant amounts of DMS.



Balance

When it comes to the drinkability of a beer, balance is the key. In other words, one of the beer's traits should not overwhelm the other. Balance can be achieved with beers with intense flavors or with fairly gently flavored

beers. For example, on the intense end, a black IPA with a huge roasted nose and hop character can still be balanced. At the other extreme might be a North American lager that is gently flavored yet balanced.

Temperature

There are certain guidelines on what the serving temperature for beer should be. Some beers—including very pale lagers and malt liquors—need to be served cold. That means in

the region of 30 to 39 degrees Fahrenheit, or straight out of the refrigerator. Hefeweizens, premium lagers, pilsners, and lambics can be served at a slightly higher temperature.

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Other beers have an ideal serving temperature of 45 to 54 degrees Fahrenheit. Those include American pale ales, amber ales, dunkelweisses, sweet stouts, porters, dunkels, helles, Vienna lagers, schwartzbiers, smoked beers, altbiers, tripels, and Irish ales.

Another temperature bracket is 54 to 57 degrees Fahrenheit. This is the classic cellar temperature in the UK for bitters, premium bitters, brown ales, India pale ales, lambics that have not been blended, bocks, Scotch ales, American strong ales, and milds.

Still other beers thrive when served at 57 to 61 degrees Fahrenheit. This range is suited for barley wines, quadrupels, imperial stouts, imperial and double IPAs, and doppelbocks. These beers, which feature a high amount of warming alcohol, are better appreciated at somewhat higher temperatures, as it enhances their flavor.

A simple rule to follow is that the gentler the flavor of the beer, the lower the serving temperature. The more intense the flavor and the bigger the alcohol content, the higher the serving temperature.



Lesson 9

ENJOYING BEER III: BUYING AND STORING

The lesson goes over factors that affect the flavor of beer, including the passage of time and the presence of different chemical materials. Then, the lesson looks at steps brewers take to maximize the quality of their beer. It closes with some beer-shopping tips.

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Changes in Flavor over Time

The flavor of beer changes with time. One of the most significant changes is a decrease in the bitterness. It is possible to measure the decrease in the iso-alpha acids from the hops. The beer's character becomes harsher. There is a decrease in the prominence of esters, and there is an increase in the prominence of the character of ribes. Sweetness can also increase, and beer may develop a more metallic taste.

Hop aroma can also change over time. The hop materials can stick onto the packaging, which is called scalping.

Some beers can improve in flavor with time. Barley wines are an example. For example, Sierra Nevada's Bigfoot barley wine develops interesting changes in flavor over time.

In fact, there is a history of beer being deliberately aged. In the past in England, for example, there was a practice of aging beer in wooden barrels. Then, the old ale was blended with a younger, newly brewed beer to create a different product.



Instability

In beer, there are numerous chemical materials derived from the malt, hops, yeast, water, and so on that influence the

flavor of beer. If the level of any of these increases or decreases so that drinkers can detect the flavor change, the result is flavor instability.

This can occur with even tiny changes in the level of a chemical material.

There may be thousands of angles to worry about, so brewers need generic solutions that minimize the overall flavor change. There are three of these. The first keeps the oxygen level in the finished beer as low as possible. Packaging technology over the years has improved greatly, but there is still a risk of flavor instability from air getting into the packaging. The tighter the seal, the better. **Pry-off crown corks perform better than twist-off crown corks.** Cans let no oxygen in at all, making them the best option for flavor stability and light resistance.

The second solution is sulfur dioxide or metabisulfite. **This material prevents beer from staling as rapidly.** In the United States, beer must be labeled to say “Contains Sulfites” if it contains more than 10 milligrams per liter of this material. This is relatively rare.

The third important factor is temperature. **The higher the temperature, the more rapidly beer will go stale.** As a rule of thumb, a beer will turn to an unacceptable degree at room temperature—68 degrees Fahrenheit—in 100 days. At 86 degrees Fahrenheit, beer will go stale in about a month, and at 104 degrees Fahrenheit, beer lasts only 10 or 11 days before going stale.



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However, at 50 degrees Fahrenheit, then 300 days is a rule of thumb. This means that beer lasts much longer in a refrigerator. Store it cold when possible.

To control temperature on their end, brewers usually try to brew the beer as close to

the customer as possible. For example, this is one of the key reasons why Sierra Nevada built a brewery in North Carolina to serve the eastern half of the country. Another helpful technique is stock rotation, which leads to turning beer stock over before it gets too old.

Purchasing Tips

This lesson closes with tips on purchasing beer. One important piece of information to look for on beer is the packaging date or best-before date. In most cases, the younger the beer, the better.

If you're buying beer, don't take advantage of cheap offers. Don't be tempted by bulk purchases at a discount, because it is likely that by the time you will be ready to drink it all, a great deal of it will be stale. Instead, buy based on the needs of yourself, your family, and your friends.





Lesson 10

PAIRING BEER WITH FOOD

This lesson is based on an interview with Jessie Massie, who works as a chef in a Sierra Nevada taproom. The lesson summarizes some food-pairing tips from Massie. It also covers other topics, including cooking with beer and how flavor changes during a meal.

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Food-Pairing Tips

Massie believes that a light lunch is the perfect opportunity to have a pale ale. If you're going to have a salad, strong pairing options include a kellerweis, saison, or crisp lager. If you're having a heavier lunch, like a pretzel and beer cheese, try a heavier IPA. The saltiness of that food will cut the beer's bitterness, and the bitterness of the beer will cut the fat.

Pairings of beer and food can take two different approaches: They can either contrast and balance one another out, or they can reinforce each other. For an example of the former in action, Massie points to pairing spicy chicken wings with a cooling, palate-cleansing Mexican-style lager. For an example of the latter, consider pairing the same wings with a strong IPA, which will increase both flavor profiles.

Be careful when choosing what to pair with sweet flavors. For instance, a bitter IPA might contrast too harshly with a particularly sweet food.



FLAVOR CHANGES

As a meal goes on, the flavors your beer delivers will change. The flavor profiles in the dish you're eating will react with each other and affect that of the beer. Additionally, as your beer becomes warmer, its flavor will change somewhat.

Cooking with Beer

When cooking with beer, it is important to know the elements of the beer. For example, you need to know when to put the beer in the food so that you don't increase the bitterness of the beer or alter other aspects of it.

In many dishes, you can braise with beer very easily. You might try deglazing a pan and then adding beer at the end. The beer will be present as a flavor component, but it will not be heated and converted to a more bitter flavor.

Cheese and Beer

A cheese board paired with a beer flight can be an entertaining way to sample multiple beers and cheeses together. If a cheese has lighter floral notes or a creamy nature,

try pairing it with a beer on the lighter side, such as a kellerweis or saison. As you try bolder cheese, try bolder beers. For example, a sharp cheese can stand up well to a bitter beer.



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Fish and Beer

The fish dish discussed in the video and audio lesson was a rainbow trout with potato salad that had been tossed in cumin, coriander, and a jalapeño-orange vinaigrette with some arugula. It was paired with Sierra Nevada's Otra Vez. The lime, salt, and sweetness paired well with the cumin and coriander. This pairing also brought out the citrus in the vinaigrette and enhanced the dish's spiciness.



A gose is not the only beer that could have paired with this dish. Another option would have been a crisp lager. However, a strong IPA would have run the risk of overpowering the dish.

Meat and Beer

The meat dish discussed in the video and audio lesson was a short rib crusted with a chili spice. The short rib was seared and then braised with more chilies and pale ale. The dish was served on top of roasted root vegetables. It was paired with a porter, with the idea of calming the sweetness of the roots. The caramel and roasted notes in the malts was meant to pair with the braise and sear of the short rib.

In general, Massie has found success pairing darker meats with darker beers. Roasted malts and roasted meats that have both had a Maillard reaction are a wonderful match.



Dessert and Beer

The lesson's dessert-and-beer pairing was milk chocolate hazelnut cheesecake and Sierra Nevada's Narwhal, an imperial stout. It is traditional to pair coffee with dessert.

Along with coffee notes, Narwhal also has cocoa notes and molasses, which means it brings more to the table flavor-wise than a cup of coffee.



A Multi-Course Meal

If you're preparing a multi-course meal, Massie recommends serving the dishes in order from light to heavy. The same generally goes for beer:

Move from light to dark and from less alcohol to more alcohol. This method helps prevent people's palates from being overwhelmed early in the meal.



Lesson 11

THE SCIENCE OF QUALITY BEER

This lesson is based on interviews with Sierra Nevada brewer Brian Grossman and quality assurance manager Liz Huber. Topics discussed in this lesson include how the brewery keeps its beer consistent across multiple facilities and environmentally conscious brewing.

Expansion Challenges

In 2009, Sierra Nevada was about to hit its capacity at the company's Chico, California, facility, necessitating expansion. The brewery's leaders made a decision to open a new facility on the East Coast for beer freshness and quality as well as lessening the environmental impact. Now, their beer is brewed in Chico and Mills River, North Carolina.

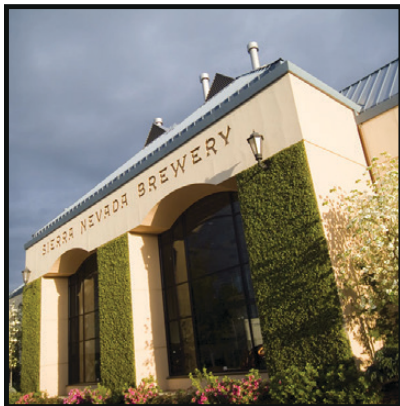
Environmental Challenges

Making and distributing beer requires a large number of resources, including barley, aluminum ore, glass, and fuel for transportation.

All of this can add up to a large environmental impact. Sierra Nevada has taken several steps to lessen that impact.

For example, the brewery recovers all of its CO₂ onsite. This means the brewery does not have to purchase beverage-grade CO₂, which is good for the environment. Additionally, recovering the CO₂ allows for a higher quality standard.

Flavor alignment took the company a large time to achieve. The largest ingredient in beer is water, and the water available at the North Carolina facility is very soft. Matching that to the water in California took a bit of effort, and it remains an ongoing challenge.



Additionally, the company has embraced aluminum cans. Those allow for the packing of 100 cases per pallet versus 70 cases per pallet. The company also uses onsite energy generation as much as possible, employing solar panels and microturbines.

SANITATION

According to Grossman, the biggest factor in making a great beer is sanitation. Breweries need to be as clean as possible because microbes can produce different changes in flavor.

Quality Assurance

Sierra Nevada employs a team of people that are highly engaged in ensuring product quality, which Huber oversees. According to Huber, the team analyzes the beer, packaging, draft systems, and more. Once the beer is produced, the team also monitors how it ages over time, including while it is stored in a warehouse.

Sierra Nevada maintains a beer library. The team keeps samples of the beer for slightly past the duration of the beer's shelf life, which the team occasionally spot checks.

Early in the production cycle of beer, the team monitors sugar levels, the beer's pH, and the yeast. They watch these traits throughout the fermentation process, and the team also monitors CO₂ and ABV levels. Additionally, the team watches out for undesirable flavors.

Because Sierra Nevada has a brewery in California and another in North Carolina, consistency between the two is a point of focus. The quality assurance team meets weekly for a flavor-profile alignment. Sierra Nevada's staff ships beers across the country to both sites. During a video conference, the quality assurance team blindly tastes two of the same beer from the two facilities. (Sometimes, to keep people alert, the beer will be from the same facility.) The purpose of the process is to ensure that the beer tastes the same, regardless of where customers buy it.

Another focus is the prevention of beer spoilage. To that end, Sierra Nevada keeps a microbiologist onsite to perform microbiological checks.



Lesson 12

BEER AND HUMAN HEALTH

This lesson focuses on the impact of beer on health and the body. There is no question that alcohol can cause serious problems, including traffic accidents, falls, and drowning. Long-term problems can include cirrhosis and pancreatitis. The key to healthily enjoying beer is to drink it in moderation rather than excess.

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Early Work

The first person to report the benefits of moderate alcohol consumption was Raymond Pearl in 1926. He interviewed more than 2,000 workers in Baltimore and concluded that moderate drinkers live longer than abstainers and much longer than those who are heavy drinkers. In other words, there is a sweet spot.

As a person drinks up to two units of alcohol and beyond per day, the person's risk of death through atherosclerosis—the buildup of fatty materials

in the arteries—is reduced. It starts to tail up again at rather high levels of alcohol consumption.

The relationship with all causes of death increases again sooner than for atherosclerosis. That is because of all the other risks, such as accidents from excessive consumption of alcohol. The conclusion is that moderate consumption of alcohol on balance is beneficial. The sweet spot is at a lower level for women than it is for men.

THE FRENCH PARADOX

Many people believe that red wine is the healthiest alcoholic option. This stems from a 1991 segment on the *60 Minutes* program, which discussed the French paradox. That paradox refers to the fact that people living in France and eating many fatty materials, like cheeses and oils, should have their arteries caked with bad cholesterol.

That was not the case, and the reason was believed to be the consumption of red wine. More specifically, the helpful ingredient was believed to be a substance called resveratrol, which is in grape skins. However, a person would have to drink a phenomenal amount of wine to get enough resveratrol to counter atherosclerosis.

Lifestyle

A famous study from Denmark in 2006 involved researchers studying supermarket purchases. They found that generally speaking, the people who bought wine also bought fruit and vegetables, poultry, low-fat cheese, and milk. In contrast, the beer buyers

bought sausages, chips, sugar, butter, and sodas. This reflects differing lifestyles between the two groups.

There can be additional complicating factors. For example, some people smoke as well as drink, and those two issues may interact.



Nutritional Value

A beer is a significant source of some of the B vitamins, especially folic acid. It compares very favorably with cereals and vegetables,

meat, and fruits. However, there are no fat-soluble vitamins in beer. That means vitamins E, D, and A are not present.

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Beer also contains silica, which is good for the bones, and an antioxidant called ferulic acid.

Additionally, beer contains soluble fiber, which comes from the grain.

Downsides

Beer and wine can be contributors to gout. There are also many studies that link consumption of alcohol to cancer, but there are some that are contrary.

Another relevant topic is the so-called beer belly. The main contributor to the calorie count in any alcoholic beverage is alcohol. **The more alcoholic the beer, the greater the calorie count.** Monitoring calories from beer is important. Keep in

mind that it is impossible to find a true calorie-free beer: Even an alcohol-free beer will still contain some residual carbohydrates and a bit of protein.

In recent years, some leading government authorities on health have lowered the guideline on alcohol consumption. The UK guideline is currently 14 units per week for men and women, which is about 16 grams of alcohol per day.

DEFINING A UNIT

A unit of alcohol is 10 milliliters of ethanol. A beer that is 5 percent ABV has 5 milliliters of alcohol per 100 milliliters. In turn, a 354-milliliter bottle—that is, a 12-ounce bottle—of that beer contains 1.8 units of alcohol.

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