FOR THE HOMEBREWER & BEER LOVER

11 RECIPES YOU CAN BREW

zymurgy®

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Brewing Up a Pilgrimage

It's hard to overstate the significance of Pilsner. Most beer sold today can trace its lineage directly to the world's very first pale lager, which was revealed on October 5, 1842, in the city of Pilsen, in what is now the Czech Republic. Pilsner changed the face of beer forever.

In the fairly short time since, pale lager has become virtually synonymous with the word *beer* for most consumers. You order "a beer," and you get a pale lager. The American Homebrewers Association's logo even features a stylized Pilsner glass. So does the logo of our parent organization, the Brewers Association. Pilsner *is* beer.

It was thus with considerable anticipation and thirst that my wife and I recently made a pilgrimage to the original source—in German, the *Urquell*—of Pilsner lager.

Pilsner Urquell is brewed from Moravian barley, Saaz hops, soft water, and a yeast called Urquell H, which has been selected from what was once a blend of as many as five strains. The mash, a long triple-decoction protocol, creates the deep golden color that differentiates Bohemian pale lagers from other similar styles. Today's Pilsner is fermented and conditioned in stainless-steel cylindroconical tanks, but fermentation historically took place in open wooden fermenters; lagering was in giant, pitch-lined wooden casks.

A small amount of Pilsner Urquell is still open fermented and lagered in wood in the labyrinth of tunnels beneath the brewery. The caves drip with water and romanticism, making them tremendous tourist attractions. But the historic setup serves a practical purpose as well—brewing small batches in the traditional way offers brewers a classic metric against which to compare the modern brew.

While the brewery is the clear draw, Pilsen, the fourth-largest city in the Czech Republic, is itself an attractive destination. The delightful brewing museum traces the local history of beer, and tours of the city's tunnels offer glimpses back to 1295.

Then, of course, there are the pubs, most of which serve "tank beer." For this, the Urquell brewery diverts some of its namesake Pilsner into temperature-controlled trucks. Within 48 hours, these trucks deliver fresh, unpasteurized (in some cases, unfiltered) lager directly to large pressurized tanks at Pilsen's watering holes, where it must be consumed inside a week. Many of your favorite American brewpubs observe a similar practice when they serve beer from the bright tank, but the American three-tier system makes it much harder to do so beyond brewery walls.

U.S. beer geeks, however, can relish knowing that we are among the only consumers to receive Pilsner Urquell in brown glass bottles. Virtually everyone else gets green glass.

Japanese brewing group Asahi took ownership of Pilsner Urquell in 2017 when SABMiller, which had owned it since 1999, divested itself of certain brands as part of the regulatory negotiations in Anheuser-Busch InBev's takeover of SABMiller. It is by no means a small operation. But it is iconic, it is historically significant, and it is a worthy destination for any beer lover.

If you're keen to brew your own Urquell-inspired Pilsner, Annie Johnson's excellent talk, "Czech Plz! What I Learned Brewing with the Czech Masters," presented at Homebrew Con 2017 in Minneapolis, is a great place to start. It's available right now at HomebrewersAssociation.org/seminars.

This is my final issue of *Zymurgy* to fully edit in Berlin, which my wife and I have called home for the past two years. In addition to my normal duties as editor, I've had the privilege of representing homebrewers and American craft beer in Europe. Many thanks to my colleagues at the BA and AHA for the opportunity. I look forward to sharing beers with you again soon in Colorado.

Dave Carpenter is editor-in-chief of Zymurgy.

Top to bottom: The 1892 Jubilee Gate entrance to the Pilsner Urquell brewery; Not Colonel Sanders! This display at Pilsen's Brewery Museum makes homebrewers feel right at home; Unfiltered Pilsner Urquell served from a tank.

Photos courtesy of Dave Carpenter; Ginny Carroll (entrance)

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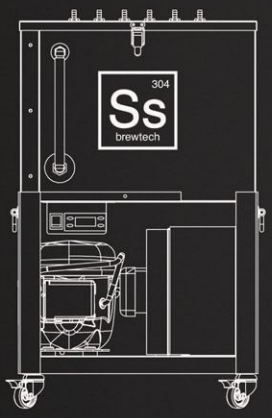

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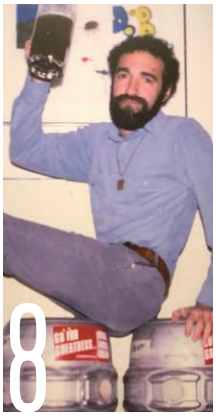

Recipe Guide

Cover Illustration
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(zī'm ər jē) n: the art and science of fermentation, as in brewing.

ON THE WEB
Find these homebrewing recipes and more on our website @ HomebrewersAssociation.org/homebrew-recipes

NOW ON Tap

Taste Beer History

HISTORIC STYLES BREWFEST AND *BEER HERE! BREWING THE NEW WEST*
HISTORY COLORADO CENTER, DENVER, COLO.

The History Colorado Center's newest exhibit, *Beer Here! Brewing the New West,* illustrates Colorado's brewing history from Gold Rush immigrants to Charlie Papazian and John Hickenlooper, and on to present day. Museum guests will learn about 19th-century saloons, Prohibition-era "drugstores," and more as they experience why the Centennial State has become so intimately associated with beer and brewing.

To celebrate the new exhibit, 25 Colorado breweries will pour historic brews at a special beer festival in the museum's atrium from 7 p.m. to 10 p.m. on Saturday, July 20.

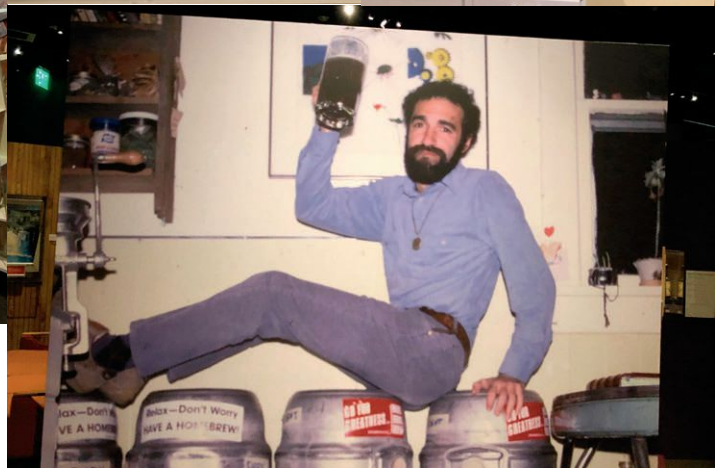
"This event will give our visitors an opportunity to travel through time with a beer in hand," said Jason Hanson, chief creative officer for History Colorado. "People often wonder what earlier generations were drinking. This is your chance to get a taste of the past."

Colorado breweries will serve recreated ancient recipes, retired craft classics, and popular historic styles, many of them exclusive to the event. Attendees can sip on these historic beers from commemorative cups while they nosh on palate-cleansing pretzels and other snacks.

VIP tickets to the July 20 beer festival are $55 ($50 for museum members) and include early access at 6 p.m. and a guided tour by lead exhibit developer and serendipitously named Sam Bock. General admission is $35 ($30 for museum members), and designated driver tickets are $14 (free for museum members).

Although the Historic Styles Brewfest is one night only, the *Beer Here!* exhibit runs May 18 to August 9, and admission is included with purchase of a regular museum ticket to the History Colorado Center.

For more information, visit HistoryColorado.org.



Photos courtesy of History Colorado Center; Jill Redding

Get There

HOPPY POSSUM: SOUTHERN BREWERS CUP

The first ever Hoppy Possum: Southern Brewers Cup takes place September 28 at TVA Credit Union Ballpark in Johnson City, Tenn. This event combines everything you love about beer festivals (fancy glasses, unlimited tastings, great music, and unique food trucks) with the interactivity of a people's choice competition. Oh, and it's all homebrew.

The competition is limited to 75 entrants and offers $10,000 in cash prizes. It costs nothing to compete except a brewer's time and beer.

"Craft beer enthusiasts are always looking for new, exciting, rare, or cutting-edge beer. Hoppy Possum offers just that," said festival director Gavin Andrews. "There'll be beers they have never tasted before and likely never will again. It's something beer lovers want and get excited about."

Gavin is president and co-founder of BrewNET (Brewers of Northeast Tennessee), a homebrew club founded in 2017. Though several club members will compete, others are helping coordinate, recruit new members, and interact with peers from around the region.

Festival organizers are currently accepting applications to compete and serve at the festival. Applications are reviewed in the order they are submitted, and only 75 spots are up for grabs. Applications must be submitted electronically at hoppypossum.com/brewer-app.

General admission tickets start at $35, and VIP tickets, which include the requisite early entry and other perks, start at $60. Ticket prices increase the week before the event.

Visit hoppypossum.com for more information.

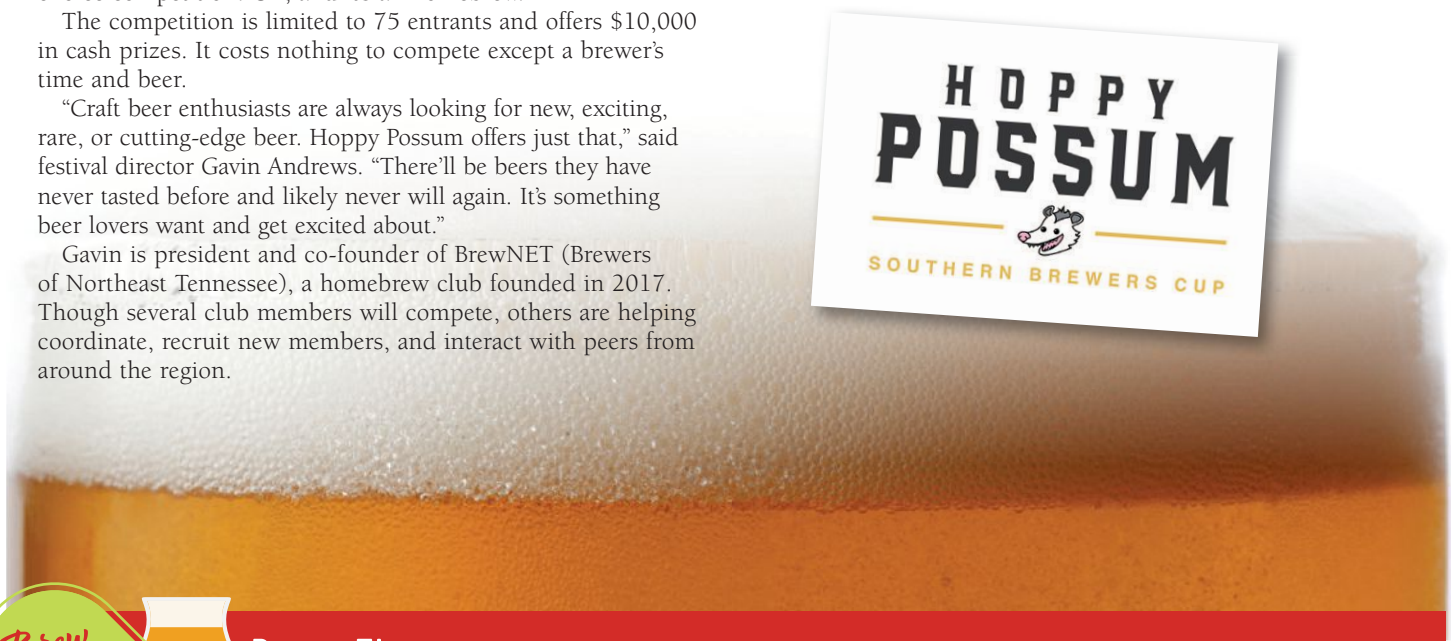


Photo © Getty/mollypix (beer)

Brew This!

Brew This

WE DON'T NEED NO STINKIN' IBUS

No-boil American pale ale
Recipe courtesy Steve Ruch

This no-boil recipe is designed to be dead simple and require only minimal investments of time, equipment, ingredients, and effort. The results, however, are anything but ordinary. With very little bitterness and robust hop character, this easy lager (or ale) is whipped up in no time.

To learn more about the inspiration behind this beer, read Steve Ruch's Last Drop article "Brewin' in a Schoolie" in this issue of *Zymurgy* on page 96.

Batch volume: 2 US gallons (9.1 L)
Original gravity: 1.050 (12.3°P)
Final gravity: 1.012 (3°P)
Color: 7-ish SRM
Bitterness: 0 IBU, at least
Alcohol: 5.1% by volume

MALT EXTRACTS

1 lb. 8 oz. (680 g) pale ale dried malt extract
10 oz. (283 g) golden light dried malt extract
8 oz. (227 g) Munich dried malt extract

HOPS

0.5 oz. (14 g) Simcoe, steep 30 min
0.5 oz. (14 g) Chinook, steep 30 min
0.5 oz. (14 g) Centennial, steep 30 min
0.5 oz. (14 g) German Cascade, dry hop 3 days
0.5 oz. (14 g) Wai-iti, dry hop 3 days
0.5 oz. (14 g) Glacier, dry hop 3 days

YEAST

1 sachet Fermentis Saflager S-189 or your favorite ale yeast

ADDITIONAL ITEMS

2 oz. (57 g) table sugar to prime

BREWING NOTES

Heat 2 qt. (2.3 L) filtered water to near boiling and thoroughly mix in half the malt extract. When the temperature has fallen to approximately 170°F (77°C), add the Simcoe, Chinook, and Centennial hops and steep for 30 minutes.

Remove the hops and thoroughly mix in the remaining malt extract. Add 6 qt. (6.8 L) near-freezing filtered water, pitch yeast, and stash away in the cabinet.

Ferment for 18 days, add the dry hops, and leave for a further 3 days.

Take a gravity reading 21 days after brew day. If the gravity has stabilized at around 1.012 (3°P), go ahead and bottle. Pop one open 3 weeks later and enjoy.

There is no all-grain version of this recipe, as that would defeat the purpose.

Homebrew Goodies

BLICHMANN FERMENTOR JACKET

Blichmann Engineering's new Fermentor Jackets ensure even temperature distributions and promote energy efficiency. Key features include thick, high-performance insulation, a reflective barrier that reduces radiant energy losses and increases thermal efficiency, and an energy-efficient design that can save up to 50% in the energy needed to cool your fermenter. The durable nylon cover is tear resistant, easy to clean, easy to install, and easy to secure with industrial Velcro seams. Blichmann's Fermentor Jackets are available to fit 7-, 14.5-, 27-, and 42-gallon Blichmann Fermenators.

Visit blichmannengineering.com for more information.

BLICHMANN SPUNDING VALVE

Research by Blichmann Engineering and White Labs demonstrates that pressurized fermentation significantly reduces ester and diacetyl production. Blichmann's new Spunding Valve lets homebrewers control pressure with exacting precision to create lager-like beer at room temperature and naturally carbonate it to a desired level.

Blichmann's Spunding Valve is precisely adjustable from 0 to 35 psi (0 to 2.4 bar) and offers excellent pressure stability. Suitable for fermenters up to 42 gallons, it is perfect for Reinheitsgebot-compliant natural carbonation and pressurized transfers. The valves are available in 1/2" NPT and Tri-clamp models, and an integral blow-off barb fitting affords homebrewers the opportunity to connect a tube and observe triumphant fermentation bubbles if they so desire.

Discover more at blichmannengineering.com.

ALPET D2 ORGANIC QUAT-FREE SANITIZER

Do you brew organic? If so, you'll be pleased to learn that the Washington State Department of Agriculture Organic Food Program recently approved Best Sanitizers Inc.'s Alpet D2 Quat-Free Surface Sanitizer for use in organic breweries and food handling areas. A no-rinse, ready-to-use sanitizer, it kills 99.999 percent of eight pathogens in 60 seconds on clean surfaces. In addition to its new organic certification, Alpet D2 is also NSF listed and certified kosher, pareve, and halal.

Alpet D2 Quat-Free Surface Sanitizer is available in 1-quart spray bottles and 5-gallon pails—convenient for most homebrewers—and in larger sizes for commercial operations and particularly enthusiastic hobbyists.

To learn more, visit bestsanitizers.com.

Malt Happenings

CRAFT MALTSTERS GUILD NAMES WINNERS OF INAUGURAL MALT CUP

The Craft Maltsters Guild held its inaugural Malt Cup awards in February and awarded medals to three craft malt houses. From the field of 21 international competitors who entered, Root Shoot Malting (Loveland, Colo.) was awarded first place, while Mainstem Malt (Walla Walla, Wash.) and Carolina Malt House (Cleveland, N.C.) took second and third, respectively. Malts were evaluated for appearance, aroma, flavor, and mouthfeel by a panel of malt industry experts.

"The Malt Cup highlights the importance of creating a product that is not only high quality but also high in flavor," said Jen Blair, executive director of the North American Craft Maltsters Guild and AHA Governing Committee member.

"We are constantly advocating for craft malt because we believe it will create better beers," says Emily Olander, communications director →

Maltsters from Root Shoot Malting, Mainstem Malt, and Carolina Malt House celebrate winning gold, silver, and bronze, respectively, in the first annual Malt Cup awards.

Photo courtesy of Craft Maltsters Guild

→ for Root Shoot Malting. "It helps brewers identify with the local consumer and produce more complex, flavorful beers."

Carolina Malt House cofounder Aaron Goss agrees. "We find that brewers in our area readily recognize the value in their locally brewed beer also being locally grown," he says. "The Malt Cup is important to show that [craft malt] is not just a gimmick or a fad—our industry makes beer this way because it's a better product."

"The Malt Cup is, without a doubt, going to raise the bar for malt quality," adds Phil Neumann, founder and CEO of Mainstem Malt.

All three winners participate in Acres to Ales, a craft beer supply chain program that connects brewers with nearby maltsters to keep malted barley local from grain to glass.

For more, visit craftmalting.com.

Brew This

TROPICALIA CATHARINA SOUR

Recipe courtesy Gordon Strong, brewed in collaboration with Fabito Koerich Ramos of Armada, Floripa, Brazil

Batch volume: 5 US gallons (20 L)
Original gravity: 1.045 (11.2°P)
Final gravity: 1.007 (1.8°P)
Color: 3 SRM
Bitterness: 5 IBU
Alcohol: 5% by volume

MALTS

4.5 lb. (2.04 kg) Pilsner malt
4.5 lb. (2.04 kg) wheat malt

HOPS

0.1 oz. (3 g) Magnum, 12K% a.a. @ 60 min (second boil)

YEAST & BACTERIA

Lactobacillus plantarum or *Lactobacillus casei* (kettle souring)
Fermentis Safale US-05 (primary fermentation)

ADDITIONAL ITEMS

5.5 lb. (2.5 kg) mango, secondary
3.25 lb. (1.5 kg) passion fruit, secondary

BREWING NOTES

Mash at 147°F (64°C) for 90 minutes, adjusting pH to 5.2 with lactic acid if needed. Latuer, sparge, collect wort, and boil 15 minutes without hops.

Cool wort to 95°F (35°C) and adjust pH to less than 4.5 with lactic acid if needed. Pitch *L. plantarum* or *L. casei* and allow to sour for 18 to 48 hours or until pH stabilizes at a value of 3.1 to 3.3.

Boil soured wort for 60 minutes, adding hops at the beginning of the boil. Chill wort to 66°F (19°C), pitch US-05 yeast, and ferment to completion.

After primary fermentation, add the mango and passion fruit. Wait one week and then cold crash and carbonate to 3 vol. (6 g/L) of CO_2.

EXTRACT VERSION

Replace the malts with 3 lb. (1.36 kg) each of Pilsner and wheat liquid malt extracts. Fully dissolve extracts in hot reverse osmosis water, bring to the initial 15-minute boil, and proceed as above.

Brew Over

In the May/June 2019 issue of *Zymurgy*, the Winners Circle recipe for Probably the Best Beer in the…House incorrectly lists the first-wort and flameout additions of Mt. Hood hops as 3 oz. (85 g) and 0.75 oz. (21 g), respectively. These additions should have been the other way around. The correct hop schedule is 0.75 oz. (21 g) first wort hops (15 IBU) and 3 oz. (85 g) at flameout (5 IBU).

ON THE WEB

The Arkansas State Legislature recently passed new legislation amending the definition of homebrewed beer and authorizing homebrewers to transport it for personal or family use. Arkansas now defines homebrew as homemade beer, containing at least 0.5% ABV, brewed for consumption but not for sale. The Arkansas Code was also amended to allow removal of homebrew from the household for personal or family use, including exhibitions, competitions, and tastings.

Read the full story at HomebrewersAssociation.org.

The Art of Homebrewing

AN INTERVIEW WITH ILLUSTRATOR VICTOR BEUREN

Santa Catarina is a state in southern Brazil. *Zymurgy* readers might be familiar with it as the home of Catharina sour, a light, refreshing sour fruit ale. In fact, the recipe on page 11, Tropicalia, is Gordon Strong's signature example of the style.

Victor Beuren, who created the cover art for this issue of *Zymurgy*, also calls Santa Catarina home. A homebrewer and freelance illustrator, he proudly proclaims Santa Catarina "the state with the most beautiful beaches." As one might expect from a region strongly influenced by German immigrants—Victor's surname, Beuren, has Teutonic origins—Santa Catarina also enjoys a lively beer culture. We asked Victor to tell us more about his art and his approach to brewing.

Zymurgy: How did you become an illustrator?
Victor Beuren: I wish I could say that I've drawn since I can remember, but that's not true. I come from the advertising industry. As an art director, my role was to hire and direct illustrators from all over the world. I started to make quick drawings in my free time, just for fun. In 2009, I felt confident enough to call myself an illustrator, and it started taking more and more of my time. In 2014, I became a full-time illustrator working with clients from around the world.

Z: What is the inspiration for your craft?
VB: My main inspiration is a short word: fun! Everything related to pure fun: beer, video games, my family, the beach. If it makes you smile, it will be in my illustrations.

Z: What is your connection to homebrewing and craft beer?
VB: Craft beer and homebrewing are relatively new in Brazil, not more than a decade old. Today I drink more beer than I make, but I study a lot and put passion into it. I don't intend to brew commercially, but if I make a great recipe one day, why not?

Some friends asked me to make a label for their beer. It was a great opportunity to mix my two passions: beer and illustration. So, I experimented with painting the label with beer. The beer had to be thick and dark so that the color would appear on paper. A Pilsner or pale ale wouldn't work, so I painted with a Russian imperial stout. It was interesting to see the illustration evolve as I put layer after layer on the paper. Hope I can make another label like that someday.

Z: How long have you been homebrewing?
VB: I started homebrewing with some friends four years ago, making some IPAs, just for fun. They wanted to brew commercially, but that wasn't my intention, so I separated from the group. Two years ago, I began making my own, just for me and friends. I'm still buying equipment, and I can't say that I've made a perfect beer. But I'm experimenting and getting there.

Z: What is your favorite beer style or favorite beer to brew?
VB: I love American pale ales and IPAs. The fresh hop aromas and flavors really inspire me.

Z: Did you include any Easter eggs or curious details in your cover illustration?
VB: Yes! In this kind of detailed illustration, I like to put my life on it. You can see my family, my dog, and my friends. When I met my wife, I had to catch up as she was a way better drinker than me. That situation is illustrated near the IPA glass. You can find my friend Nicolas flying with the hop aroma, a guy climbing the pint, and some paratroopers going to the beers. One of them has released his parachute to get there faster!

See more of Victor's work at victorbeuren.com.

ON THE WEB
To learn more about the Catharina Sour beer style, check out Gordon Strong's presentation "The Style Hunter" from the 2018 Homebrew Con in Portland, Ore., available exclusively to AHA members at HomebrewersAssociation.org/seminars.

Photos courtesy of Victor Beuren

THE ARTIST
To learn more about Victor's process in creating the cover illustration including photos and video, visit HomebrewersAssociation.org/ja19.

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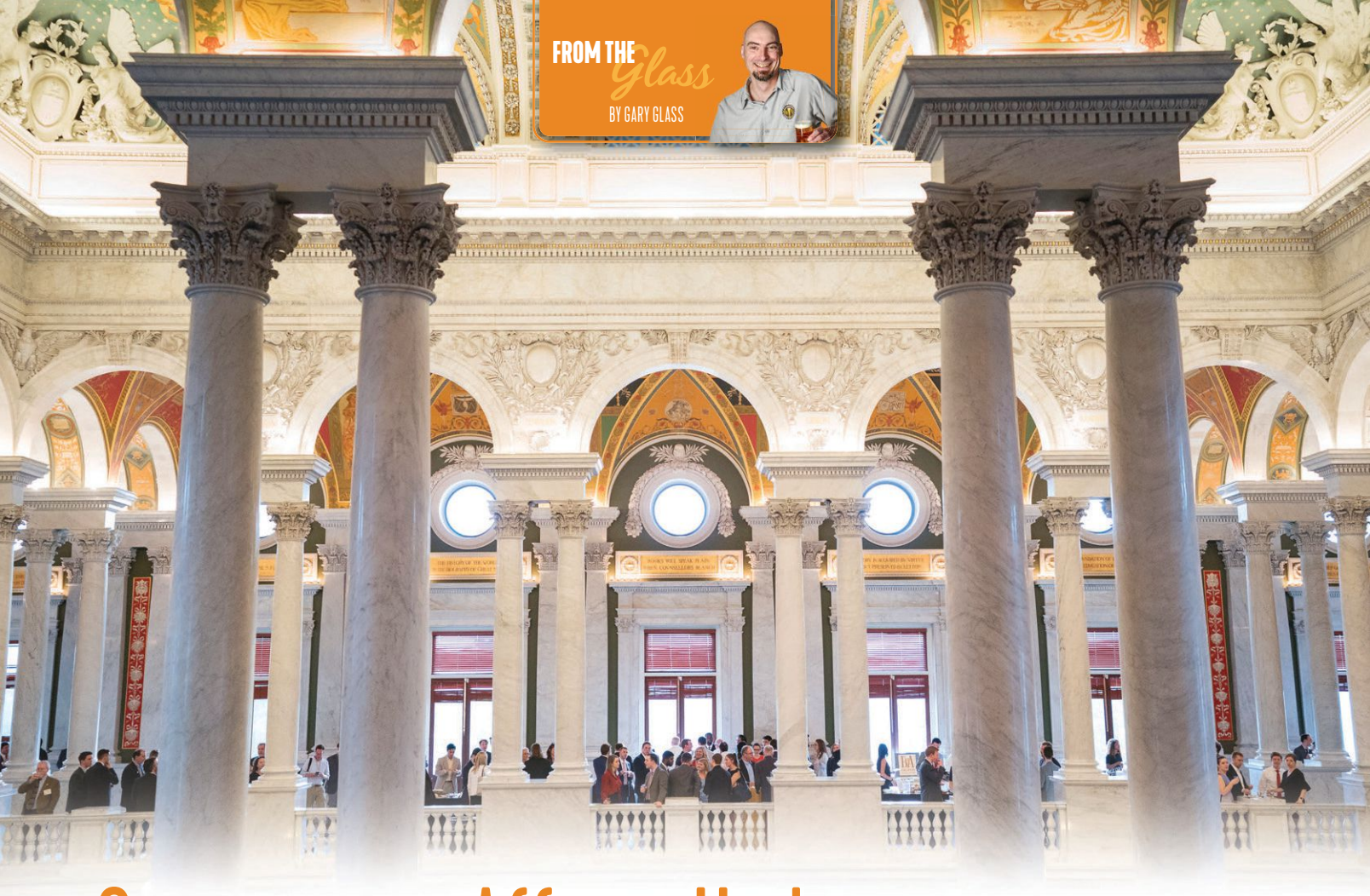

FROM THE *Glass*

BY GARY GLASS

Government Affairs Update

The AHA served a homebrewed saison at the Brewers Association's Capitol Hill Reception on May 16 at the Library of Congress in Washington, D.C.

On May 16, the AHA served a saison, brewed at my house by AHA staff, to members of Congress and their staffs during the Brewers Association's Capitol Hill Reception. Our participation in this event allows the AHA to promote the hobby of homebrewing, the AHA's annual Capitol Hill Staff Homebrew Competition, and the mission of the AHA to federal legislators. (See Saison Capitale recipe on page 18.)

In Arkansas, House Bill 1877 passed the House and Senate. This bill amends the definition of "home-brewed" beer to be in line with the federal definition of beer and authorizes a homebrewer to remove homebrew from the household for personal or family use, as well as for organized affairs, competitions, and tastings. Prior to the bill, the Arkansas Alcohol Beverage Control Agency did not allow homebrew to be removed from the household for these uses.

In Nebraska, homebrewers successfully passed new homebrew legislation (LB 235) to allow for the transportation and service of homebrew at events such as tastings, competitions, exhibitions, and fundraising events that are for nonprofit organizations, as long as it is not sold or offered for sale. Prior to the bill, Nebraska homebrewers were not legally permitted to participate in competitions and fundraising events.

In New York, a bill has been introduced that would amend the alcoholic beverage control law in relation to allowing homebrew supply shops to sell beer for off-premises consumption. The changes would add a definition of what constitutes a "brewery supply store" and include "brewery supply store" in the list of retail establishments eligible to apply for a license to sell beer for off-premises consumption.

A NEW BREW GURU

Early in 2019, the AHA began work on a new version of the Brew Guru app. We launched a preliminary Apple version of Brew Guru 3.0 just prior to publishing this issue of *Zymurgy* to address incompatibilities between the most recent iOS update and Brew Guru 2.0. The full 3.0 release will arrive later this summer for both Apple and Android users. While functionality will be similar to that of the previous version, Brew Guru 3.0 is built on a new platform that provides a better user experience with faster load times and a more native look and feel. Best of all, Brew Guru 3.0 brings

BREW GURU®

back the AHA Member Deal proximity notifications that were in the original version of the app, ensuring members don't miss out on chances to save money!

If you aren't familiar with Brew Guru, this app is available for free download from the Apple and Google app stores. It provides access to your digital AHA membership card; displays a map of all the breweries, beer bars, and homebrew supply shops in our database; highlights nearby AHA Member Deals; contains a database of AHA homebrew recipes (including National Homebrew Competition medal winners, brewery clone recipes, and recipes found in *Zymurgy* magazine); and keeps you updated with news from the AHA.

Members can use Brew Guru to nominate businesses that don't currently offer AHA Member Deals. This function is the top source of new Member Deals leads for AHA staff, so you can help us offer new deals in your area by using Brew Guru.

Brew Guru also provides nonmembers a taste of what the AHA has to offer. After downloading the app, nonmembers can start a 30-day, no-obligation AHA trial membership that includes all the digital benefits of AHA membership except event registration. Thus, Brew Guru is an excellent way to introduce friends to the AHA.

BIG BREW RESULTS

May 4 marked the 21st annual AHA Big Brew event, which celebrates National Homebrew Day. This year's Big Brew saw 3,593 homebrewers at 279 sites, located in 8 countries, brew 9,118 gallons (34,515 liters) of homebrew. Thanks to all the participating homebrewers who made Big Brew 2019 a worldwide success!

MEAD DAY

Next up: Mead Day. Every year on the first Saturday in August, the AHA pays homage to what is probably the original fermented beverage, mead. Join the fun on August 2 by mixing water, honey, and yeast to make a batch of mead. This year's recipe, Prairie Rose Meadery Vanilla Cinnamon Mead, comes courtesy of former AHA Governing Committee member Susan Ruud, founder of Prairie Rose Meadery in Fargo, N.D. Susan is an outstanding meadmaker, so I am eager to try out this recipe. It's available now under Mead Day in the Events section of HomebrewersAssociation.org.

HOMEBREW CON 2020

I hope to see you in Providence, R.I., as Homebrew Con™ 2019 gets underway just a few days after this issue of *Zymurgy* goes live. Whether or not you attend, plan to take advantage of the educational sessions that take place during the conference, as we post recordings of the sessions for all members to enjoy a few weeks after Homebrew Con concludes.

Look for additional coverage of Homebrew Con 2019 in the Sept/Oct issue of *Zymurgy*.

Photos © Getty/Kovaleva_Ka (honey); Getty/benedek (Nashville)

For now, let's look ahead to what 2020 has in store for Homebrew Con. Next year, we head to Nashville, Tenn. Tennessee has a vibrant homebrewing community, and Nashville has a particularly awesome craft beer scene. Obviously, Nashville is known for music, so anyone planning to attend should add a visit to the honky-tonks on Broadway to their to-do list. Nashville is also home to many great restaurants, so expect to eat well.

The Gaylord Opryland, located right next to the Grand Ole Opry, plays host to Homebrew Con 2020. This property can accommodate all the convention space we need, and it has the capacity to house every attendee.

Special thanks go to homebrewer and AHA member Art Whitaker, now a part-time pro brewer at VonSeitz TheoreticAles, who worked hard to get a bill passed by the Tennessee legislature to allow us to bring Homebrew Con to Nashville. Art is also the host of the *Milk the Funk* podcast, which is dedicated to the brewing of funky beers.

Homebrew Con 2020 takes place June 18–20. Get it on your calendar: you won't want to miss this one!

GREAT AMERICAN BEER FESTIVAL

GREAT AMERICAN BEER FESTIVAL MEMBER PRE-SALE

The Great American Beer Festival® (GABF) takes place October 3–5 at the Colorado Convention Center in Denver. While the GABF is now hosted by the AHA's parent organization, the Brewers Association, the original GABF, held in Boulder, Colo., in 1982, was hosted by the American Homebrewers Association.

The event sees 800 breweries from across the USA serve more than 4,000 different

beers to 62,000 attendees over the course of four tasting sessions.

As an AHA member, you are eligible to purchase tickets for general admission and the members-only session during the member pre-sale on July 30. The public ticket sale takes place the following day on July 31. To be eligible for the member pre-sale, you must have a current AHA membership on July 17.

AHA members are also eligible to participate in the GABF Pro-Am Competition. This event allows Brewers Association member breweries to submit entries based on the award-winning recipes of AHA members. Those entries are

judged just like the other beers entered in the GABF competition. Additionally, GABF attendees can sample the GABF Pro-Am entries during the festival at the GABF Pro-Am booth organized by the AHA. It's easily my favorite booth to visit during the festival, as it is a testament to the creativity and skill of AHA members and BA craft brewers alike.

For more information, check out greatamericanbeerfestival.com.

HOMEBREW CLUB INSURANCE

For all you club members out there, here's a reminder that the deadline for annual enrollment in the AHA's homebrew club insurance is September 1. This program offers US-based, AHA-registered homebrew clubs affordable general and liquor liability insurance, as well as a directors and officers insurance option. The AHA works with West's Insurance to provide this coverage. West's general and liquor liability coverage for clubs costs just $3.75 per club member per year.

To make this insurance even more accessible, the AHA will reimburse a club's general and liquor liability insurance coverage premiums if 75 percent or more of the club's members, as reported to West's Insurance, are also AHA members. AHA members can update their club membership status in the AHA database by logging onto HomebrewersAssociation.org and clicking "MY ACCOUNT" at the top of the page.

In the 2018–2019 enrollment period, the AHA reimbursed the insurance premiums for 47 clubs!

The 2019–2020 club insurance enrollment period is open July 1 to September 1, 2019. Don't miss this opportunity to get your club's insurance premium reimbursed while supporting the AHA at the same time. See HomebrewersAssociation.org/community/clubs/homebrew-club-insurance for details.

Until next time, happy brewing!

Gary Glass is director of the American Homebrewers Association.

Brew This!

Saison Capitale

Recipe by Gary Glass

Batch volume: 10.5 US gallons (39.7 L)
Original gravity: 1.057 (14°P)
Final gravity: 0.999 (–0.3°P)
Bitterness: 40 IBU
Color: 4 SRM
Alcohol: 7.7% by volume

MALTS

14 lb. (6.35 kg) Pilsner malt
5 lb. (2.27 kg) Vienna malt
1 lb. (454 g) flaked oats
1 lb. (454 g) flaked wheat

HOPS

1 oz. (28 g) Amarillo, 8.5% a.a. @ 65 min
1 oz. (28 g) Centennial, 9.5% a.a. @ 65 min
1 oz. (28 g) Amarillo, 8.5% a.a., steep/whirlpool 15 min
1 oz. (28 g) Centennial, 9.5% a.a., steep/whirlpool 15 min

OTHER INGREDIENTS

8 oz. (227 g) cane sugar @ knockout
8 oz. (227 g) corn sugar @ knockout
1 oz. (28 g) crushed coriander seed @ knockout
0.35 oz. (10 g) sweet orange peel @ knockout
0.32 oz. (9 g) bitter orange peel @ knockout
0.25 oz. (7 g) crushed peppercorns @ knockout

YEAST

3 sachets Lallemand Belle Saison

WATER

Very low-mineral water, similar to that of Pilsen

BREWING NOTES

Mash at 149°F (65°C) for 1 hour and then raise to 168°F (75.6°C) for a 10-minute mash-out. Boil 75 minutes, adding hops, cane sugar, corn sugar, and spices as indicated. Pitch yeast at 67°F (19.4°C) and ferment 3 days before allowing temperature to free rise to 71°F (21.7°C). Hold 6 days, or until specific gravity falls to 0.999 (–0.3°P). Crash to 50°F (10°C) and age 6 days before bottling or kegging with 3 vol. (6 g/L) CO_2.

PARTIAL-MASH VERSION

Reduce Pilsner malt to 2 lb. (907 g), omit Vienna malt and flaked wheat, and replace the remaining Pilsner malt with 8 lb. (3.6 kg) Pilsner, 4 lb. (1.8 kg) Munich, and 1 lb. (454 g) wheat liquid malt extracts. Mash Pilsner malt and oats 60 minutes at 149°F (65°C). Dissolve extracts completely in wort and top up with reverse osmosis water to desired boil volume. Proceed as above.

Chiller and pump not included.

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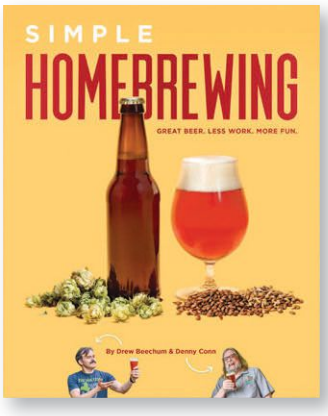

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Aging Makgeolli

***Dear* Zymurgy,**
As luck would have it, I was already planning on making my first makgeolli when Amahl Turczyn's article came out (May/June 2019). When is the makgeolli optimal using your process? I've heard one to two weeks or many months after bottling is generally optimal for single-addition makgeolli. I ask because I want to get the timing right for an event at which I will serve it.

Bottoms up,
Roger Masson
Oak Park, Ill.

***Zymurgy* associate editor Amahl Turczyn responds:** *Hi Roger, so glad you will be making this for a get together! After bottling, one week to one month in the fridge will give you a fuller, sweeter result. After a month in the fridge, it will become tangier. As an experiment, I kept bottles of full-strength, undiluted makgeolli a full three months, and I have to say they really improve with age! I think for my next batch I'm going to keep all of them at least two months before I start drinking and sharing them. I'd err on the side of longer aging if you are making the strong recipe.*

To avoid over-carbonation, I've begun loosening the caps to a partial seal once they reach a good level of carbonation. That way if they further pressurize, the caps will release the excess gas. The carbonation tends to stay in the beverage at fridge temps. It's not an exact method, but it's saved me from having rock-hard bottles that were sure gushers—the ones you pretty much have to open over a large bowl and hope they don't spray down your kitchen.

Hope this helps! I'd be curious to know how your batch comes out.

BREWING CATS AND DOGS

My homebrew supervisor Sylvia enjoys her place atop a warm mash tun on brew days. She advises, "The longer the mash, the better."

Ryan Urban
Rice Lake, Wis.


Sylvia


Sophie

You may have to look closely as my brew dog Sophie matches our Grainfather (and the imperial stout we brewed that day). She is small in stature but big in heart. We'd like to thank you for the time and effort you put into the magazine. We enjoy curling up on the couch and reading it each time it comes in the mail.

Terry J. Cogbill
Cottage Grove, Minn.


Cooper

Here is my brew dog Cooper keeping an eye on things.

Matt DeVries
Jenison, Mich.

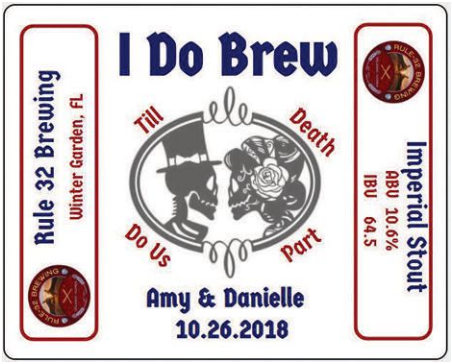
HOMEBREW LABEL SUBMISSIONS

I have homebrewed for three years and have been a member of the AHA for two.

This label was for my daughter's wedding. She and her fiancé wanted something Halloween-themed that wasn't too scary, and their wedding colors are reflected in the design.

The imperial stout must have been good: we went through the entire 5-gallon batch at the reception!

David Moss
Brewers Anonymous
Winter Garden, Fla.



My ancestors are Dutch and I am a private pilot, so The Flying Dutchman just made sense. Plus I like the legend of the ghost ship that is doomed to sail the oceans forever.

My daughter Lauren Perry is a talented architect, calligrapher, and artist. For Christmas, she designed this label in her studio and had it printed for me.

I use it for all of my homebrewed beers, but my favorite beer is my Flying Dutchman IPA. I have been an AHA member for two years and have been homebrewing for three.

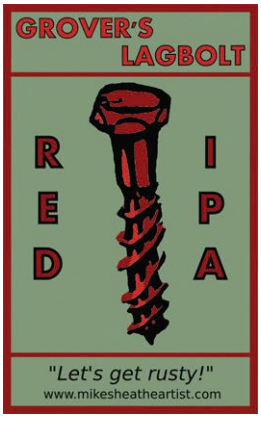
Rob Bogaard
Smithfield, Va.

I've been homebrewing for seven years and an AHA member for two. Grover's Lagbolt is a red IPA, and it is my favorite example of why competition feedback is so valuable. I entered it as an American IPA and lost, but the judge said it was an outstanding red IPA and to switch categories. I did so and took home a second-place medal.

It is named after my brother-in-law, who was the first person to taste this beer for me. His name is not Grover; somebody mistakenly called him that. Coincidentally, I punctured my tire that weekend by running over a large screw on Grover Street.

I am an artist on the weekends, and I base most of my labels on my original artwork. The picture of the bolt itself is from a linoleum block print that I carved. I scanned it, then did the rest digitally with Inkscape.

Mike Shea
North Shore Brewers
Beverly, Mass.



SUBMIT YOUR LABEL

Do you make custom labels for your homebrew? Want it featured here in the pages of *Zymurgy* for all to see your work?

Send them to us at HomebrewersAssociation.org/magazines/submit-bottle-label and we will take it into consideration!

This is my faithful brewing assistant, Mani. He is a four-year-old Australian Shepherd and has been with me for every brew day since I started. He loves to help keep an eye on things, and his reward is a batch of spent-grain dog treats.

Prost!
Daniel Bentley
Brewers of Central Kentucky
Lexington, Ky.

This is O.P., an American Standard Brew Spaniel. He never misses a day of brewing, and his favorite step is getting the foam after hot break!

Jon and Teri Newton
Burien, Wash.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ASK THE AHA

Hops A-Pliny

I'm organizing a group brew for Final Gravity Craft Brewers of Atlanta, and we were planning to use the Pliny the Elder clone recipe on the AHA website.

The recipe calls for 3.5 oz. (99 g) of Columbus/Tomahawk/Zeus (CTZ) hops at the beginning of the 90-minute boil. When put into multiple recipe calculators, this yields a beer with more than 200 IBU. Upon digging further, I found posts on several forums in which people said they brewed the recipe and it was way too bitter. I am wondering if you could verify from the original recipe sent by Vinnie if the quantity is actually 3.5 oz. (99 g) of CTZ or perhaps another number.

Thanks and cheers,
Toby Johnson
Marietta, Ga.

Thanks for the question, Toby. We asked Vinnie Cilurzo at Russian River about it, and here's what he had to say.

There is a huge loss of bitterness from wort knockout to the final beer. This is because yeast cell walls take up a lot of the isomerized alpha acids (and hop oils), which is why the yeast from an IPA tastes so bitter and hoppy. The bitterness for Pliny the Elder at wort knockout is around 120, but the final number is in the high 70s.

Of course, the brewer also needs to closely look at pH, as a lower pH reduces efficiency, and thus there will be lower extract of the hops. This is one of the tricks that a lot of brewers are using these days when making hazy IPAs, and it is a good trick to reduce bitterness. Pliny the Elder uses a good amount of gypsum to accentuate hop bitterness. Further, … to add a little sweetness (and body) to counter the bitterness, … add some calcium chloride.

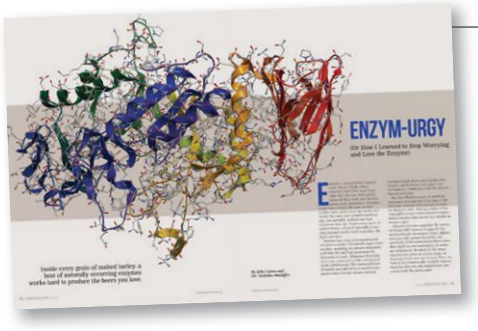

Photo © Getty/Dmytro (hops)

ENZYM-URGY

I thoroughly enjoyed reading "Enzym-urgy" in the March/April 2019 issue of *Zymurgy*. I've been homebrewing since 1978, and ever since I switched to all-grain brewing at the beginning of this century, I've always added amylase enzyme to my mash tun.

You see, I am a "doubting Thomas" who can't accept that there is enough amylase in base malt to complete the enzymatic transformation, so I add a bit of amylase myself. I typically mash in at 140 to 145°F (60–62.8°C) for 3 to 4 hours just to be sure. I haven't found my beers to be thin-bodied and high in alcohol.

But that is not why I'm writing. I thought I remembered reading somewhere that amyloglucosidase becomes deactivated above about 104°F (40°C). That conflicts with the table in the article, which says less than 150°F (66°C) at a pH of 3.5 to 5.5. Could you please confirm the optimum temperature range for amyloglucosidase activity?

Christopher Cape
Chester, N.J.

Nick Madaffer responds: *Thank you so much for your praise of the article! Before answering your question, I have to comment on your mash time of 3 to 4 hours. I recommend you perform an iodine test: this may allow you to confirm that starch conversion is complete much quicker than you think, especially given your use of supplemental amylase.*

To perform an iodine test, pull a small amount of wort and place it on a white plate. Add a drop of iodine tincture, available at drugstores, and check the color. If the iodine remains yellowish-brown, there are few to no starches left for conversion. If it turns dark blue, there's still unconverted starch in the mash.

As for the maximum temperature of amyloglucosidase, the spec sheet for White Labs WLN4100 Ultra-Ferm (a highly concentrated liquid form of the enzyme) says, "It can be added at the beginning of the mash-in. Ultra-Ferm optimal pH is between 3.5 and 5.5. Temperature should not exceed 60°C [140°F]. Amyloglucosidase activity is completely destroyed when the wort is held at 85°C [185°F] for 10 minutes."

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TASTE RESPONSIBLY.

WHAT IS BULK AGING?

I have a question about a recipe on HomebrewersAssociation.org called Gone But Not Forgotten Burton Old Ale (originally printed in the Nov/Dec 2012 issue of *Zymurgy*). The instructions say, "Bulk age as long as you can, up to a year."

What is meant exactly by that? After I've completed primary fermentation and racked the beer off the yeast, could I then just store it in another fermenting bucket for up to a year? Or would there be too much headspace in a bucket? Should I "bulk age" in a carboy with less headspace, similar to a secondary ferment, but for a long period of time?

Thank you for any info you could provide.

Herman Pulcher
Troy, N.Y.

Hey Herman, bulk aging just means a long secondary fermentation, although the word fermentation is a bit of a misnomer: little to no actual fermentation usually happens in secondary unless you add something like sugar, fruit, or another microbe. In most cases, secondary fermentation might better be called conditioning, maturation, or—yes—bulk aging.

No matter what you call it, the best long-term option is a carboy or CO_2-purged keg with as little headspace as possible. Plastic is usually less desirable than glass or stainless because most standard-issue plastic fermentation buckets are semipermeable and can admit small amounts of oxygen over the course of many months or a year. Glass carboys, certain PET carboys, and thick HDPE plastic vessels like FastFerment conicals and Speidel beverage tanks are less permeable. Obviously stainless conicals and kegs are completely impermeable to gas ingress, gaskets, O-rings, and other rubbery, plasticky bits notwithstanding.

Hot, Alcohol, and Solvent Off-Flavors

Fermentation temperature tolerance varies from one yeast strain to the next. Consequently, controlling temperature is one of the most important ways brewers can produce top-quality beer. Because yeast metabolism is exothermic at times during fermentation, which means it produces its own heat, it's easy for fermentation to exceed the recommended temperature range for a given yeast strain, especially in warm climates.

Some strains can take the heat, particularly Belgian and saison strains, which produce desirable beer characteristics even when they reach temperatures of 80°F (26.7°C) or more. Most strains aren't so heat tolerant, though, and the most common result of fermenting warm is increased ester and higher-alcohol (fusel alcohol) production. Both of these can cause hot, solvent-like off-flavors. Esters and fusel alcohols are distinct from ethanol, which, along with carbon dioxide, is usually the desired byproduct of anaerobic respiration during fermentation.

ESTERS

All yeasts create esters as secondary fermentation byproducts, although ale strains are generally more prolific producers than lager yeasts. More than 60 esters are found in beer, the most common of which are ethyl esters. The following short list identifies the most frequently encountered ethyl esters in brewing, including descriptions of the main aromas and flavors associated with them.

Keep in mind that each compound can have different characteristics depending upon a number of factors, including the taster's sensitivity to the compound, its concentration in the beverage, the temperature of the beverage, carbonation level, and so on. Perception thresholds are provided as ranges that roughly bookend the spectrum between very sensitive tasters and tasters who only pick up the compound at higher levels. Perception threshold will also vary with beer style, body, and other qualities.

- **Ethyl acetate** is pleasantly fruity and floral, with pear, apple, and rose notes at low concentrations. Sometimes it can smell like Juicy Fruit gum, and it's part of the expected sensory profile of many English ales. Usually found in beer at concentrations of 5–30 mg/L, it has a perception threshold of 5–10 mg/L. Excessive levels cause solvent flavors.
- **Ethyl butyrate** evokes tropical fruits like pineapple, mango, and papaya. It is often used as an additive in processed orange juice, as most associate its odor with that of fresh orange juice. It works well alongside tropical aroma hops in "juicy" IPA and New England IPA (NEIPA). Ethyl butyrate is common in many Belgian styles, but it can also indicate the possible presence of butyric acid, which can mean sanitation problems. A big part of the "funky" or "dunder-y" Jamaican rum profile, this ester is found in beer at concentrations of 0.05–0.25 mg/L and has a taste threshold of about 0.3 mg/L.
- **Ethyl octanoate** or **ethyl caprylate** (not to be confused with ethyl caprate, which is, well, "goaty") is sweet and fruity and associated with banana, pear, pineapple, and apricot flavors, as well as brandy, port, burgundy, and sometimes soap and wax. The perception threshold is 0.01–1.5 mg/L.
- **Ethyl hexanoate (aka ethyl caproate or ethyl pentanoate)** is sweet and wine-like, with fruity (apple, anise, banana, rose, pineapple) and vinous (rum, sherry, brandy) character. Found in beer at concentrations of 0.07–0.5 mg/L, its threshold is 0.15–0.25 mg/L.

While not part of the ethyl group, two other esters are common enough in beer to warrant mention.

- **Isoamyl acetate**, which tastes like banana, is found in all beer, but its higher concentrations in Bavarian wheat beer makes it a big contributor to that style's flavor profile. It's usually found in beer at concentrations of 0.8–6.6 mg/L and has a perception threshold of about 1.1 mg/L in beer. Excessive concentrations cause solvent flavors.
- **Isobutyl acetate** reminds tasters of papaya or apple. This is another compound found in all beers, but it is especially noticeable in Belgian ales. It's found in beer at concentrations of 0.1–1.2 mg/L and has a perception threshold of 0.5–1.6 mg/L.

But it's not all bananas and roses. Excessive concentrations of any of these esters are a defect in beer, although here again, what constitutes excessive varies with perception. Ester production is increased at high fermentation temperatures and when yeast is stressed.

Harsh, solvent-like flavors occur when ethanol and, to a lesser degree, other alcohols are reduced by oxygen and undergo esterification. That's when you get aromatics and flavors that start to become unpleasant: think paint thinner, nail polish, acetone, glue, turpentine, and other similarly harsh solvents. Wild yeast strains can also produce solvent-like esters, as can other, less common compounds such as ketones and aldehydes.

The most common cause, however, is ethyl acetate in high concentrations. Factors that may put undue stress on yeast and increase ester production include under-pitching, under-oxygenation, free amino acid deficiency, mineral deficiency (e.g. zinc and calcium), excessive trub, prematurely racking off the yeast, and high-gravity fermentation.

Esters have two main precursors: acetyl coenzyme A (aCoA), which yeast normally uses to synthesize lipids for building cell membranes, and alcohol acetyl transferase (AAT). When aCoA isn't needed, it reacts with ethanol to produce ethyl acetate and with isoamyl alcohol to produce isoamyl acetate. Both produce solvent flavors in high concentrations.

There are many things you can do to minimize ester precursors. The main preventive measures are to provide adequate oxygen, pitch a lot of yeast, and exercise careful temperature control. Supplying ample oxygen at pitching causes yeast to take up aCoA and build strong cell wall membranes, which minimizes excess aCoA.

As many of us know firsthand, aging can also decrease ester concentrations. Yeast produces esterase enzymes that break down excess esters in beer. That's one reason you don't want to rack your beer too early. Fermenting under pressure also suppresses yeast growth and, therefore, ester production. Be sure to match the temperature and gravity of your yeast starter to the beer you're pitching into, particularly if adding the entire starter volume.

Typical ester concentrations in beer rarely exceed 60 mg/L in lagers; for ales it's more like 80 mg/L.

FUSEL ALCOHOLS

Most fusel alcohols are created during primary fermentation as byproducts of the metabolism of amino acids and carbohydrates, and it can be difficult to distinguish their harsh, solvent-like flavors from the solvent flavors caused by excessive esters. Each amino acid can be linked to a fusel alcohol, and some amino acids involved are synthesized by yeast.

Fusel alcohols can come off as sweet, vinous, and brandy-like in low concentrations, but higher levels can create burning, numbing, prickly, or peppery sensations and a volatile, fumy alcohol aftertaste. Beer judges sometimes describe this aroma, flavor, and mouthfeel as "hot," a good indication that any accompanying solvent flavors are due to fusel alcohols rather than excessive esters.

Some yeasts, particularly wild strains, produce more fusel alcohols than others. As with esters, fermentation temperature also plays a role, especially in the early stage between pitching and high kräusen. Here, the threshold temperature is only 70°F (21° C) for ales and 55°F (13°C) for lagers. Increased fusel production is also associated with low wort concentrations of free amino nitrogen (FAN) and amino acids, high-gravity wort fermentations (over 13°P or 1.053), metabolism of fatty acids from cold break carried into the fermenter, and re-pitching the same yeast too many times (this can produce 2-phenyl ethanol).

Unlike esters, fusel alcohols are difficult to remove once they've formed. As with esters, a good way to prevent fusel production, besides yeast strain selection and keeping fermentation temperatures low, is adequate oxygenation.

Fusel alcohols can also chemically react with oxoacids to produce esters. Again, here is a list of the most common fusel alcohols, along with detectable flavor characteristics and their threshold ranges. Normally, these higher alcohols are not produced in sufficient quantities to be

detectable in beer—ales should not exceed 100 mg/L, and lagers should not have more than 90 mg/L.

The last three higher alcohols are also referred to as phenols, as they incorporate a phenyl ring (a cyclic group of atoms with the formula C_6H_5).

- **Isobutanol** is an alcohol detectable in beer at 80–100 mg/L.
- **Propanol,** another alcohol, is detectable in beer at 80–100 mg/L.
- **Isoamyl alcohol** is described as fruity or sweet, with notes of bananas, grapes or wine. It's detectable in beer at 30–70 mg/L.
- **Glycerol** is sweet and viscous. It is detectable in beer at 1,300–3,000 mg/L.
- **Tyrosol** is bitter and detectable in beer at 3–40 mg/L.
- **2-phenylethanol** comes off as roses or perfume. High concentrations can cause bitterness. It's detectable in beer at 8–35 mg/L.
- **4-vinyl guaiacol** is classic clove. This one is common in Bavarian wheat beers and Belgian-style beers and detectable in beer at 0.05–0.55 mg/L

These alcohols are not just harsh to drink, but consuming them can cause headaches and hangovers.

ETHANOL

Ethanol is what we want yeast to produce, and its presence should not be confused with solvent character. Even in barleywines and imperial stouts, ethanol should be perceived as warming and drying, not as hot, bitter, fumy fusel alcohol or the sharp mineral spirits and acetone of excessive esters.

A good way to experience this is to do a side-by-side comparison of *ginjo* sake with *honjozo* sake. The *honjozo* has been fortified with pure grain ethanol, which affects its flavor, texture, mouthfeel, and aftertaste.

Ethanol has little aroma or flavor of its own, but it adds a sensation of volatility and dryness, lightens body and mouthfeel, and brings a warming glow to the aftertaste. It may also give visual clues to its presence by forming "legs" in a glass, particularly at concentrations of 10 percent or more by volume. Ethanol has a very high flavor threshold of 14,000 mg/L (or 14 g/L).

RESOURCES

1. Barnes, Thomas. "The Complete Beer Fault Guide v. 1.4," 2011-2013.
2. Bickham, Scott. "Flavors from Esters and Alcohols," *Brewing Techniques,* Vol 7, No. 3.

***Amahl Turczyn is associate editor of* Zymurgy.**

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17TH ANNUAL
BEST BEERS
IN AMERICA

OLD SCHOOL *IS STILL COOL*

BY JILL REDDING
WITH RECIPES BY AMAHL TURCZYN

Not so fast, hazy IPAs, pastry stouts, brut IPAs, and modern gose interpretations. New-school beers might be getting all the hype these days in the craft brewing world, but old-school brews are still at the top of their class.

Classic IPAs and pale ales that have been around the block a few times are still beloved and revered by craft beer drinkers. Need proof? Look no further than *Zymurgy*'s 17th annual Best Beers in America survey, where three stalwarts—Bell's Two Hearted Ale, Russian River Pliny the Elder, and Sierra Nevada Pale Ale—were voted the top three beers in America by members of the American Homebrewers Association.

AHA members were able to vote for up to five of their favorite commercial beers available for purchase in the United States—a daunting exercise, considering the mind-boggling, constantly expanding offerings currently available from more than 7,400 breweries nationwide.

"Just an enormous amount of amazing beers to choose from," commented AHA member Jeff Grubbs of Fresno, Calif. "Makes me feel blessed to have a difficult time picking just five!"

"What a great time to be a beer dork," proclaimed Hans Muecke of San Marcos, Calif. "It seems like every time I stop in the store, there's another new and exciting beer that inspires creativity in my own brewing."

AHA member David Comins of Chelmsford, Mass., might have been gazing into his crystal ball when he commented, "I hope whatever gets chosen doesn't fall into the hot trend of the moment. I will be happy when the NE IPA trend fades—and I live in New England!"

MR. CONSISTENT

Two years ago, Bell's Two Hearted Ale overtook Pliny the Elder for the top spot in the poll, ending Pliny's eight-year reign. Bell's iconic American IPA showcases Centennial hops, having gotten its start in 1993 as a homebrewed "super IPA" by a Bell's employee. The rest, as they say, is history.

AHA members love Two Hearted not just for its flavor and drinkability, but also for its consistency.

#1
BELL'S
TWO HEARTED ALE

#2
RUSSIAN RIVER
PLINY THE ELDER

#3
SIERRA NEVADA
PALE ALE

#4
FOUNDERS
KBS
(KENTUCKY
BREAKFAST STOUT)

#5
THE ALCHEMIST
HEADY TOPPER

#6
FOUNDERS
CBS
(CANADIAN
BREAKFAST STOUT)

TOP-RANKED BEERS

(T indicates Tie)

1.	Bell's *Two Hearted Ale**
2.	Russian River *Pliny the Elder**
3.	Sierra Nevada *Pale Ale**
4.	Founders *KBS (Kentucky Breakfast Stout)*
5.	The Alchemist *Heady Topper**
6.	Founders *Canadian Breakfast Stout (CBS)*
T7.	Founders *All Day IPA*
T7.	Bell's *Hopslam**
T9.	Founders *Breakfast Stout*
T9.	WeldWerks *Juicy Bits**
11.	Cigar City *Jai Alai IPA**
T12.	Tree House *Julius**
T12.	Three Floyds *Zombie Dust**
14.	Left Hand *Milk Stout Nitro**
15.	Deschutes *Fresh Squeezed IPA**
T16.	Sierra Nevada *Celebration Ale**
T16.	New Holland *Dragon's Milk**
T18.	Lawson's Finest Liquids *Sip of Sunshine**
T18.	Boulevard *Tank 7 Farmhouse Ale**
20.	Goose Island *Bourbon County Brand Stout*
T21.	Allagash *White**
T21.	The Alchemist *Focal Banger**
23.	North Coast *Old Rasputin**
T24.	Odell *IPA**
T24.	Russian *River Blind Pig I.P.A.**

* The independent craft brewer seal is your assurance that the beer you're holding was crafted by an independent brewery.

"Consistently phenomenal," commented Ross O'Neill of Warrenville, Ill.

"Simply a straight up, incredible, traditional IPA," wrote Thomas Flannagan of Danvers, Mass. "Everything about this beer is great: the smell, carbonation, mouthfeel, taste, aftertaste (a good thing), and alcohol content. I can smell it as I write this."

"Nothing disappoints me more than when a craft brew changes over time," commented Bill Lammers of Cedar Rapids, Iowa. "Bell's Two Hearted has been a delicious, consistent IPA that has never disappointed. The gold standard when it comes to balanced American IPAs."

"Extremely consistent," commented Dakota VandenToorn of Grand Rapids, Mich. "It stands the test of time through all the fads."

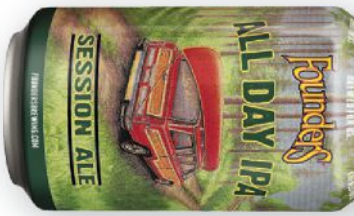
Noticing a trend here? Consistency is paramount for Bell's, according to director of operations John Mallett.

"We want to make great beer all the time, not just sometimes," said Mallett. In addition to fastidious raw materials selection, ironclad standard operating procedures, and rigorous staff training, Mallett said much attention is placed on packaging when it comes to consistency.

"As unsexy as packaging might be to some, it is the place where we absolutely influence the finished beer quality that the beer drinker experiences," Mallett said. "Meticulous packaging quality is an essential 'ingredient' in our beers."

Getting hop-forward beers like Two Hearted to consumers in optimal condition requires a team effort. "Working with a knowledgeable and passionate team that understands how everyone contributes to the goal of getting fresh beer to our fans is inspiring," said Mallett.

#7T
FOUNDERS
ALL DAY IPA



#7T
BELL'S
HOPSLAM

#9T
FOUNDERS
BREAKFAST STOUT

#9T
WELDWERKS
JUICY BITS

PLINY THE ELDER

Speaking of consistent, Pliny the Elder, a double IPA produced by Russian River Brewing, based in Santa Rosa and its new facility in Windsor, Calif., has achieved cult-like status since it was first produced in 2000, and that adoration shows no signs of slowing down. Pliny the Elder is brewed with Amarillo, Centennial, CTZ, and Simcoe hops, and is 8 percent ABV.

"A classic DIPA that never gets old," described Thomas Timkanic of Walnut Creek, Calif. "The quality and character have remained the same, even with the massive new facility in Windsor."

"At the original pub on 4th Street in Santa Rosa, this IPA still has character like no other double IPA," believes Carlo Camarda of Sonoma, Calif. "Soft, quiet depth of malt with a classic West Coast hop aroma and flavor never duplicated. Still the best there is."

THE ONE THAT STARTED IT ALL

As every craft beer lover knows, Sierra Nevada Pale Ale, which debuted in 1980, played a significant role in launching the craft brewing movement. And while the brewery has stayed innovative with offerings such as Hazy Little Thing and Sierraveza, its flagship Pale Ale has stood the test of time. A consistent top-15 beer since *Zymurgy*'s poll started in 2003 (it was ranked number one that year and again in 2004), Sierra Nevada Pale Ale enjoys its highest finish this year since tying for second with Arrogant Bastard in 2006.

"The epitomy of pale ale," summed up Michael Hoban of South Bend, Ind. "The beer that put Sierra Nevada on the map. A perfect showcase of Cascade hops."

"A true classic," commented Steve Ruch of Crescent City, Calif.

Sierra Nevada is beloved not just by fans, but by its fellow craft brewers as well. When the brewery put out a call for assistance with its Camp Fire Fund—raising money for the most devastating fire in California history, which came dangerously close to the brewery and greatly impacted brewery employees and customers—founder Ken Grossman thought "maybe 200" breweries would join in to brew Resilience Butte County Proud IPA. Instead, more than 1,400 did.

Resilience IPA received several votes in the poll as well.

"Ya know, after being hit over the head with hazy IPA this last year or two, this [Resilience] was a super refreshing return to what IPA was when I first started drinking it," commented Jesse Gutierrez of Portland, Ore. "Not only is the cause great, but the beer is damn good, too."

Steve Wieland of Willow Grove, Pa., called Resilience a "great, balanced IPA with a great message to get the support of a nation!"

THE REST OF THE BEST

The rest of the top 10 beers were *almost* the same as last year—with one substitution and a bit of rearranging. Finishing fourth was Heady Topper, a double IPA from The Alchemist in Vermont, described by Darren Buford of Wheat Ridge, Colo. as "the most complex beer in the United States."

Founders Brewing Company in Grand Rapids, Mich., placed a whopping four beers in the top 10, including three versions of its popular Breakfast Stout as well as All Day IPA, a session India pale ale.

Bell's Hopslam also finished in the top 10, tying for seventh with All Day IPA.

Juicy Bits, a hazy IPA brewed by WeldWerks Brewing in Greeley, Colo., once again squeezed into the top 10, tying for 9th with Founders Breakfast Stout.

TOP BREWERY

For the third straight year, Bell's Brewery, based in Comstock, Mich., garnered the top spot among its peers. Founders, which is partially owned by Spanish brewer Mahou San Miguel, finished in second place and Russian River was third.

While Bell's continues to brew its beloved brands such as Two Hearted and Hopslam, the brewery is also staying innovative with offerings such as Official, a recently released hazy IPA that joined the year-round lineup.

Last summer, the brewery commissioned two pilot brewing systems: a 3-barrel system at its pub in Kalamazoo, and a 12-barrel automated and scaled version of the main brewhouses at the production facility in Comstock.

"With these new tools, we have expanded our playful pilot brewing program," said Mallett. "The team headed by Andy Farrell has been busy making a large variety of beers. The Leaves of Grass series, celebrating the life and work of poet Walt Whitman, originates from the ever-fertile imagination of Larry Bell and is being developed by Andy's team."

Mallett and the team at Bell's are homebrewers at heart. "We are just so grateful

Brew This!

zymurgy BEST BEERS IN AMERICA

Cigar City Jai Alai IPA Classic Clone

Recipe by Amahl Turczyn with updates from Cigar City brewmaster Wayne Wambles

Cigar City brewmaster Wayne Wambles deemed this recipe "pretty close to classic Jai Alai circa 2009–2010." He made a few suggestions to bring this recipe closer to the original, including use of the Thames Valley ale yeast strain, Munich malt in the 6–10˚L range, and an updated water profile that "pushes the sulfate up to 150 ppm and the chloride up to 125 ppm. This will jack up the calcium, but we find that quite a bit of it precipitates out." Many thanks, Wayne!

Batch volume:	5.5 US gallons (20.8 L)	**Color:**	10 SRM
Original gravity:	1.074 (18˚P)	**Alcohol:**	7.5% by volume
Final gravity:	1.020 (3.3˚P)	**Efficiency:**	75%
Bitterness:	70 IBU		

MALTS

13.25 lb.	(6.01 kg) pale two-row malt	12 oz.	(340 g) 60˚L caramel malt
12 oz.	(340 g) 6–10˚L Munich malt	4 oz.	(113 g) 25˚L Victory malt

HOPS

0.5 oz.	(14 g) Ahtanum, 6% a.a., FWH @ 60 min. (9 IBU)	0.5 oz.	(14 g) Centennial, 10% a.a. @ 15 min. (7 IBU)
0.5 oz.	(14 g) CTZ, 14% a.a., FWH @ 60 min. (22 IBU)	0.5 oz.	(14 g) Cascade, 5.5% a.a. @ 15 min. (4 IBU)
0.5 oz.	(14 g) Ahtanum, 6% a.a. @ 60 min. (8 IBU)	0.5 oz.	(14 g) CTZ, 14% a.a. @ 15 min. (10 IBU)
0.25 oz.	(7g) CTZ, 14% a.a. @ 60 min. (10 IBU)	0.5 oz.	(14 g) Ahtanum, 6% a.a. @ 5 min. (2 IBU)
0.5 oz.	(14 g) Amarillo, 8.5% a.a. @ 60 min. (12 IBU)	0.5 oz.	(14 g) Cascade, 5.5% a.a. @ 5 min. (2 IBU)
		0.5 oz.	(14 g) Amarillo, 8.5% a.a. @ 5 min. (2 IBU)
		2 oz.	(28 g) Simcoe, 13% a.a., dry hop 14 days

OTHER INGREDIENTS

1 tablet Whirlfloc @ 10 min

YEAST

Wyeast 1275 Thames Valley Ale Yeast, 2L stir plate starter

WATER

Ca 100 ppm, Mg <10 ppm, SO_4 150 ppm, Na <10 ppm, Cl 125 ppm, HCO_3 23 ppm

BREWING NOTES

Mash at 150˚F (66˚C) for one hour. Boil 60 minutes, adding kettle hops as indicated. Pitch yeast starter at 65˚F (18˚C) and ferment for 7 days. Dry hop at 65˚F (18˚C) and lower the fermentation temperature slowly, about 2˚F (1˚C) each day, over the next 14 days until it reaches 34˚F (1˚C). Cold condition 10 days at 34˚F (1˚C), then carbonate and package.

EXTRACT VERSION

Substitute 10.25 lb. (4.65 kg) pale malt extract syrup for pale malt and 0.75 lb. (340 g) Munich malt extract syrup for Munich malt. Omit water salts and Victory malt. Steep crystal malt at 160˚F (71˚C) in reverse osmosis water 30 min. Remove grain, dissolve extracts completely in the wort, then top off with reverse osmosis water to desired boil volume.

LOOK WHAT JUST CAME ASHORE...

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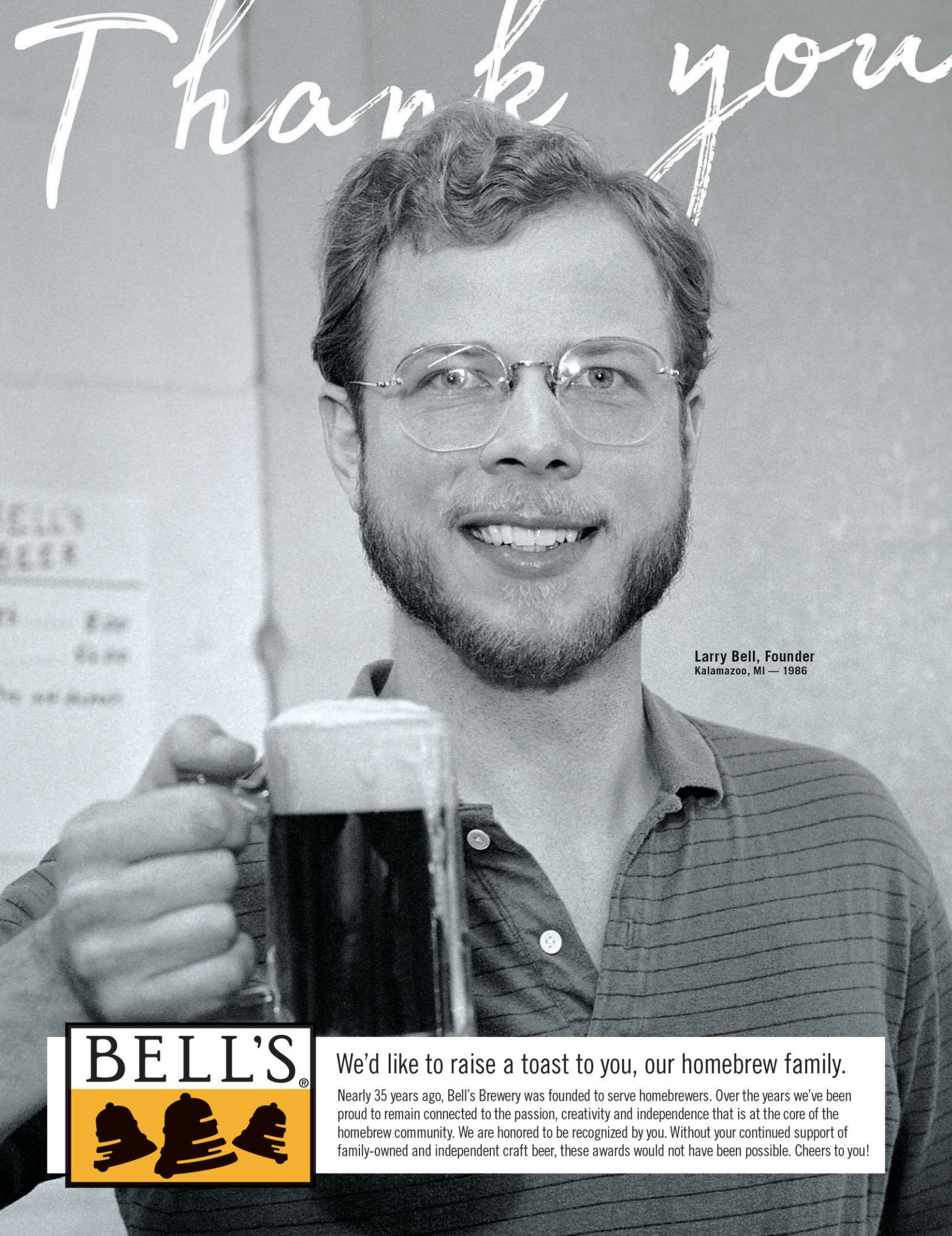


We'd like to raise a toast to you, our homebrew family.

Nearly 35 years ago, Bell's Brewery was founded to serve homebrewers. Over the years we've been proud to remain connected to the passion, creativity and independence that is at the core of the homebrew community. We are honored to be recognized by you. Without your continued support of family-owned and independent craft beer, these awards would not have been possible. Cheers to you!

for the kind love that beer fans show for the beer and brewery," said Mallett when he found out the news of this year's poll. "I will smile and have a Two Hearted at our pub on the way home."

LIFE PARTNERS

Many of us experience life's greatest pleasures—from a relaxing brunch to an epic hike—with a delicious craft beer in hand, and this year's group is no exception. Here's a sampling of some of the best beers for those moments.

Georgetown Bodhizafa IPA: "This beer is summer, fishing, blue water, clear skies, and joy in a can!" (John Kent, Danville, Va.)

Coronado North Island: "I tried this beer for the first time on the beach in San Diego and the aroma rocked my socks off!" (Vincent Alger, Westerville, Ohio)

Deschutes Fresh Squeezed: "I drank Fresh Squeezed for the first time after hiking 88 miles on the John Muir Trail. It was and is delicious." (Damon Penny, Biloxi, Miss.)

Omni FAD: "This is an incredible brunch beer. It has a great, deep, orange hue and drinks like a mimosa made from barley and hops—yum!" (Dustin Haug, St. Paul, Minn.)

Central State Garden Gose: "Summer would be incomplete without a super refreshing and funky Garden Gose." (Rev. Matthew Miller, Plymouth, Ind.)

North Coast Old Stock Ale: "The best campfire and sunset companion on Earth." (Ken Tyhurst, Ripon, Calif.)

Sierra Nevada Celebration Ale: "I look forward to the winter holidays every year so I can enjoy this great ale." (Gary Baxley, Louisville, Colo.)

Alesmith San Diego Pale Ale .394: "Whether you're enjoying the San Diego weather, working in the yard, or relaxing by the pool, this hop-forward home-run of a beer is perfect for your day and evening activities." (James Gallant, San Diego, Calif.)

Elevation False Summit: "One of the best quads on the planet. It's always our dessert beer after a night out." (Forrest Roe, Buena Vista, Colo.)

Bell's Oberon: "It is sunshine in a glass. After a long winter, it speaks to summer evenings." (James Schultze, Rapid City, S.D.)

Photo © Bell's Brewery, Inc.

TOP BREWERIES

(T indicates Tie)

1.	Bell's Brewery, *Comstock, Mich.**
2.	Founders Brewing Company, *Grand Rapids, Mich.*
3.	Russian River Brewing Company, *Santa Rosa and Windsor, Calif.**
4.	Sierra Nevada Brewing Company, *Chico, Calif. and Mills River, N.C.**
5.	Dogfish Head Craft Brewery, *Milton, Del.**
6.	Tree House Brewing Company, *Charlton, Mass.**
7.	The Alchemist, *Stowe, Vt.**
T8.	Deschutes Brewery, *Bend, Ore.**
T8.	Odell Brewing Company, *Fort Collins, Colo.**
T10.	Firestone Walker Brewing Company, *Paso Robles, Calif.**
T10.	Stone Brewing, *Escondido, Calif.**
T12.	Boulevard Brewing Company, *Kansas City, Mo.**
T12.	Cigar City Brewing, *Tampa, Fla.**
T12.	WeldWerks Brewing Co., *Greeley, Colo.**
15.	New Glarus Brewing Company, *New Glarus, Wis.**
16.	New Belgium Brewing, *Fort Collins, Colo. and Asheville, N.C.**
17.	Three Floyds Brewing Company, *Munster, Ind.**
T18.	Lagunitas Brewing Company, *Petaluma, Calif. and Chicago, Ill.*
T18.	Oskar Blues Brewery, *Longmont, Colo., Brevard, N.C., and Austin, Texas**
20.	Tröegs Independent Brewing, *Hershey, Pa. **
21.	Avery Brewing Company, *Boulder, Colo.*
22.	Allagash Brewing Company, *Portland, Maine**
23.	Left Hand Brewing Company, *Longmont, Colo.**
T24.	Goose Island Beer Company, *Chicago, Ill.*
T24.	New Holland Brewing Company, *Holland, Mich.**
T24.	Surly Brewing Company, *Minneapolis, Minn.**

* The independent craft brewer seal is your assurance that the beer you're holding was crafted by an independent brewery.

Brew This!

Brew This!

Left Hand Milk Stout Clone

Recipe by Amahl Turczyn. This recipe first appeared in *Zymurgy* Jul/Aug 2009.

Batch volume: 5 US gallons (18.9 L)
Original gravity: 1.068 (16.5°P)
Final gravity: 1.016 (4°P)
Bitterness: 19 IBU
Color: 41 SRM
Alcohol: 7% by volume

MALTS

7 lb. (3.18 kg) pale malt
1 lb. (454 g) roasted barley
1 lb. (454 g) lactose (15 min.)
12 oz. (340 g) 60°L crystal malt
12 oz. (340 g) Munich malt
12 oz. (340 g) chocolate malt
8 oz. (227 g) flaked barley
8 oz. (227 g) flaked oats

HOPS

0.3 oz. (8.5 g) Magnum, 13% a.a. @ 60 min
1 oz. (28 g) East Kent Goldings, 5% a.a. @ 10 min

YEAST

California/Chico ale yeast

BREWING NOTES

Mash at 151°F (66°C) for 60 minutes. Boil for 90 minutes, adding hops. Add lactose 15 minutes before end of boil. Ferment at 70°F (21°C), then condition at 60°F (16°C) for at least one week.

PARTIAL MASH

Replace pale malt with 3.85 lb. (1.74 kg) light malt extract syrup plus 2 lb. (907 g) pale two-row malt for the mini-mash. Crush specialty grains and pale malt and mash with flaked barley, oats, and 2 gal. (7.6 L) brewing water. Hold mash at 151°F (66°C) for 60 minutes or until conversion is complete. Sparge, run clear wort into kettle, dissolve extract, top up kettle to 5.5 gal. (20.8 L), and proceed with boil as above.

Three Floyds Brewing Zombie Dust IPA Clone

Recipe by Amahl Turczyn

Batch volume: 5.5 US gallons (20.8 L)
Original gravity: 1.066 (12.5°P)
Final gravity: 1.019 (4.8°P)
Bitterness: 77 IBU
Color: 8 SRM
Alcohol: 6.2% by volume
Efficiency: 72%

MALTS

11.5 lb. (5.22 kg) pale two-row malt
1 lb. (454 g) 10°L Munich malt
8 oz. (227 g) melanoidin malt
8 oz. (227 g) Carafoam
8 oz. (227 g) 60°L crystal malt

HOPS

0.75 oz. (21 g) Citra, 12% a.a., FWH @ 60 min
1.25 oz. (35 g) Citra, 12% a.a. @ 15 min
1.25 oz. (35 g) Citra, 12% a.a. @ 10 min
1.25 oz. (35 g) Citra, 12% a.a. @ 5 min
1.25 oz. (35 g) Citra, 12% a.a. @ 1 min
3 oz. (85 g) Citra, 12% a.a., dry hop 7 days

YEAST

Fermentis SafAle S-04 English Ale Yeast

WATER

2 g/gal. gypsum added to reverse osmosis (RO) water.

BREWING NOTES

Mash at 155°F (68°C) for 1 hour. Pitch yeast at 62°F (17°C) and allow to rise to 67°F (19°C) over 7 days. Ferment at 67°F (19°C) to terminal gravity. Crash to 42°F (6°C) and hold 10–14 days.

EXTRACT VERSION

Substitute 8.3 lb. (3.76 kg) pale malt extract syrup for pale malt. Omit water salts. Mash remaining malts at 155°F (68°C) in reverse osmosis water for 30 minutes. Remove grains, dissolve extracts completely, then top off with reverse osmosis water to desired boil volume. Proceed as above.

RECIPES

As usual, we're including clone recipes for some of the top beers in the poll, assembled by *Zymurgy* associate editor Amahl Turczyn. The recipe for Two Hearted Ale appeared in the Jul/Aug 2017 issue, Russian River's recipe for Pliny the Elder was published in Jul/Aug 2014, and a Sierra Nevada Pale Ale clone appeared in the Jul/Aug 2004 issue. (Sierra Nevada also graciously provides a 5-gallon recipe at sierranevada.com).

We've published many other clone recipes in the past. Search the *Zymurgy* index or the Homebrew Recipes section at HomebrewersAssociation.org to find your favorite clone.

Thanks to all AHA members who took the time to vote in this year's poll, and for your insightful comments that once again helped tell the story of *Zymurgy*'s Best Beers in America.

Jill Redding is the former editor-in-chief of* Zymurgy. *She is editor-in-chief of* The New Brewer, *the journal of the Brewers Association.

ON THE WEB
Find the Best Beers in your state on our website @ HomebrewersAssociation.org/JA19

Tree House Brewing Company Julius Clone

Recipe developed by AHA member Marshall Bishop and adjusted by Amahl Turczyn

AHA member Marshall Bishop loves Tree House Julius so much that he has devoted untold hours to developing a faithful homebrew clone, the recipe for which he has kindly shared with us. Marshall offers helpful advice for brewing this recipe.

Water chemistry, a specific combination of yeasts, plus acids and essential oils from the hops combine to give this beer its hazy appearance. Tree House doesn't use flaked grains.

Minimizing calcium in the brewing water contributes a soft mouthfeel. Hard water ions such as magnesium and calcium can contribute chalky, thick sensations—if you want softness in a beer, start with soft water. Using canning salt (sodium chloride) provides chloride without adding calcium.

The long whirlpool at 108°F (42°C) extracts and retains volatile hop flavor and aroma compounds that would otherwise evaporate at higher temperatures. You can replace the whirlpool with a hop stand to maximize contact between hops and wort, but you will get the best utilization from constantly stirring during whirlpool.

Dried yeast has sufficient sterols for healthy fermentation, so there's no need to aerate or oxygenate. You want to stress the yeast enough to encourage ester production. Esters and other complex, fruity, yeast-derived flavors match perfectly with the hop-derived fruity flavors and aromas. Resist the temptation to round up the specified quantities of WB-06 and T-58 if you can't measure less than one gram, as these will dominate the clean strain and add too much farmhouse character.

Pitching warm and then cooling the fermentation encourages ester production while retaining volatile aromatic compounds. You still want some yeast activity when adding the dry hops, more to prevent oxidation than for any biotransformation mumbo jumbo.

Dry hopping in a mesh bag is not recommended. You'll get better wort contact by letting the pellet hops dissolve and float free in the primary. Cold crashing won't clear the beer of hop/polyphenol haze, but it will settle yeast.

Learn more about Marshall's process at trinitybrewers.com.

Batch Volume: 5.5 US gallons (20.8 L)
Original gravity: 1.067 (12.5°P)
Final gravity: 1.012 (3°P)
Bitterness: 68–70 IBU (calculated)
Color: 5.7 SRM
Alcohol: 6.8% by volume
Efficiency: 82%

FERMENTABLES

5.5 lb. (2.49 kg) US two-row pale malt
4.5 lb. (2.04 kg) Golden Promise pale malt
1.25 lb. (0.57 kg) Carafoam
1 lb. (454 g) aromatic malt
4 oz. (113 g) dextrose

HOPS

0.5 oz. (14 g) Warrior, 15% a.a. @ 60 min
0.5 oz. (14 g) Apollo, 17% a.a. @ 20 min
0.75 oz. (21 g) Citra, 12% a.a. @ 15 min
0.5 oz. (14 g) Apollo, 17% a.a. @ 10 min
1.5 oz. (42 g) Apollo, 17% a.a., whirlpool 60 min @ 108°F
3 oz. (85 g) Citra, 12% a.a., whirlpool 60 min @ 108°F
1.5 oz. (42 g) Apollo, 17% a.a., dry hop 4 days
4.5 oz. (127 g) Citra, 12% a.a., dry hop 4 days

YEAST

12.8 g Fermentis SafAle S-04 English Ale
0.4 g Fermentis SafBrew WB-06 Wheat
0.7 g Fermentis SafBrew T-58 Specialty Ale

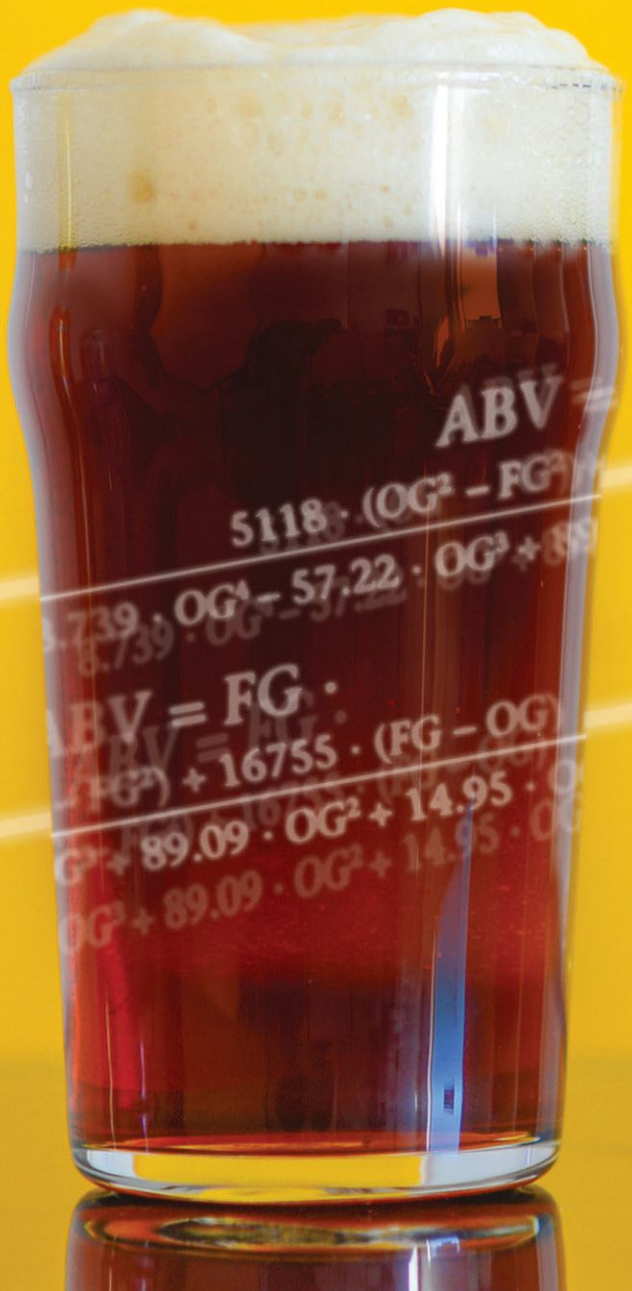
WATER

Add NaCl, CaCl, and $MgSO_4$ to reverse osmosis water to achieve the following profile: Ca 15 ppm, Mg 26 ppm, SO_4 140 ppm, Na 78 ppm, Cl 120 ppm

BREWING NOTES

Mash at 156°F (69°C) for one hour, adjusting pH to 5.2 with citric acid if necessary. Mash out at 168°F (76°C). Fly sparge at 168–170°F (76–77°C). Don't use Whirlfloc or Irish moss in the boil. Chill to 108°F (42°C) and add whirlpool hops, stirring or whirlpooling to keep hops in suspension for 60 minutes. Chill to 70°F (21°C) and pitch dry yeast blend; do not pitch more WB-06 and T-58 than specified, as they will dominate the clean base strain. There is no need to hydrate the dry yeast prior to pitching and no need to aerate or oxygenate the wort. After 24 hours, lower fermentation temperature gradually to 64°F (18°C) over a 60-hour period, let fermentation run at 64°F for 4–5 days depending on yeast activity, and then add the dry hops to primary and ferment to completion (usually about 2 days). Take care to minimize oxygen uptake at all times after fermentation. Cold crash to 32°F (0°C) for 2 days, then closed-transfer to a keg and force carbonate.

HOW MUCH ALCOHOL IS IN YOUR HOMEBREW?



REVISITING ABV CALCULATIONS

By Petr Novotný

Alcohol, more precisely ethanol or ethyl alcohol, is clearly an important part of any alcoholic beverage, beer included. Homebrewers care at least as much about flavor and aroma as alcohol content, but we are educated consumers. For the random imbiber at a party, "kick" is often what counts most.

Nonetheless, alcohol remains an interesting parameter even for beer geeks seeking truly noble enjoyment. It goes without saying that a 4% ABV (alcohol by volume) light lager should be approached differently than a 10% ABV imperial stout. Otherwise, the consequences could be severe.

Even more to the point: what is the most common question you receive about your delicious homebrew from family, friends, or significant others? The first question I get is, "How did you cap it?", followed by "How did you put the bubbles in?", and, finally, but by no means the least common, "How much alcohol has it got?"

Professional brewers regularly have their beers analyzed for exact alcohol content, but this costly analysis is usually not an option for amateur brewers. An imprecise estimate is usually sufficient for our purposes, and as with many other important brewing parameters, we rely on calculations to arrive at a result.

If you have ever searched this topic on the internet or in brewing literature, you have probably found dozens of similar or sometimes quite different equations. But where do all these equations come from, which one is the most accurate, and what kind of precision can we expect from them? I will try my best to address all these questions, and maybe even a little bit more, in the following paragraphs. So sit tight, relax, sip your delicious homebrew, and let's explore alcohol.

BASIC FERMENTATION THEORY

There would be no alcohol without the action of yeast. Thus, we start with what goes on in the fermentation vessel: yeast breaking down sugar into ethanol and carbon dioxide. It would be incorrect to assume that yeast does this simply to make beer or because it is fun to do. Yeast does it for a living: sugar is food, and alcohol and CO_2 are just waste products. It turns out that for each molecule of glucose (the basic component of most brewing sugars), yeast produces approximately two molecules of ethanol and two molecules of CO_2.

Thus, if you know how much sugar yeast consumes, it should be relatively easy to calculate how much alcohol it produces. And we have the tools to determine how much sugar is in wort. Just before fermentation, we measure original gravity (OG), and when fermentation ceases, we measure final gravity (FG). With those values, we can calculate alcohol content. Let's immerse ourselves in a little bit of simple math. I promise to keep it simple.

These equations are not magical spells that have fallen from the sky. They have theoretical foundations. If you want to describe and quantify natural processes such as fermentation, you must speak the language of nature. That language is neither English nor Latin, but rather chemistry and math.

Our starting point is to calculate how much sugar the yeast has consumed, which is simply:

Eq. 1

$$\Delta P = P_i - Re$$

where ΔP is consumed sugar and P_i and Re are the initial extract and real extract after fermentation, respectively. The value of P_i is the original gravity of the beer expressed in the Plato scale—in other words, the percentage of sugar in solution by mass.

Real extract (Re) however, does not correspond directly to final gravity. The reason for this is that during and after fermentation, wort is a solution of not just sugar, but also of ethanol, which has a lower specific gravity than water. Therefore, we measure the *apparent* extract that corresponds directly to FG. It is apparent because it is only an apparent concentration of sugar as shown by a hydrometer. Fortunately, alcohol production and sugar consumption are not random but are coupled through fermentation balance and can be corrected quite easily. The real extract can be calculated from original and apparent extract via [1]:

Eq. 2

$$Re = 0.1808 \cdot P_i + 0.8192 \cdot P_f$$

Inserting Eq 2 into Eq 1, we obtain:

Eq. 3

$$\Delta P = P_i - 0.1808 \cdot P_i - 0.8192 \cdot P_f = 0.8192 \cdot (P_i - P_f)$$

Now we have a formula for calculating the consumed sugar from values that we can easily measure. But we are interested in calculating alcohol, not sugar, so now it is time to apply the relationship that one molecule of glucose ferments to two molecules of alcohol. These two molecules do not weigh the same, so we must also introduce their molecular weights, *M*, to get the relative masses right. Alcohol by weight (ABW) is the mass of dissolved ethanol divided by the total mass of the solution:

Eq. 4

$$\Delta P = 1/2 \cdot \frac{M_{sugar}}{M_{ethanol}} \cdot ABW = 1/2 \cdot \frac{180.16}{46.07} \cdot ABW = 1.955 \cdot ABW$$

Inserting into Eq. 3 we arrive at:

Eq. 5

$$1.955 \cdot ABW = 0.8192 \cdot (P_i - P_f)$$

Eq. 6

$$ABW = 0.419 \cdot (P_i - P_f)$$

And that is almost it, except we are used to having alcohol on a volume basis (ABV) instead of by weight (ABW), and we typically measure specific gravity rather than Plato. Let's convert them using the simplest relations [2]:

Eq. 7

$$P = \frac{SG - 1}{4} \cdot 1000$$

Eq. 8

$$ABW = \frac{ABV \cdot 0.791}{FG}$$

After inserting these two equations into Eq. 6 we arrive at:

Eq. 9

$$\frac{ABV \cdot 0.791}{FG} = 0.419 \cdot \left(\frac{OG - 1}{4} \cdot 1000 - \frac{FG - 1}{4} \cdot 1000 \right) = 104.74 \cdot (OG - FG)$$

Eq. 10

$$ABV = 132.4 \cdot FG \cdot (OG - FG)$$

We can further simplify this equation by recognizing that most of our beer has a final gravity close to 1.01, which means we can afford to approximate the first FG in the equation by 1.01 which gives the final result as:

Eq. 11

$$ABV = 133.7 \cdot (OG - FG)$$

You are probably quite familiar with this equation. It is one of the most common ABV calculations to be found in brewing literature. The leading constant varies between 131 and 135 according to slightly different assumptions that each author makes.

CAN'T WE DO BETTER?

When you are deriving such an equation, the assumptions you employ play a critical role. In this short mathematical exercise, we used several assumptions, two of which were rather critical and worth further discussion. First, we assumed that one molecule of glucose yields two molecules of ethanol. In reality, it is a little bit less than two. Second, we used a very simple relationship to convert Plato to specific gravity (SG), which is not completely accurate, especially for strong beers.

Why does the stoichiometry of fermentation differ from a 2-to-1 ratio? Where do we lose sugar if it is not used to make alcohol and CO_2? You might think this has to do with fermentation byproducts that are so important to brewers and beer drinkers—sometimes desirable ones such as aromatic esters and other flavors, but sometimes undesirable ones such as diacetyl and acetaldehyde.

In fact, all these compounds make up very tiny quantities in beer compared to ethanol and CO_2. That does not mean that they don't matter; they are just insignificant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relative to the big picture of fermentation balance. Think of them as spices. A very little goes a long way, but they do not form the bulk of the meal.

The discrepancy between reality and the theoretical fermentation coefficient 2 is mostly due to yeast multiplication and growth. This was recognized as early as 1865 by Karl Balling, who developed fermentation theory and relationships that are surprisingly robust and widely used even today. We could use his equations and derive supposedly more precise relationships.

For instance, in the very popular article "Math in a Mash," Michael L. Hall [3] derived a formula that uses Balling's equation of fermentation. Does that mean Hall's equation is better than the simplest one? One might assume that using a less restrictive assumption would yield better precision, but that is not necessarily true.

I derived formulae using different combinations of restrictive and less restrictive assumptions, as well as one that uses state-of-the-art equations with no restrictive assumptions at all. As you might expect, fewer assumptions makes the math increasingly complicated. I will spare you another, even harder mathematical exercise and simply say that I applied the steps above to Balling's equations for fermentation balance and a more accurate polynomial formula for the conversion between Plato and SG [4]. Here is the result:

Eq 12.

$$ABV = FG \cdot \frac{5118 \cdot (OG2 - FG2) + 16755 \cdot (FG - OG)}{8.739 \cdot OG^4 - 57.22 \cdot OG^3 + 89.09 \cdot OG^2 + 14.95 \cdot OG - 105.99}$$

Looks scary, right? I call it the "ultimate ABV formula." To the best of my knowledge, no one has ever published such a complex ABV equation. It uses the least restrictive set of assumptions and therefore would be expected to provide the best results. With a calculator, it is not even that difficult to use as-is.

We'll get to validation of this formula shortly, but for now, let's assume that this really is the most precise equation and take it as a "gold standard" to compare the others. I used real-world OG and FG data from 120 homebrewing recipes that are in my Czech book *Pivařka* [5] and are good representations of what homebrewers make. I calculated ABV using three different equations that differ in their assumptions and used the "ultimate formula" (Eq. 12) as the reference standard for comparison.

The first equation is our Eq. 11 that assumes simple stoichiometry and simple

Figure 1:

Effects of assumptions on the results of the discussed equations. Original gravity and final gravity data sampled from recipes in the book *Pivařka*. Eq. 12 ("ultimate formula") serves as the reference standard. Hall's formula overestimates ABV for strong beers due to inaccurate conversion between specific gravity and Plato, whereas "reverse Hall" underestimates ABV for strong beers because the basic fermentation balance was used. In the case of Eq. 11, these contradictory effects canceled out. Lucky us!

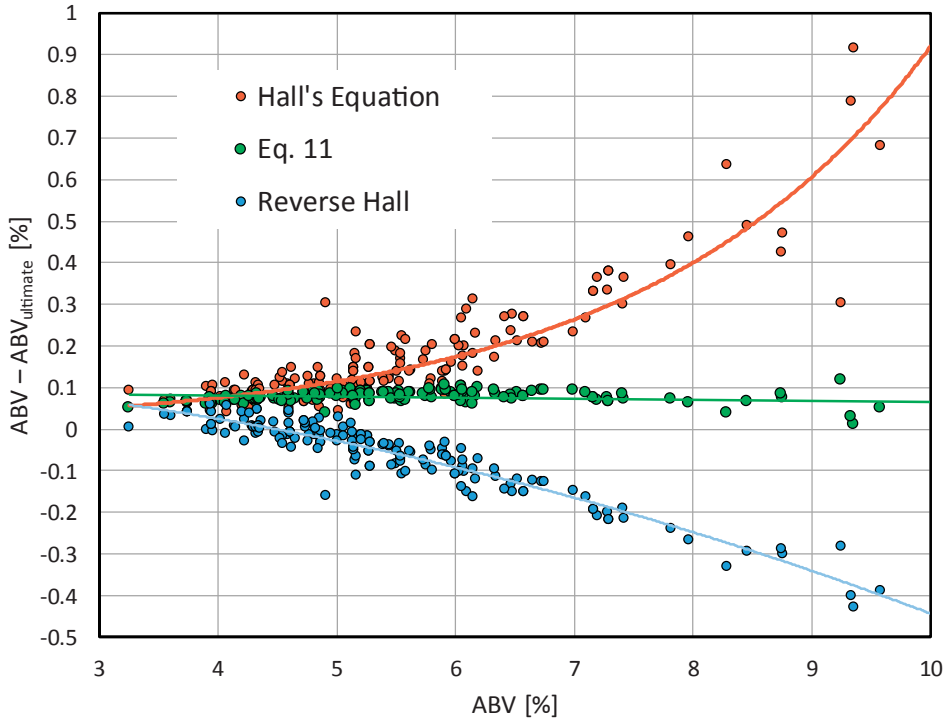


Figure 2:

Ultimate formula validation: the closer to diagonal the better. Many thanks to the breweries that shared data.

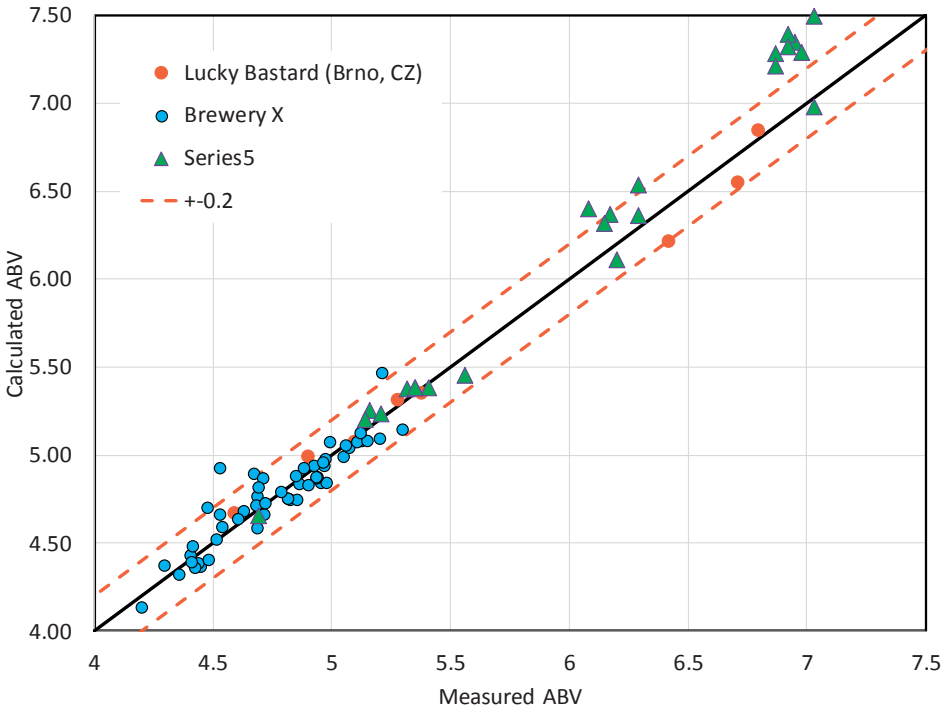
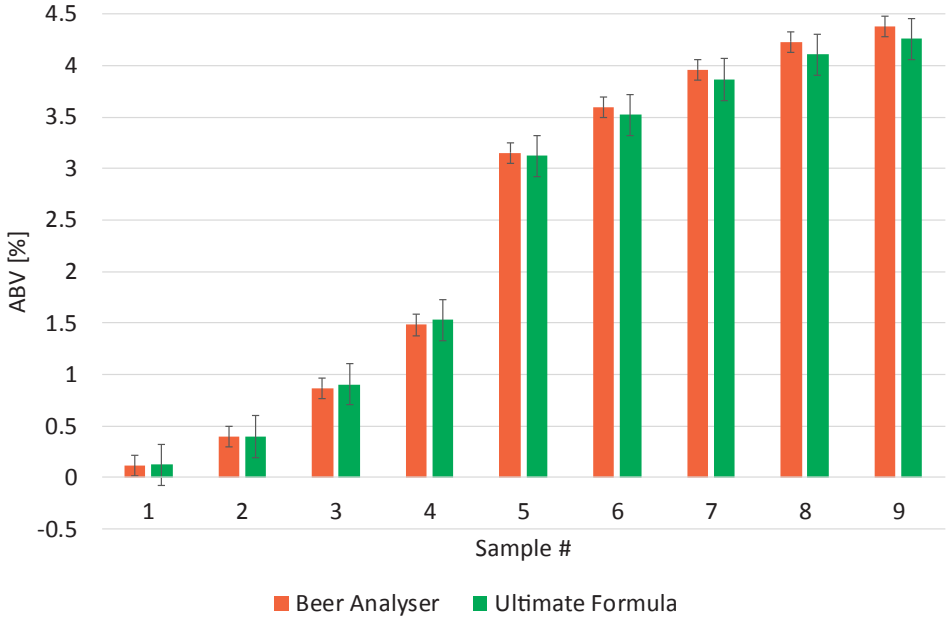


Figure 3:

Monitoring ABV during fermentation using the ultimate formula and beer analysis. (Source: Anonymous Brewery Z)



Plato/SG conversion. The second equation is Hall's original formula that assumes Balling's molecule balance but with simple Plato/SG conversion. To have a direct opponent to Hall's formula, I derived an equation where the assumptions are flipped: simple stoichiometry but accurate Plato/SG, which I call "reverse Hall." This formula serves only to illustrate the effects of those two assumptions. I have not presented it here for your own protection because I don't want anyone to use it!

Surprisingly, Hall's formula, which is supposedly more accurate than the simplest one, does not perform as well as the others, especially above 5% ABV. It turns out that it is false to unconditionally assume that one restrictive assumption is better than two. It might be surprising, but, again, it is not magic. Let me walk you through it.

Assuming simple stoichiometry of the fermentation (Eq. 4), as opposed to Balling's balance, underestimates ABV. On the other hand, assuming a simple conversion between Plato and SG (Eq. 7) overestimates ABV. This is one of those rare moments in which more bad is better. In deriving the simplest equation (Eq. 11), we made two major assumption, one of which underestimates ABV and the other of which overestimates it. We were lucky that these effects canceled out.

Imagine trying to walk straight on a narrow beam with a friend on either side to help you if you lose balance. Here, the beam represents the precise result (ultimate formula), and your two friends represent the two assumptions. Your friends can either support you by balancing you when you need it (good friend/assumption) or can try to push you out of balance (bad friend/assumption). If one of your friends pushes you and the second doesn't react, you will fall (Hall's formula and "reverse Hall"). However, if the second friend also pushes to counteract the first one, and you are lucky enough that both apply the same force, you can stay on the beam (Eq. 11). That's precisely what happened with our equations.

What this shows is that during derivation of any formula, you must be very careful and take the time to analyze the effects of each assumption. Otherwise, you have no control over the results. Analysis can be powerful, but it should be only the first step. Nothing is better than hard data against which you can validate your equation.

VALIDATION

The problem is that homebrewers do not normally have access to such data. The precise value of ABV is simply not important enough to us that we are willing to pay 25 to 50 dollars for beer analysis—that represents a whole batch of beer to most of us. Fortunately, when it comes to fermentation balance, yeast works the same in your fermentation bucket as it does in a large conical in a brewery.

Some fermentation characteristics, such as ester production, can vary between homebrew-sized fermenters and commercial cylindroconicals. The latter vessels place significant hydrostatic pressure on yeast cells. As much as these effects can affect flavor and aroma, they negligibly affect basic fermentation balance. All of those very important flavor and aroma compounds produced by yeast are present in very tiny quantities compared to the main products ethanol and CO_2.

I was lucky enough to get my hands on data from four different commercial breweries. I won't present the raw data or reveal the exact brands since these data are sensitive and, in some instances, proprietary. The important part is that this dataset is quite diverse: four breweries on opposite sides of the Atlantic (USA and the Czech Republic) and a wide range of OG, FG, attenuation, and yeast strains cover most of the situations that we encounter. The results are shown in Figure 2.

In most cases, ABV calculated with the ultimate formula is within ±0.2 percentage points of the value found by laboratory beer analysis. In theory, the closer to the diagonal the better, but we must consider that even beer analysis has an experimental error (around 0.05% to 0.1% ABV), and we can usually measure OG and FG to within 0.001 (0.2°P) accuracy, meaning not all the error is necessarily due to the equation.

EFFECT OF PRIMING SUGAR

Priming with sugar does affect the results. Fortunately, it is not that hard to account for it if you want to. Here you go:

$$ABV = ABV_0 + k \cdot C_{sugar}$$

where ABV_0 is the alcohol by volume calculated from OG and FG, C_{sugar} is a concentration of priming sugar, and the constant k depends on the type of sugar used and on concentration units of your choice as follows:

k	for C_{sugar} in g/L	for C_{sugar} in oz./gal.
Corn sugar (dextrose, glucose)	0.056	0.42
Table sugar, beet or cane sugar (sucrose)	0.061	0.46
Dried malt extract	0.040	0.30

If you do the math, you will find that the standard priming dosage of 4 oz. (113 g) of corn sugar per 5-gallon batch (0.8 oz./gal. or 6 g/L) will add 0.34% ABV to your homebrew.

There are outliers, notably a cluster of points around 7% ABV, although those are data points from one particular brand of one brewery, which suggests either an experimental error or some technological aspect that makes the equation less precise.

Various aspects of how the fermentation is conducted are natural constraints of any ABV equation. For example, if you dilute or thicken the beer at any point during fermentation, the precision of the calculation will suffer substantially. The dilution can be due to adding some flavor extract, adding additional wort that is not as strong, dilution with water in the case of high-gravity brewing, etc.

Anything that increases gravity, such as the addition of malt extract, sugar, fruit (fruit can dilute or thicken wort, depending on its sugar content), priming and other interventions will reduce calculation precision as well. In general, any post-boil (after you measure OG) adjustment of gravity changes the fermentation balance and makes the calculation fail. Just be aware of those limits.

Figure 3 shows fermentation progress monitored via a beer analyzer and using the ultimate formula. You can clearly see that the ABV formula is reliable over the whole range of attenuation thanks to its robust foundations.

LINEAR SIMPLIFICATION, FULL CIRCLE

We have established a new formula that makes use of the least restrictive assumptions and is therefore reliable under most conditions. I have shown that the accuracy of such a calculation is usually as good as ±0.2% ABV. But I'm not done with ABV calculations yet.

It might seem as if I have some kind of obsession with digging deep and making problems harder than they really are. But that is not true. I am a chemical engineer by training, and chemical engineers love simplification. Surprising precision of the simplest equation indicates that perhaps the whole system can be described by a much simpler linear relationship. Who would not like that? I found the following equation to describe the ultimate formula within the margin of error of our experimental tools:

$$ABV = 132.6 \cdot (OG - FG)$$

I calculated the coefficient 132.6 using nonlinear regression to best fit the ultimate formula, which usually produces results within 0.05% ABV of that formula.

Now, you are probably scratching your head and thinking that after so much work, we ended up in pretty much the same place we started. Yes, it is true, but we arrived at this coefficient of 132.6 not by simple derivation but by matching the results of a much more sophisticated formula to a linear approximation. And we learned quite a bit along the way.

We learned that some equations that should have been better are actually worse. We learned that we can usually estimate ABV to within ±0.2 percentage points. And, hopefully, I was able to highlight a different, more technical view of fermentation. Math may be a foreign language for many, but it is not foreign to nature. If you speak it well enough and ask the right questions, nature will answer.

Many thanks go to Tony Rau, Jan Grmela, Jan Najbrt, and Petr Košin, who were great help in putting this piece together.

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DEALING WITH DIASTATICUS

By Keith Thomas

We all appreciate some carbonation in our beer. Some styles, such as German wheat beer, are highly effervescent. Others, such as smooth stouts and mild ales, benefit from a softer fizz. Rarely, though, do we appreciate so much carbon dioxide that it throws itself out of the bottle and all over us, leaving little to savor but wet clothes.

But when live yeast produces natural carbonation in the bottle, gushing is always a possibility, thanks to a couple of factors. Misjudging the amount of priming sugar necessary for secondary fermentation is one major cause of carbonation distress. A more recently identified cause is the curse of *diastaticus* yeast. Some commercial breweries have received unwanted press in recent years after *Saccharomyces cerevisiae* var. *diastaticus* forced recalls of contaminated batches of beer.

More on *diastaticus* later, but first, let's review the basic control of carbonation in secondary fermentation.

Conditioning for Carbonation

In bottle and cask conditioning, closed fermentation provides the final carbonation, ideally to our chosen level. Table 1 lists target carbonation levels for common beer styles.

In bottle or keg priming, we add sugar to relatively flat beer to yield the target carbonation after primary fermentation is complete. By the stoichiometry of fermentation, 1 gram of fermentable sugar will generate around 0.494 grams of carbon dioxide. So, for example, to produce 20 liters of a beer with 4 grams CO_2 per liter, we will need to add 162 grams of sugar:

$$\left(\frac{4\text{ g } CO_2}{1\text{ L beer}}\right) \times (20\text{ L beer}) \times \left(\frac{1\text{ g sugar}}{0.494\text{ g } CO_2}\right) = 162\text{ g sugar}$$

Another approach is to package the beer before all the fermentable sugars are used up, which avoids the need to add priming sugar. One specific gravity point (0.26°P) will generate around 1.43 grams of carbon

Table 1: Carbonation levels of general international styles. Carbonation levels expressed in grams per liter are roughly twice the value of volumes of CO_2 per volume of beer at standard temperature and pressure (STP).

Beer Style	CO_2 [g/L]	Volumes CO_2 at STP
British-style ales	2.0–5.0	1.0–2.5
Porter and stout	3.3–4.5	1.7–2.3
Belgian-style ales	3.7–4.7	1.9–2.4
European lagers	4.3–5.3	2.2–2.7
North American lagers	4.7–5.3	2.4–2.7
Gueuze	4.7–5.3	2.4–2.8
Fruit lambic	5.9–8.8	3.0–4.5
German wheat beers	6.5–8.8	3.3–4.5

dioxide per liter. As such, it is possible to predict how carbonated our beer can be if we know the level of residual fermentable sugar when it is packaged.

A problem with this approach is that we may not know how far our wort will ferment. Will the final gravity be 1.010, 1.008, or 1.007 (2.6°P, 2.1°P, or 1.8°P)? All are possible, depending on wort composition and yeast activity.

The solution is to reserve a small portion of wort—500 mL will do—and conduct a forced fermentation alongside the main brew. Fermenting this at a warm temperature with a heavy pitch of our chosen yeast forces it to reach terminal gravity well in advance of the main brew and tells us the final gravity to expect. From this, we know when to seal fermentation of the main batch with just enough residual sugar for our target carbonation.

Whatever approach we take to manage secondary fermentation, we aim to achieve a target CO_2 level and enjoy our beer in its best condition.

Over-Carbonation by Contamination

Now here's the real hazard: over-carbonation due to microbial contamination by *Saccharomyces cerevisiae* var. *diastaticus* or another species of non-brewing yeast. Such yeasts have the ability to ferment dextrin sugars through the secretion of a glucoamylase enzyme.

In secondary fermentation, we have a target final gravity that reflects the presence of residual unfermentable sugars: dextrins that are not able to enter yeast cells. These remain in the beer and provide body and mouthfeel. Or at least they do in a stable beer.

In a beer with microbial contamination (or with a non-standard brewing yeast) these dextrin sugars may be broken down by glucoamylase and fermented to produce extra carbonation. In fact, it can produce so much extra carbonation that the beer explodes when opened—or even before opening.

So, what's special about *diastaticus*? In fact, it isn't *diastaticus* that is special, but the standard brewing yeast we are using. The presence of a *diastaticus* (STA) gene isn't special because many yeast species have it. Our most popular brewing yeasts, the ale yeast *S. cerevisiae* and the lager yeast *S. pastorianus,* also have it, but the enzyme produced is not secreted into the beer—instead, the yeast uses it internally. It is likely that over the centuries, brewers have selected yeasts without the secretory glucoamylase gene, disabling their ability to ferment dextrins.

Doubtless brewers of the past found that these yeasts produced beers with a fuller body and residual sweetness that was more attractive to drinkers. This heritage is now deeply embedded in our brewing operations and recipes. It's also fundamental to the mash temperatures we choose to control the level of dextrins through selective activation of alpha and beta amylase enzymes.

Today, however, that heritage is being superseded by the use of novel yeasts such as saison strains or even wild yeasts with little characterization. Many of these do possess an active STA gene that produces enzymes to digest dextrins in beer. If we are aware of this, we can allow for it in our carbonation calculations and let fermentation reach its natural end—in most cases a low final gravity down to 1.003 (0.8°P) or so.

More problematic is when we are unaware of this strain-specific genetic trait and package our beer while there are still significant residual dextrins, say at 1.007 (1.8°P). Fermentable gravity points correspond to carbon dioxide at a ratio of 7 points per 10 g/L CO_2 (i.e., 0.7 fermentable gravity points yield 1 gram of CO_2 per liter of beer), so 1 to 2 points are suitable to generate standard carbonation levels. The further fermentation of 5 units of gravity down to 1.003 will lead to 7 grams per liter of CO_2 (3.5 volumes) and a major blowout when the package is opened, possibly even bottle explosion. Unfortunately, digestion of dextrins can be a slow, multi-week process that is only discovered some time after bottling.

Genetic Constitution

Let's take a closer look at the features of the *diastaticus* problem. Here we need to isolate the commonly associated yeast *Saccharomyces cerevisiae* var. *diastaticus* from the gene causing the trouble. For many years, this yeast was identified as a separate species, *S. diastaticus*, but more recent genetic studies suggest it is actually a group of strains of our standard brewing yeast, *S. cerevisiae*.

Diastaticus-type yeasts not only possesses genes for enzymes that can digest dextrins, but also certain flavors, particularly the phenolic off flavors so desired by wheat beers but abhorred in standard ales and lagers. They may also have some toxicity factors that inhibit other yeasts, thus giving it a selective advantage when present in a blend or as a contaminant. All in all, a dubious pedigree.

And what of the genes causing all these problems?

The gene coding for the *diastaticus* glucoamylase enzymes has some interesting features. In fact, there are three individual genes—STA1, STA2 and STA3—found on separate chromosomes IV, II, and XIV respectively. These all code for an extracellular glucoamylase enzyme that can digest starch molecules when secreted out of the yeast cell.

There is enough similarity in sequence between these three genes to suggest a common origin. They are also similar to an intracellular glucoamylase gene, SGA, that may have been the initial precursor, with a role in digesting reserve carbohydrates for sporulation or possibly at the start of fermentation.

More intriguingly, the STA genes are similar to those found in other organisms, for example the starch-digesting genes found in bacteria, molds, and mice, all of which feed on starch. Further similarities are present with genes for alcohol dehydrogenase and with a yeast mating control gene, demonstrating how fluid yeast evolution has been.

Such similarities between different genes are not uncommon and may reflect the duplication of the yeast genome that is believed to have occurred a hundred million years ago and thus provided spare genes to evolve into novel applications.

In a further twist, the enzyme structure of yeast glucoamylase appears to be a combination of two proteins. One is a functioning glucoamylase able to digest sugar polymers, and the other is a bacteria invasin protein. *Invasins* are toxins produced by bacteria to damage cells and assist infection, suggesting that the gene has an even broader origin that warrants further investigation.

But enough biochemistry, interesting as it is. What we are particularly interested in is how to prevent this hazard from spoiling our beer.

Dealing with *Diastaticus*

It would be easy to say that hygiene is a major controlling factor in *diastaticus* management. Keep yeasts pure, keep brewing and bottling areas clean, and we should have no problem with contamination. Certainly, these precautions will provide protection, but it is easy to be complacent.

A further source for the homebrewer is equipment ranging from fermentation vessels to tubing and implements. *S. cerevisiae* var *diastaticus* seems to be particularly good at residing in biofilm, which consists of surface layers of microbes covered in protective extrusions of carbohydrates, protein, and DNA. We can't

always see these biofilms, but they develop readily on any surface that hasn't been thoroughly scrubbed free of beer, wort, and yeast residues.

Biofilms offer good protection against cleaning agents and allow for the release of viable cells the next time they come in contact with wort or beer. If you look inside well-used tubing or valves and see deposits, think *biofilm* and replace them. Beware of scrubbing too hard, as this may create micro-scratches that retain biofilm even more tightly.

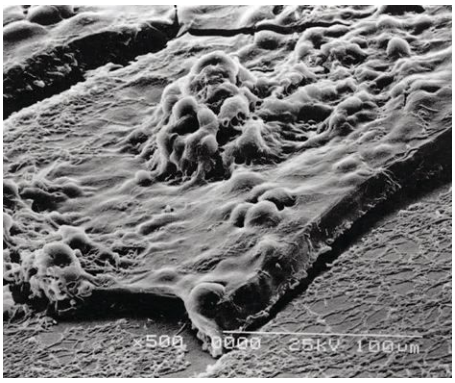

Figure 1: Microbial biofilm showing yeast and bacteria cells embedded in biofilm matrix.

When packaging any beer, be sure to check that your bottles are reusable and undamaged. When packaging beers that are liable to over-carbonate, it makes sense to use bottles with a screw top or flip top so you can check pressure. Plastic PET bottles offer some indication of the internal pressure—just squeeze—and they usually take a screw cap that can easily release excess carbonation with a twist. Furthermore, PET bottles intended for soda can usually withstand much higher pressures.

Major legal suits show that contamination is not necessarily the providence of our own actions. Contamination of commercial yeast can create a problem at the source. In light of litigation, yeast suppliers are rigorously testing their stocks, so we might expect this to be less of an issue in the future. If in doubt, ask your yeast supplier for a certification of testing.

Those who use wild yeast strains are particularly vulnerable. Wild yeasts are likely to possess the STA genes, as they will have arisen from a natural environment where it is valuable to ferment as much carbohydrate as possible.

Cross contamination from seemingly domesticated saison and wheat beer yeasts is another problem source. Yeasts from both of these groups are highly attenuative due to STA genes and will easily contaminate other stocks. Keep yeast strains apart and minimize activities that require different beers to be handled together (e.g. packaging a saison at the same time you rack a mild ale).

As a next step, it is possible to test yeast for the STA gene, and doing so is a worthwhile precaution if you use wild isolates. Looking for the STA gene requires some fairly complex molecular biology, and although simplified test kits are available, they are unlikely to be affordable for homebrewers.

More relevant are tests that use an agar substrate containing only starch, no sugar. Any growth on this would suggest the presence of a diastatic yeast. Such tests aren't foolproof, however, as not all strains can digest molecules as large as starch.

Finally, and perhaps easier to manage at home, is to simply examine a sample of beer or yeast under a microscope. Cells of *S. cerevisiae* var. *diastaticus* tend to be smaller than those of domesticated brewing yeast and more varied in shape. Of course, there are many other yeast species that will have different appearances entirely, often elongated, spherical, or filamentous. These too, though, are likely to have a diastatic ability. Once you are aware of the appearance of your standard yeast, spotting a rogue cell becomes a good indication of problems.

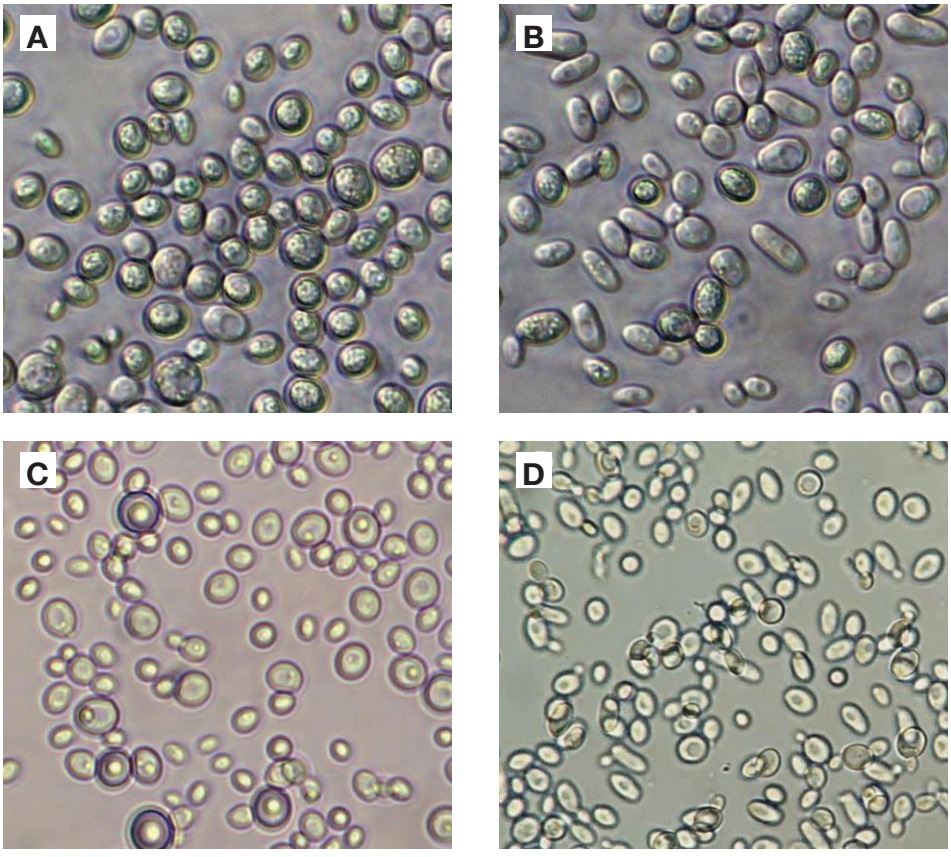

Figure 2: Microscope images of yeast morphologies illustrating differing morphologies. **A:** *Saccharomyces cerevisiae* culture yeast. **B:** *S. cerevisiae* culture yeast contaminated with a diastaticus yeast. **C:** *S. cerevisiae* culture yeast contaminated with wild yeast. **D:** Wild isolate from nectar.

Photos courtesy of Keith Thomas

Living with *Diastaticus*

Having said all this, *S. cerevisiae* var *diastaticus* does have positive potential. In beer, it can deliver flavors that are generally high in fruit and spice, particularly clove, which makes it suitable for wheat beer styles. Its high attenuation is also good for biofuel production and distilling, in which the presence of residual sugars after fermentation means a loss of alcohol.

Diastaticus may become more prevalent as we expand our portfolio of beer styles and broaden our brewing microbiology. Being aware of its features simply adds another layer of richness to our knowledge and skills.

Keith Thomas founded Brewlab in 1996 to provide training and analysis to amateur and professional brewers and as an application of his microbiology expertise. In addition to managing the company, he teaches at the University of Sunderland and conducts research into yeast physiology and novel brewing ingredients.

FAHRENHEIT

BREWING WITH HOT ROCKS

Editor's note: *If you brew with hot rocks, please, please be careful. Wear closed-toed shoes, safety glasses, heavy gloves, full-length trousers, and other protective gear. And wait until after the successful, injury-free brew day to celebrate with a beer.*

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We took rocks, threw them into a campfire until they were very hot, then picked them out and threw them into a pot of wort. We repeated the process until the wort boiled for an hour. Then we chilled it as normal and made beer.

By Jason Barker

Most of us have heard that humans have been making "beer" for about 7,000 years. But how good was that beer? Probably not quite Pliny the Elder. Still, curious modern brewers love to look back at ancient procedures to see how beer might have been brewed. What processes did our ancestors use that might still have value today?

If you think about the invention of modern metals and their impact on brewing—let's say your boil kettle—it's fun and interesting to consider how *you* would make beer if you didn't have a metal kettle to put over a fire. You could use a clay or wooden vessel to hold the hot liquid, but how would you heat that liquid? Enter rocks. Hot rocks. Very hot rocks. As in, rocks hotter than 1000°F (538°C)!

The Idea is Kindled

In 2017, at the Pacific Northwest Homebrewers Conference in Vancouver, Wash., Annie Johnson gave a presentation featuring her club making steinbier (sh-TINE beer). A few other Oregon Brew Crew (OBC) members and I love listening to Annie speak and were in attendance. As her presentation continued, we became more interested, intrigued, and fascinated by this process. By the end of the presentation, we were all on the edges of our seats, frantically scribbling notes and whispering back and forth how *our* club could do something like this.

A scan of Google and YouTube revealed a little more information about this process, but mostly I just saw horribly dangerous setups with personal injury potential written all over them. If we were to do this, we would need to set some rules and think of how to do this safely. The first rule was no drinking until flameout (rock out?). We wanted to stay sharp! Many of the videos I saw had brewers

literally dropping white-hot rocks into boiling wort with a huge *ker-CHUNK* and splashes everywhere. Tending the fire and handling hot rocks would demand attention to safety.

We sat on the idea for a year before we decided to attempt our own steinbier project. We decided it would be a great idea to do this during our annual Oregon Brew Crew camping trip at the Trask River County Campground. We've brewed beer at this place before (Sour Beer Camp 2016) and we knew if we kept our "campfire" within the designated steel fire ring, we would have no problems from the camp authorities. We did push the definition of *within* a little, but that's what it takes when you're going old school.

So, what exactly is steinbier? In a nutshell, you use superheated rocks as your source of heat instead of a gas burner or electric element. In our case, to keep things easy, we decided on a simplified, low-gravity English strong ale recipe using dry malt extract and steeping grains. We were camping after all, so simplicity and easy transport were key during this inaugural run.

Of course, you can take this ancient form of brewing as far as you want. Since this was our very first time, we decided to only replace the heating and boiling of the wort with the hot rocks; for everything else we used all the modern conveniences of home brewing—well, as many conveniences as you can have while camping in the Tillamook Forest of western Oregon.

Planning and Testing

We started planning and testing several weeks prior to brew day. First up: what kind of rocks to use? Research showed that most people use granite, but here in western Oregon, basalt is abundant. We discussed as a group and decided it would be best to test a few different easily sourced rocks in a fire to see what happened. Also, we decided that softball-sized basalt river rocks were by far the easiest to handle.

But what about exploding rocks? River rocks can explode when heated in a fire: the trapped water within rapidly expands and exerts tremendous force, enough to violently shatter the rock. Not good.

But never fear! One of our members, Alex Parise, noted that the water inside river rocks slowly soaked in over a long period of time. Conversely, a long, slow bake under modest heat should expel the water. Genius!

Armed with that information, I loaded up my oven with as many rocks as it would hold and baked them at 250°F (121°C) for 48 hours. I weighed a couple of the rocks every few hours and, indeed, Alex was correct: gram by gram, they were losing weight! When the weight plateaued, it was time for the next batch of rocks. I prepared about five 5-gallon (19-liter) buckets worth of rocks, but we ended up only needing half that amount.

Once the rocks were prepared, I lit a raging fire in my steel tailgating fire pit and threw the rocks in. The temperature rose to at least 800°F (427°C), measured with my laser thermometer, and as Alex had predicted, no explosions! I fished them out of the fire with a specially modified pitch fork and potato fork and ever-so-carefully lowered them into my Spike Brewing pot full of water.

There was a great deal of steam and sizzling, and it was cool to watch and hear! I also tried marble rocks, which broke easily and disintegrated into sand in the boil pot. No matter: these basalt river rocks were virtually indestructible and easy to handle, which promoted safety, too.

How do you get the fire hot enough to heat the rocks? Turning to Annie's advice, we knew we had to get a fire much hotter than a normal, smoky campfire. Keeping within the campground rules, OBC member Miles Eshaia suggested we dig the steel fire ring out

Photos courtesy of Jason Barker

of the ground and flip it over so that the grate was on the bottom. This idea proved genius since it gave us a shelf to put the rocks on instead of having them directly on the dirt.

We also left about a 2-inch (5 cm) gap under the ring so a fan could blow directly underneath the fire to provide a blast of oxygen and produce more heat. We used mostly oak firewood because it has a higher energy content than regular pine or fir. Some people suggested that pine or fir might leave a sappy taste in the beer, but these people have obviously never built a fire this hot. By the time the rocks hit 1000°F, any sap residue had long since vaporized. These rocks were white hot, with no residue except very small amounts of ash. And most of that got shaken off when they were out of the fire and banged around a bit with metal tools.

How does one safely transfer 1000°F rocks out of a raging fire and into a pot of wort? How does one then remove them from the wort and return them to the fire as needed? During my testing day, I experimented with several tools, but the best method by far was to use a heavy-tined pitchfork that I slightly modified, as well as a similarly tined potato fork. These two tools allowed us to dig around in the fire at different angles to retrieve the blistering hot rocks from a safe distance and safely carry them over and lower them into the pot with ease—no splashing or dropping!

We used two turkey-fryer baskets in rotation to easily remove the stones from the wort once they had given up their energy. We simply placed an empty basket into the wort and lowered the hot stones in one by one until full. Then, when the wort temperature had plateaued, we lifted the basket out, set it aside, inserted the second empty basket, and repeated the process in rotation. This let us keep the fire raging hot with as many rocks as we could.

Feeling confident that we had a legitimate and safe process ready to go, we ventured off on our camping trip.

Brew Day

With wort ready and waiting in a vessel just like those used 7,000 years ago (Spike Brewing 20-gallon stainless pot with sight glass, Tri-Clamp outlet, and factory-etched volume graduations), we heated the rocks in the fire until they were as hot as possible and then carefully lowered them one by one into the wort. Once a temperature equilibrium had been reached, we removed the rocks, replaced them with fresh hot rocks, and repeated the process until the wort was boiling. We continued that process to sustain the boil for 60 minutes. After that, it's pretty much business as usual: chill, oxygenate, rack to the fermenter, and pitch your yeast.

BOSCOS FAMOUS FLAMING STONE

Recipe by Chuck Skypeck

Some readers may recognize Chuck Skypeck as the technical brewing projects manager for the Brewers Association, the AHA's parent organization. But once upon a time, Chuck served as co-owner and brewmaster at Boscos Restaurant & Brewing Co. in Memphis and Nashville, Tenn., and Little Rock, Ark.

According to Boscos' website, it was "the first North American brewery regularly making a stone beer, the original being Rauchenfels in Neustadt, Germany. Boscos began brewing Famous Flaming Stone Beer in 1993."

Of the hot-stone process, Chuck says, "The flavors created, while unique, are subtle. For this reason, all my steinbier formulas minimized extemporaneous and competing flavors. What really worked well was somewhat of a helles recipe."

Chuck adds, "This formula produced a very drinkable beer that carried the unique caramel flavor created by the stones. It was our number-one-selling beer in all our pubs. We typically sold about 7 barrels a week, week in and week out, all year round."

Batch volume: 5 US gal. (18.9 L)
Original gravity: 1.048 (12°P)
Final gravity: 1.010 (2.6°P)
Bitterness: 13 IBU
Color: 5 SRM
Alcohol: 5.1% by volume

MALTS

8.25 lb. (3.74 kg) Pilsner malt
12 oz. (340 g) Munich 10°L malt
2 oz. (57 g) Carapils malt

HOPS

0.25 oz. (7 g) Perle, 8% a.a. @ 60 min
0.75 oz. (21 g) Tettnang, 4.5% a.a. @ 10 min

YEAST

Fermentis Saflager W-34/70 or your favorite lager yeast.

BREWING NOTES

Conduct a single infusion mash at 154°F (67.8°C) for 60 minutes or use your favorite sequence of infusions, decoctions, and direct heat to perform a step mash with rests at 145°F (62.8°C), 160°F (71.1°C), and 168°F (75.6°C) for 30 minutes, 45 minutes, and 10 minutes, respectively. Lauter and sparge to collect 6.5 gal. (24.6 L) of pre-boil wort in a kettle large enough to comfortably accommodate that volume plus the stones that will supply heat. Carefully lower white-hot stones into the wort until a stable boil is reached. Boil 90 minutes, adding hops as indicated above. Swap out fresh stones as necessary to maintain a boil.

Chill the wort to 48°F (8.9°C), pitch yeast, and ferment until specific gravity measures approximately 1.020 (5.1°P). Raise the temperature to 59°F (15°C) and hold for a diacetyl rest until the specific gravity settles at or near 1.010 (2.6°P). Lager for 4 weeks at near-freezing before bottling or kegging with 2.6 vol. (5.2 g/L) CO_2.

EXTRACT VERSION

Replace the malts with 5 lb. (2.27 kg) and 8 oz. (227 g) Pilsner and Munich dry malt extract, respectively. Heat 6 gal. (22.7 L) reverse osmosis water to 160°F (71.1°C), remove from the heat, and fully dissolve the extracts. Proceed with hot-rock boil as above.

STEINBIER SUPPLIES

- ❑ Brew kettle
- ❑ Immersion chiller with hoses and water source
- ❑ 2 turkey-fryer baskets
- ❑ Firewood
- ❑ Rocks
- ❑ Fire tools
- ❑ Fan with power source *(we used a generator)*
- ❑ Brewing ingredients
- ❑ First aid kit

We started early because none of us knew how long this process would take. Could we *really* heat 13 gallons (49.2 liters) of wort to boiling and sustain that boil for an hour? It sounded daunting, but we were up for it.

Everything went smoothly. We lit our huge fire first thing in the morning to prepare a nice bed of coals. I had learned during my test day that even with a good raging fire and a generous bed of coals, adding 5 gallons of cold rocks really sucks up the energy and dampens the fire. That's why a fan is essential. The fan makes the fire so hot and efficient that it gets the temperature very high and produces no smoke: just heat, baby!

We experimented with putting the rocks down first and building the fire on top versus just chucking them into the fire. Ultimately it didn't seem to matter because the rocks eventually worked their way to the bottom anyway. Having that heavy grate at the bottom was helpful because we could easily dig them out as needed.

We found it best to assign members to specialized tasks so things didn't get too hectic and confused. Miles Eshaia, Nick McElmurry, Todd Young, Ian Romanick, and I provided the necessary muscle power to keep things rolling along like a finely tuned pit crew. Some tended the fire to keep it raging, while others dug out rocks and carried them to the pot. Two of us lifted the heavy turkey fryer basket full of rocks out of the wort, and so on. The rest of the OBC members in attendance performed such valuable tasks as pointing and laughing, guffawing, mocking, and asking condescending questions. ("Why are you doing it *that* way?! Why don't you just blah, blah, blah…?")

It all sounds crazy, but as long as you stay sober, work slowly and methodically, and use common sense, it is all very safe. A few of us lost some arm hair in the beginning because we didn't realize how much of a blast furnace we had created with the fan blowing under the fire, and the fire was burning so cleanly we couldn't see how high the flames were. (We ended up switching off the fan anytime someone needed to dig a rock out.)

The sound of lowering a 1000°F rock into wort is amazing and somewhat hypnotic. It sizzles, of course, especially if you just lower it halfway and watch it frantically boil the surrounding wort. But even after the rock is fully immersed, it still sizzles for several minutes as it gives up its energy.

The only unexpected problem was when we finally achieved a boil and realized we had no way to turn the heat down. With boil over imminent, I grabbed a spray bottle to mist down the foam a bit and saved the day from becoming a sticky mess. But it was a real fiasco for a minute or two.

At the end of the boil, we realized that our boil-off rate had been much higher than expected. Coupled with losses from removing the rocks from the wort, this gave us an original gravity of 1.070 (17.1°P) instead of our target of 1.060 (14.7°P). That meant the pitch rate would be off a little, but we just shrugged and pitched anyway.

Ultimately, everything went much more quickly than we had anticipated, and we were done by early afternoon. Once the wort had chilled, we pitched the yeast as normal and oxygenated. Left outside the rest of the day and overnight, it remained at 68°F (20°C) until I got it safely home and into my fermentation chamber.

Verdict

Two weeks later, the gravity had fallen to 1.015 (3.8°P), and the kräusen ring on the fermenter appeared different than that of any beer I had made before. It had a distinct dark gray tint, perhaps from ash residue. The aroma was mild and had a subdued malt character, but the taste was something else. It had a horribly burnt rubber phenolic flavor!

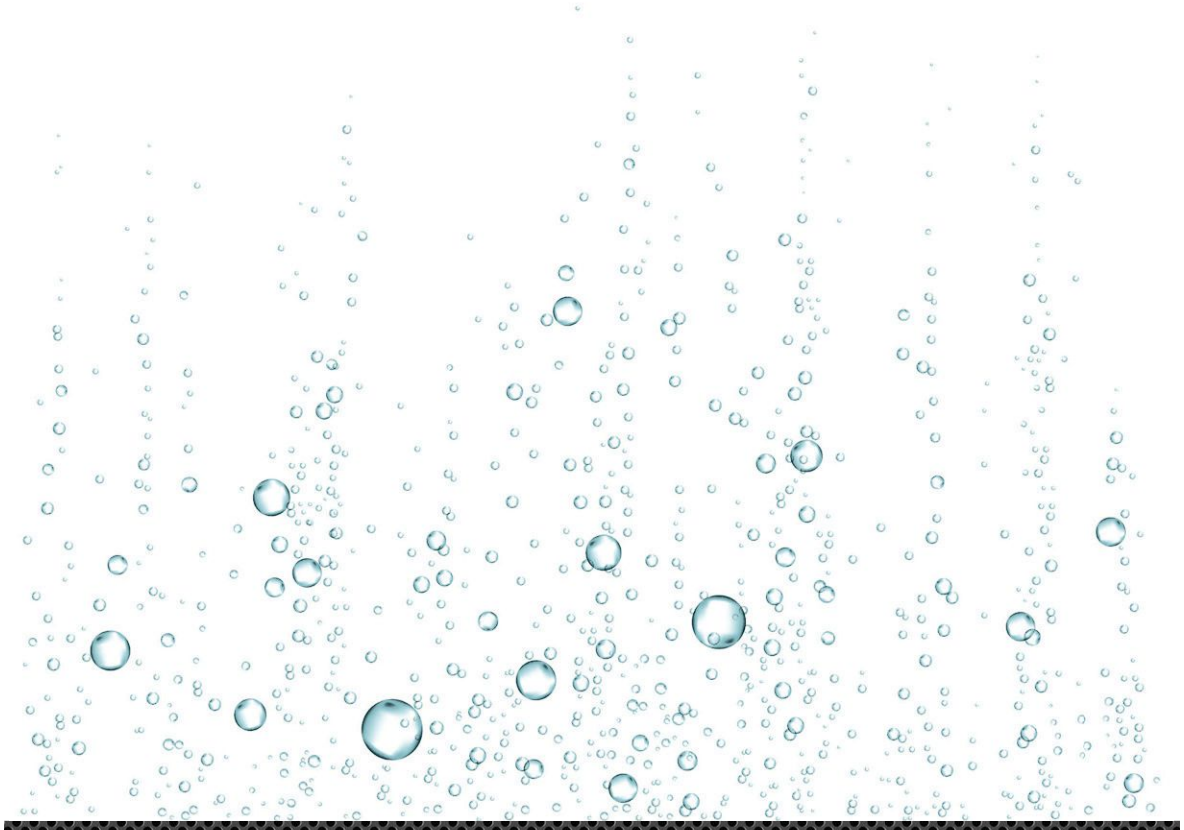
Of course, I thought it must be the ash, but this was distinct burnt rubber, like you get from a very stressed fermentation. Disappointed, I let my club know the sad news. Many didn't seem concerned and recommend that I relax, not worry, and have a homebrew.

Two weeks later, I tasted the beer again and, indeed, it had dramatically improved! The smoky note was still there, but it was not as rubbery and off-putting as before. We decided it was good enough to haul a keg down to the Social Club booth at the Portland Homebrew Con happening that weekend.

Reviews were mixed. Unsurprisingly, most of who helped brew the beer thought it was fantastic. Others still thought it had a harsh smoke flavor. I generally don't like smoked beer of any kind, so I agreed that it was still too strong and harsh. So back in the fridge it went, where it has remained with occasional tastings and hope for improvement. We are convinced that the off flavor was due to a fermentation problem, not the process of using hot rocks.

We kept our recipe extremely simple by using dried malt extract and steeping grains. We wanted to focus on the boiling process the first time around. In the future we will implement a more complicated process and eliminate some modern technology, as the club members are willing to try.

Jason Barker, a native Oregonian, homebrewer, and BJCP Certified judge since about 2012, also served two years as education chairman on the Oregon Brew Crew board of directors. He is a throat cancer survivor and dedicates this article to two fellow home brewers and great friends who lost their cancer battles, "PJ" Paul Johnson and Kate Jones.



PURE WATER

How Reverse Osmosis Works

By Martin Brungard

Water is the largest component in beer, and water quality directly affects beer quality. Brewers historically used the water they had available, but making great beer is difficult if your source doesn't provide water that's suited to brewing the beers you want to make. Purification enables brewers to tailor water to the beer you want to brew. >>>

There are several ways to purify water. Filtration removes things like bacteria and silt. Chemical precipitation can remove calcium and magnesium. However, brewers may need purer water that is better suited for the beers they want to brew. Distillation makes water pure, but that method is costly in both time and energy.

Reverse osmosis (RO) is a modern method that provides high-purity water for brewers and brewing. This two-part article guides readers on the selection, operation, and care of RO filters for homebrewing. In this part, we'll look at what RO is and what system components you should or shouldn't use for brewing.

How Does RO Work?

Reverse osmosis is the process of forcing water through a semipermeable membrane. The membrane features tiny pores that are small enough to allow water to flow while preventing most dissolved ions in the water from passing through. **Figure 1** illustrates schematically how water flows through a RO machine.

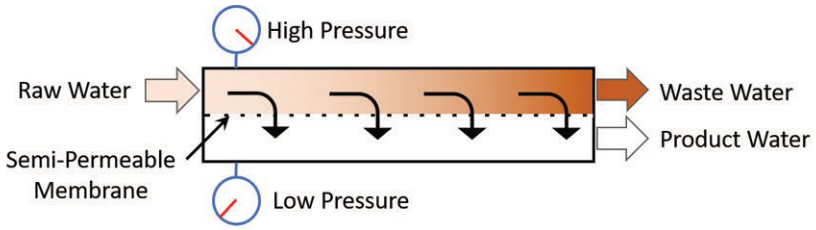


Figure 1: Schematic of reverse osmosis system flow.

A pressurized water supply drives water through the membrane, and the water on the inlet side becomes more mineralized. That mineralized water is directed to *wastewater*, while water passing through the membrane, called *product water*, has substantially lower dissolved solids.

Dissolved solids in drinking water are largely comprised of the ions—electrically charged atoms or molecules—shown in **Table 1**. The electrical charges for these common drinking water ions are also given. Although other substances are often present in drinking water, their concentrations are typically very low.

Table 1: Common dissolved solids in drinking water.

Ion
Calcium (Ca^{+2})
Magnesium (Mg^{+2})
Sodium (Na^{+1})
Sulfate (SO_4^{-2})
Chloride (Cl^{-1})
Bicarbonate (HCO_3^{-1})

The RO process was first demonstrated in 1949. Systems for industrial and municipal water supplies soon followed, but economically priced RO equipment for home use only became widespread about two decades ago. The cost to purchase and maintain home RO equipment is now within reach of many homebrewers. Most residential RO equipment uses the water pressure of your home's water supply to force water through the membrane. If the water supply pressure is less than about 50 pounds per square inch (3.5 bar), then a booster pump is recommended to increase pressure and improve the RO production rate.

The pores in a thin-film RO membrane are generally smaller than 0.002 microns. One micron is a thousandth of a millimeter (0.001 mm), and for comparison, a human hair is about 100 microns wide. RO pores are about 10,000 times smaller than the openings in most water and air filters, which are usually 1 to 10 microns. Water molecules are about 10 times smaller than RO pores and pass through the membrane. It is the small size of those RO pores that make it possible to filter out dissolved solids while letting water through.

The ions listed in **Table 1** are only slightly larger than water molecules, but these ions generally don't pass through RO pores because they have positive or negative electrical charges that attract and hold onto nearby water molecules. That is to say, the ions become "hydrated."

Imagine an ion as a person who wants to pass through a narrow doorway, but whose choice of outerwear makes it difficult to fit through. Monovalent ions (sodium, chloride, bicarbonate) have a +1 or -1 charge and can be thought of as wearing a modest, puffy coat of water. Divalent ions (calcium, magnesium, sulfate) have a +2 or -2 charge and have thicker, puffier water coats.

It is the electrical charges and sticky water coats that keep those ions from passing through RO pores while free water molecules can pass through. A greater percentage of ions such as calcium, magnesium, and sulfate are prevented from passing through the membrane (rejected) than are sodium, chloride, or bicarbonate ions. The difference in the diameters of those hydrated ions means that about 1 to 3 percent of the divalent ions and about 3 to 5 percent of the monovalent ions make it through the membrane. That is pretty good! If you know your typical raw water ion concentrations, you can estimate your RO product water quality using those percentages.

As water molecules pass through the membrane, the remaining dissolved ions become concentrated on the raw water side of the membrane. If those ions become too concentrated, some will precipitate out of solution, accumulate on the membrane, and clog it (a.k.a. scaling). To avoid excessive concentration and scaling, the RO process flushes extra water across the raw water side of the membrane, and that flow becomes wastewater. Around 50 to 85 percent of the total water inflow amount becomes wastewater. That wastewater can sometimes be directly reused as long as the mineralization doesn't interfere with that secondary use.

Water temperature is a significant factor for RO system performance. Cold water is more viscous (flows less easily) than warm water, so the production rate for RO systems is reduced when the water temperature is low. While warm water is preferred, a benefit of cold water is that the RO process rejects more of the dissolved solids from the water and the product water is purer. But the difference in purity is minor, so avoid using cold water if you live in a cold climate.

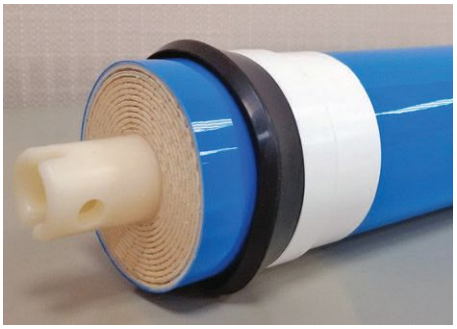
A side benefit of the RO process is that bacteria and viruses are also filtered from the product water. However, you shouldn't assume that the product water is always contaminant-free since there could be defects in the membrane that may let some contaminants through.

Another component that will make it through a RO system is dissolved gas in the raw water. For water supplies with rotten-egg aroma, the hydrogen sulfide that creates that odor will concentrate in the product water. That may require that the product water be aerated to dissipate the gas. Other gases such as oxygen and carbon dioxide also make it through the membrane, but their effects are minor.

What Brewers Need in a Reverse Osmosis System

The heart of an RO system is the membrane. Modern commercial and residential systems configure membrane cartridges into spiral-wound, cylindrical units that are compact and easy to construct. **Figure 2** shows a close-up view of a typical membrane. Those thin RO membrane layers are neither easy to clean nor repair, and a sediment filter is needed to protect the membrane from clogging or damage.

Figure 2:
End view of wound RO cartridge



Sediment Filter

To protect the membrane, the sediment filter should have a rating of 5 microns or less. A 1-micron filter is preferred as long as it doesn't reduce flow too much. If the water supply has a significant amount of sediment, adding a second, 5- to 10-micron sediment filter upstream of the main (1- to 5-micron) filter will extend the lives of the filters. Placing that second sediment filter downstream of an activated carbon filter helps keep carbon sediment out of the membrane. **Figure 3** shows a trio of filter housings for a RO system with sediment filters upstream and downstream of a carbon block filter.

Figure 3: Filter housing assembly

For residential systems, cylindrical filter units are produced in 2.5- and 4.5-inch (6.4 and 11.4 cm) diameters and 10- and 20-inch (25.4 and 50.8 cm) lengths. The housings shown in Figure 3 are 2.5-inch diameter, 10-inch long units. Those housings can hold either sediment or activated carbon cartridges. The highest-capacity membranes in a residential RO system potentially require a raw water flow rate of nearly 1 gallon (3.8 liters) per minute. That flow rate is well within the flow capability of a 2.5-inch diameter, 10-inch long filter unit. The only reason to install larger filter units for sediment removal is to extend the period between cartridge replacements.

Membrane

Residential RO units typically employ spiral-wound membrane cartridges that are 1.8 inches (4.6 cm) wide and 12 inches (30.5 cm) long (referred to as "1812" membranes). Commercial RO systems also employ spiral-wound cartridges, but their cartridge dimensions (and costs) are significantly larger.

The quality of the membranes in the cartridges is a prime consideration for the efficiency, performance, and longevity of the unit. Off-brand or unbranded membranes can provide poor treatment and short life and should be avoided. Brands such as Filmtec, AMI, and Axeon have proven performance and should be considered over off-brands.

You can obtain membrane cartridges for residential RO that yield 15 to 200 gallons per day (57 to 757 liters per day). While it may seem that you would want to obtain the highest capacity membrane available, it may not be desirable to do so. Higher capacity membranes cost more, let more ions through, and are prone to shorter life. The most important reason not to get the highest capacity membrane is that it still won't produce product water at a rate most brewers would consider acceptable. A 200 gallon per day (gpd) flow rate is equivalent to 0.14 gallons (0.5 liters) per minute, which is still slow. Compare that to the typical garden hose that delivers around 4 to 5 gallons per minute. A product water storage tank is a better option. The sweet spot for membrane production, cost, and performance seems to be in the 50 to 75 gpd (189 to 284 liters per day) range.

Carbon Filter

If your water is supplied by a municipality or utility, it likely contains disinfectants such as chlorine or chloramines. Those substances will degrade and eventually destroy RO membranes. Therefore, it is important to remove such disinfectants upstream of the RO unit. Activated carbon is typically employed for this purpose. Chlorine is removed from water about 10 times better

than chloramines when using activated carbon filtration. This difference in removal capability becomes an important factor in sizing activated carbon filtration units for RO systems.

Disinfectant removal is directly related to the time water spends in contact with the activated carbon media. If the water flow rate is too high, or if the media unit is too small, disinfectants may not completely be removed.

The choice of activated carbon media is an important one. Some media are better than others. All carbon media are effective at removing chlorine from water, but some carbon media have enhanced chemistry that improves chloramine removal. If your water supply is known to use chloramines for disinfection, then using enhanced carbon media may be helpful. Just be aware that the performance improvement of enhanced media is minor. The flow rate through the carbon must still be very slow for complete removal of chloramines.

Activated carbon media are typically coarse granules. Old-style residential carbon cartridges use granular media. Newer-style cartridges take that medium and compress it into dense carbon blocks that provide more treatment capacity. Opt for carbon block cartridges over granular activated carbon (GAC) cartridges.

The sizing and capacity of activated carbon units can be critical to preserving and extending the life of the RO membrane. If the raw water has only chlorine disinfectant, then a 2.5-inch diameter, 10-inch long carbon unit should be sufficient to remove the chlorine to supply any residential RO membrane since the total flow rate is less than 1 gpm. When the water supply is disinfected with chloramines, the size of the filter and the membrane production rate become critical. To keep chloramines from the membrane, the membrane capacity needs to be 100 gpd (379 liters per day) or less, and the carbon filter needs to be a 4.5-inch diameter, 20-inch long unit.

As should be evident from the carbon filter sizes described above, an undersized carbon unit must be avoided if long membrane life is desired. Some RO system providers offer compact systems that use in-line carbon filters that have little capability of removing all disinfectants from the raw water supply. Avoid systems with small carbon filters—they will not be able to protect your expensive RO membrane for long, which means it will have to be replaced more often.

Product Water Storage

Passing water through tiny RO pores means low RO production rate—too slow to meet the demands of a typical brew day. To provide a more usable flow rate, it's recommended to store RO product water. Two options are available for storage: open and pressurized vessels. Each option has advantages and limitations.

Open storage means that the water is stored in an open vessel and either drained by gravity or pumped from the vessel. Pressurized vessels are closed vessels that contain the pressurized water from the RO unit and use that pressure to drive the water out when needed. An open-storage system has a significant advantage over a pressurized-storage system because the much lower pressure on the product water side of the membrane lets more water through. A pressurized storage system will not produce as much product water because there is higher pressure on the product water side of the membrane. The advantage of pressurized storage is the convenience of having water flow from the tap as needed.

The very low ionic content in RO water makes it corrosive to many metals. Metal wants to dissolve into that very pure

water, so the materials used for storage vessels, piping, and fittings must be corrosion resistant. Copper, brass, iron, mild steel, and solder are not suited for RO systems. Plastics and stainless steel are most commonly used. Polyethylene, PEX, Teflon, Acetal, PVC, and ABS are examples of plastics used for RO system piping and fittings.

An important note regarding pressure tanks for RO storage: common well pressure tanks cannot be used because they have exposed internal metal surfaces that will corrode with RO water contact. Plastic-lined pressure tanks intended for RO storage are required. Be aware that RO water may also corrode low-grade stainless steel, but temporary contact with low-grade stainless brewing equipment should not be a problem. In general, non-magnetic stainless steel is safe for RO storage use.

What Brewers Do Not Need in a Reverse Osmosis System

Many RO system suppliers provide features that may not be warranted or desirable for brewery use. Suppliers often refer to each filter or treatment unit in a RO system as a *stage*. However, adding unnecessary stages may not make better brewing water. Getting only the features that you really need reduces the cost of RO system ownership.

Too Many Filters

If your water is not from a municipal supplier, it probably does not have any disinfectants in the water. That means that an activated carbon filter unit is not required to dechlorinate your raw water supply. However, all systems should include a 1- to 5-micron sediment filter before the membrane to protect the membrane.

Deionization

Some brewers think a RO system should produce the purest water possible. That is not what brewing requires, and low levels of the ions listed in **Table 1** are acceptable and desirable in brewing water. For that reason, a deionizing unit is not useful. These units remove virtually all ionic content. Only users that need extra-pure water for laboratory use or aquarium use should consider this addition.

Booster Pump

If your water supply pressure is at least 50 psi (3.5 bar), then you don't need a booster pump. Large commercial RO systems often include a pump, but their membranes are built to handle high pressure. The 1812 membrane cartridges used in residential RO systems can be damaged by excessive pressure, and an unnecessary booster pump may over-pressurize the membrane. An option for minor pressure boosting in residential RO systems is to use a permeate pump that harnesses the system's discharge pressure and uses it to slightly increase the raw water pressure. The drawback with permeate pumps is they produce a noisy, clunking sound during operation.

Discharge Carbon Filter

An activated carbon filter on the product water line is not needed for brewing. Assuming that the raw water has passed through an activated carbon filter, the taste and odor components in the raw water have likely been removed, and a post-membrane carbon filter will not significantly alter the water character or quality.

UV Treatment

Even though RO product water has had water supply disinfectants stripped away, it is still typically free of microorganisms. An ultraviolet-light (UV) treatment unit can be used to destroy waterborne organisms in conventional water treatment, but the virtually complete organism removal of an RO membrane makes UV treatment unnecessary. Additionally, UV treatment only kills organisms within the UV unit itself. Any organisms that find their way into the storage vessel downstream of the UV unit are free to grow. Fortunately, RO water is usually devoid of carbon, nitrogen, and phosphorus (the building blocks of life), and organisms will struggle to grow in it. As long as your raw water supply does not have significant dissolved carbon or nitrogen content, organisms should not grow in it. UV treatment is not necessary for most RO systems.

Summary

Reverse osmosis is a great way to obtain lightly mineralized water that you can re-mineralize to suit your current brew. RO also helps eliminate the water quality fluctuation that occurs in some water supplies. Modern technology has brought the cost of RO systems down, and they are affordable to most brewers. Purchasing a system that has only the components you need reduces the purchase price and operational costs. Having extra stages doesn't necessarily mean better water, but it almost always means higher cost. Two or three stages (sediment filter, RO membrane, and maybe carbon block) are the only components necessary for brewing use.

Here are highlights to remember:

- RO removes most of the dissolved content from the raw water: that's OK for brewing.
- The RO membrane must be protected from sediment: use a 5-micron or finer filter.
- Disinfectants in public water supplies must be removed: use a carbon block filter.
- Chloramines in your water supply mean you need a *big* carbon filter.
- RO water production is slow: get a non-reactive storage vessel.
- Don't buy system components that don't serve a brewing purpose.

In the second part of this series, we'll cover what to expect with RO system operation, RO system enhancements, and RO system maintenance.

Martin Brungard is a civil and environmental engineer who has provided water and wastewater consulting services to municipal and industrial clients for over 30 years. A member of the AHA Governing Committee, he brews in his basement brewery using reverse osmosis water to craft great beer. Martin is the author of Bru'n Water software and the Bru'n Water website for brewing water knowledge.

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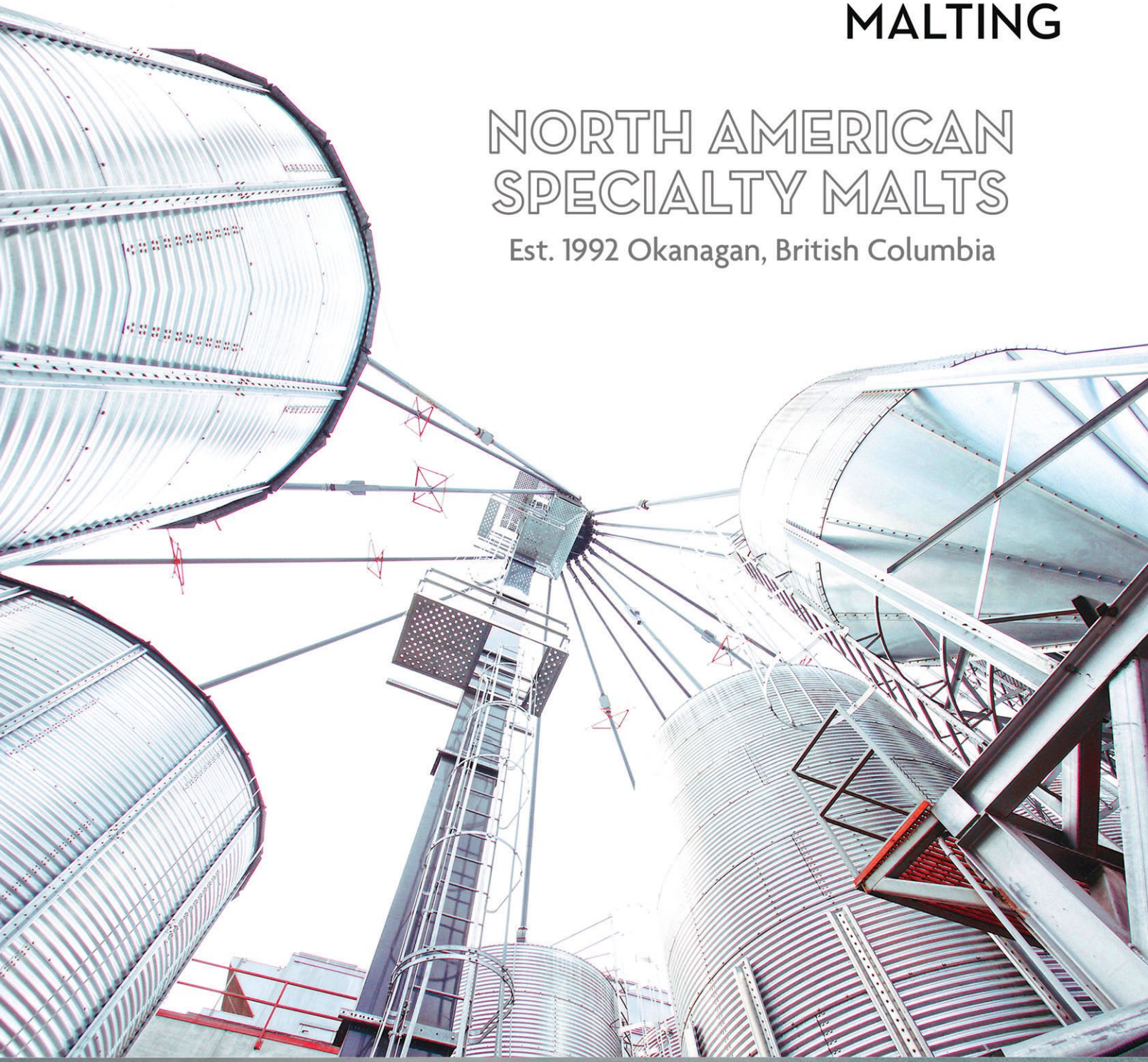

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Third Annual Port City Plunder Homebrew Competition

By Amahl Turczyn

Hosted by the Wort City Brewers (WCB), this year's Port City Plunder competition serves the Cape Fear, N.C., region and was judged Saturday, March 23 at Waterline Brewing Co. in the historic Riverfront area of Wilmington, N.C. It is an AHA/BJCP-sanctioned competition and part of the Southeastern Homebrewers Association competition circuit.

This year's competition had 252 entries from 73 individual brewers. According to competition organizer Hunter Oates, most entries were from North Carolina, South Carolina, and Virginia, but a few arrived from further afield, including Providence, R.I.; Knoxville, Tenn.; New York, N.Y.; and even Tacoma, Wash.

"Our club, the Wort City Brewers, was started in 2007 with a grand total of three members brewing at each other's houses," Oates recalls. "The name comes from the nickname of our home city of Wilmington, which is known as The Port City."

The club started small and remained that way for several years, but things really took off when a homebrew supply store opened in 2012.

"With the new meeting location, we had a much easier time obtaining equipment and ingredients," Oates continues.

Best of Show winner Benjamin Pulley with his family, left to right, Paisley, Suzanne, and Logan.

Photo © Whitney Whitfield

> "I mostly work on a propane outdoor burner, modified Igloo cooler, and some basic kitchen equipment. Nothing fancy
>
> — *Best-of-show winner Benjamin Pulley*

Top to bottom: The Wort City Brewers and judging at the Port City Plunder.

"As a result, the local homebrewing scene increased quickly, as did our club's membership. We currently have around 20 to 25 members, down a bit from our peak of 35 two years ago. We meet once a month to talk, share brews and bottles, do a guided BJCP-style group tasting and judging, and do a fair bit of Q&A. We do two large group brews a year in May and October, and we currently have two club-owned wooden barrels as part of our group sour beer project."

Despite WCB's modest size, the club's shared knowledge base makes it a powerhouse of brewing talent that continues to spawn professional brewers. "We are very proud of the fact that our club has been an incubator for the local craft beer scene," Oates says. "Eight members have gone on to brew professionally or run or manage a brewery. We keep losing our members to the industry!"

Like many clubs, WBC soon decided it needed a proving ground for local brewing talent. When a local craft brewery's annual competition fell through, the club suddenly found itself taking the reins, and the Port City Plunder competition was born.

"For many years (on and off since at least 2013), local brewpub Front Street Brewery had run an informal homebrewing competition in mid-March," Oates explains. "As the level of interest in the competition increased, so did the logistical problems for the brewery. It came to a head in January 2017, when the brewery's manager admitted that that year, their homebrew competition just wasn't going to happen.

"He offered to let our club take over but said that we had to keep the same time on their event calendar. So, we rebranded it as the first annual Port City Plunder (with a pirate theme) to distinguish it as a new AHA/BJCP-recognized event, with just eight weeks of prep time. Despite the very short schedule and an evening of having a wedding reception being set up around us while judging was still going on in our event space, the competition went through and was deemed a success."

Photos courtesy of Hunter Oates

The Plunder has been held annually since then. In 2018, the club's first competition director, Zach Kosslow (2017 AHA Homebrewer of the Year), relocated, so the club selected Oates as the new director, and Waterline Brewing Co. as the new location. "And that is where we stand currently in year three," he concluded.

One thing that helps make the Plunder competition unique is its role in the Southeastern Homebrewers Association Brewer/Club of the Year circuit. The consistency of entries year over year allows people like Oates, who are involved in circuit competitions, to track the skill and success of perennial entrants.

"We get most of our entries from other participating homebrew clubs in the region," he says. "After multiple years helping out with other competitions, you get to recognize many different names and brewing styles. The competition has a large contingent that enters every year. It has been very nice to meet several of these brewers and watch their skills progress over the years."

The club now also engages with its community by incorporating fundraising into the competition. "We held our first charity raffle with donated prizes this year. Our partner charity is Wilmington Area Rebuilding Ministries (WARM). WARM's goal is to help local elderly and low-income residents with home accessibility, safety work and repairs. We chose them because of the excellent work they do and the vast number of requests they had dealing with the aftermath of Hurricane Florence in 2018. We were able to raise $350 from the raffle sales." (More information on WARM's efforts can be found on their website at warmnc.org.)

Sponsorship for the event comes from several sources nationally and locally. "We are very grateful for the generosity of our donors," Oates said. "This year, at the national level, we have BSG, Five Star Chemicals, Blichmann Engineering, GrowlerWerks, the AHA, White Labs, GigaYeast, and BeerSmith to thank. Locally, Waterline Brewing, Wilmington Homebrew Supply, Wrightsville Beach Brewery, Good Hops Brewing, New Anthem Beer Project, Salty Turtle Beer Co., Red Hare Brewing, Bond Brothers Brewing, Elijah's Restaurant, Cape Fear Wine and Beer, Island Beverage, and The Mundy Companies gave generously to support the Port City Plunder competition. We would particularly like to thank GrowlerWerks of Portland, Ore., for their contribution of a 128-ounce uKeg beer system. It was by far the crown jewel of our charity raffle."

The competition's host venue, Waterline Brewing Co., also donated judging and storage space. Oates, in addition to serving as competition director, also holds the post of assistant brewer at Waterline—yet another tie between the Wort City Brewers and Wilmington's professional craft brewing community.

Best-of-show winner Benjamin Pulley got into brewing thanks to some friends who brewed after college, but he modestly admits that his early efforts were less than stellar.

"I only tried out a few stovetop kits at that time," Pulley remembers. "As expected, they turned out below average." But after his education, he returned to the hobby with a vengeance. "I got really into zymurgy as a biologist, so I bought some equipment and joined the Carolina Brewmasters homebrew club in Charlotte, N.C., to learn more and get better."

Armed with both local and professional knowledge, the adventurous husband and father—of a precocious three-year-old who can already name half a dozen Charlotte-area breweries—was ready to take on just about any style, and got plenty of inspiration from those craft pros.

"I'm not too picky about the beers that I drink or brew, but I have really been appreciating how good lagers are becoming right now. I brew primarily ales and only just started experimenting with kettle souring." One thing he has noticed is that some brewing styles and ingredients have

Curse

Spice, Herb, or Vegetable Beer (30A) – chocolate stout with Japones chiles

Benjamin Pulley, best of show, third annual Port City Plunder homebrew competition

Batch volume: 5 US gal. (18.9 L)
Original gravity: 1.062 (15.3°P)
Final gravity: 1.016 (4°P)
Bitterness: 35 IBU
Color: 32 SRM
Alcohol: 6% by volume
Efficiency: 75%

MALTS

10 lb. (4.54 kg) Carolina Malt House pale malt
0.5 lb. (227 g) 40°L crystal malt
0.5 lb. (227 g) UK chocolate malt
6 oz. (170 g) roast barley
4 oz. (113 g) Weyermann Carafa III

HOPS

1 oz. (28 g) Northern Brewer, 8% a.a. @ 60 min (26 IBU)
1 oz. (28 g) Northern Brewer, 8% a.a. @ 10 min (9 IBU)

OTHER INGREDIENTS

1 tablet Whirlfloc @ 10 min
15 Japones chiles @ flameout, steep 10 min

YEAST

White Labs WLP001 California Ale Yeast

BREWING NOTES

Mash at 152°F (67°C) for 60 minutes and batch sparge. Boil 60 minutes. Add chiles at flameout and steep 10 minutes. Chill to 68°F (20°C), oxygenate, remove chiles, and pitch yeast.

EXTRACT VERSION

Substitute pale malt with 7.5 lb. (3.4 kg) pale malt extract syrup. Steep remaining malts in 160°F (71°C) reverse osmosis water 30 minutes, and then remove grains. Dissolve extract in wort, top up with reverse osmosis water to desired boil volume, and proceed with boil as above.

emerged as trendy. "Lactose is becoming an overused ingredient and seems to be showing up in styles where it just doesn't fit." (Take that, milkshake IPA!)

His quest for knowledge continues as he pursues both BJCP judge and Cicerone certification. He also does "a lot of reading and re-brewing" in the noble pursuit of brewing top-quality beer. "My nightstand is filled with books about brewing, and I'm currently going through *Water: A Comprehensive Guide for Brewers*. With the perspective that book has provided, I'm going back to retry and tweak old recipes, finding and fixing any flaws the beers had. It's been invaluable, forcing myself to improve with each batch."

Pulley keeps his brewing equipment simple and straightforward but puts his microbiology knowledge to best use with top-tier yeast management. "I mostly work on a propane outdoor burner, modified Igloo cooler, and some basic kitchen equipment. Nothing fancy. I did just build my own double-tap kegerator and have been enjoying the thrill of not bottling. My next steps are yeast collection and propagation, using my biology lab equipment. I might even work on isolating my own 'house yeast.'"

Pulley's best-of-show-winning recipe was the first beer he'd ever brewed, but he's made tweaks and improvements over the years to perfect it.

"The beer that won is called Curse, which is an English-style stout with chocolate malt and chiles. I wanted it to work kind of like Mexican hot chocolate, with background spice and a warmth rather than an intense heat. This latest version has just a hint of chile heat that really works well with the chocolate malt. This is my fourth or fifth iteration of the recipe.

"I've spent a lot of time testing how to use peppers, ginger, and spices in beer, with my wife (and muse) helping me create multiple runs and experiments to determine how flavors are extracted, and the best time to add spices during the brewing process. She also helps me do 1-gallon stovetop batches of new recipes and ingredients before scaling them up to 5-gallon batch size. She's a scientist too, and loves the data collection. With this particular beer, I went through about a dozen tests to find the right quantity and time to add the peppers."

In keeping with that scientific approach, Pulley also made use of a local homebrewer-friendly craft brewery, aptly named Pilot Brewing, where he brewed his recipe on its 10-gallon pilot system.

"Pilot Brewing has this really fun Homebrew Guest series, where a person can submit a recipe, and if it's good and fits their schedule, they'll let you brew it on their pilot system. It was great experience, as it let me see the difference between my system and a professional setup.

"When I did this stout with them, we split it into two batches—the chile-infused version and an unspiced base recipe—so people can taste the difference the chiles make. The brewers also gave me brewing tips, including a better way to infuse the chiles."

***Amahl Turczyn is associate editor of* Zymurgy.**

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Relax, Don't Worry, Have a *Homebrew!*

That mantra rings as true today as it did in 1978 when Charlie Papazian cofounded the American Homebrewers Association with Charlie Matzen. Homebrewing can be as simple or as complex as you want to make it, but the first step is always to relax and not worry.

To aid your relaxation and help you get the most out of *Zymurgy*, here are some standard assumptions and methods for our recipes. Of course, when a recipe says to do something different, follow the recipe. But you can always fall back on these general tips to brew great beer.

ON THE WEB
For more detailed info, head over to HomebrewersAssociation.org and dive into our How to Brew resources.

BREWING WITH *ZYMURGY*

MAKING WORT

Most recipes in *Zymurgy* offer an all-grain version and a malt extract or partial-mash alternative. Pick the procedure you prefer and prepare some wort!

Malt Extract Recipes
Making wort from malt extract is easy.

- Crush specialty grains.
- Place milled grains in a mesh bag and tie it off.
- Steep bag of grains in 150–160°F (66–71°C) water 30 min. in your brew pot.
- Remove bag of grains from the pot.
- Fully dissolve extract in the hot, grain-infused water.
- Top up with water to your desired boil volume. (Leave some room for foam!)

All-Grain and Partial-Mash Recipes
Unless otherwise specified, all-grain brewers can conduct a single-temperature infusion mash with these parameters:

- Water/grain ratio: 1.25 qt./lb. (2.6 L/kg)
- Mash efficiency: 70%
- Mash temperature: 150–153°F (66.7–67.2°C)
- Mash duration: 60 minutes

Partial-mash recipes make the same assumptions but use a smaller amount of grain and augment the wort with malt extract.

BOILING

No matter how you get here, everyone loves adding hops.

- Boil time is 60 minutes.
- Boils are assumed to be the full batch volume, but you can also boil a concentrated wort and top up with water in the fermenter.
- Hop additions are given in minutes before the end of the boil.

Brew Lingo

Every field has specialized language, and homebrewing is no different. Here are a some of the key terms, abbreviations, and acronyms you'll find throughout *Zymurgy*.

AA – alpha acid

ABV – alcohol by volume

AHA – American Homebrewers Association

BBL – US beer barrel (31 US gal or 117.3 L)

BIAB – brew in a bag

BJCP – Beer Judge Certification Program

Chico – American ale yeast, AKA Wyeast 1056, WLP001, SafAle US-05, and others

CTZ – Columbus, Tomahawk, and Zeus: interchangeable high-alpha-acid hops

DME – dry malt extract

DMS – dimethyl sulfide, an off flavor similar to canned corn or cooked vegetables

DO – dissolved oxygen

EBC – European Brewing Convention (beer color)

FG – final gravity

FWH – first wort hops, added to the boil kettle as it fills with sweet wort after mashing

HERMS – heat exchange recirculating mash system

HLT – hot liquor tank

IBU – international bittering unit

LHBS – local homebrew shop

°L – degrees Lovibond (malt color)

LME – liquid malt extract

MLT – mash-lauter tun

NHC – National Homebrew Competition

OG – original gravity

°P – degrees Plato (density of wort or beer)

RIMS – recirculating infusion mash system

RO – reverse osmosis, a water purification process that removes most dissolved ions

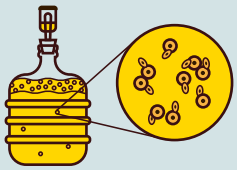
SG – specific gravity (wort/beer density)

SMaSH – single malt and single hop

SMM – S-methyl methionine, precursor to dimethyl sulfide (DMS)

SRM – Standard Reference Method (beer color)

FERMENTING & CONDITIONING



Pitch yeast into chilled, aerated or oxygenated wort.

- Use twice as much yeast for lagers as you do for ales.
- Ales ferment at 60–70°F (15–20°C). Lagers ferment at 45–55°F (7–13°C).
- Condition ales at room temperature or colder for a week or two.
- Condition lagers at close to freezing for several weeks.

BOTTLING & KEGGING

If you bottle,

- Use 1 oz. of dextrose (corn sugar) per gallon of beer (7.5 g/L) for a good, all-purpose level of CO_2.
- Use less sugar for less fizz.
- Take care with higher carbonation levels—many single-use beer bottles aren't designed for high pressure.

If you force carbonate in a keg,

- Use the chart to dial in the pressure on the regulator.
- Add 0.5 psi (35 mbar) for every 1,000 feet (300 meters) you live above sea level.
- To convert psi pressures to mbar, multiply by 69.
- To convert volumes of CO_2 to g/L, multiply by 2.

REGULATOR PRESSURES (PSI) FOR VARIOUS CARBONATION LEVELS AND SERVING TEMPERATURES

TEMP. (°F)	VOL. CO_2										
	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
33	5.0	6.0	6.9	7.9	8.8	9.8	10.7	11.7	12.6	13.6	14.5
34	5.2	6.2	7.2	8.1	9.1	10.1	11.1	12.0	13.0	14.0	15.0
35	5.6	6.6	7.6	8.6	9.7	10.7	11.7	12.7	13.7	14.8	15.8
36	6.1	7.1	8.2	9.2	10.2	11.3	12.3	13.4	14.4	15.5	16.5
37	6.6	7.6	8.7	9.8	10.8	11.9	12.9	14.0	15.1	16.1	17.2
38	7.0	8.1	9.2	10.3	11.3	12.4	13.5	14.5	15.6	16.7	17.8
39	7.6	8.7	9.8	10.8	11.9	13.0	14.1	15.2	16.3	17.4	18.5
40	8.0	9.1	10.2	11.3	12.4	13.5	14.6	15.7	16.8	17.9	19.0
41	8.3	9.4	10.6	11.7	12.8	13.9	15.1	16.2	17.3	18.4	19.5
42	8.8	9.9	11.0	12.2	13.3	14.4	15.6	16.7	17.8	19.0	20.1

■ = PSI

Source: Brewers Association Draught Beer Quality for Retailers

Sanctioned Competition Program

SEPTEMBER 2018

Maryland Microbrewery Festival Homebrew Competition, 96 entries
Sean Kinnas, Irwin, PA

Fresh Hop Ale Festival, 30 entries
Garret Burge, Kennewick, WA

2º Concurso CCGM de Cervejas Caseiras, 30 entries
Jorge Glaucio, Rio de Janeiro, Brazil

Rocktober Fest, 181 entries
Steve Wilson, Beaverton, OR

6th Annual O'Connor's Home Brew Shop Competition, 98 entries
Andrew Brouwers, Grand Rapids, MI

Festival Curitibano de Cerveja Artesanal 2018, 22 entries
João Carlos Maximiano, Curitiba, Brazil

III Concurso Caceres Beer, 31 entries
Javier Cedres, Las Palmas de Gran Canaria, Canary Islands, Spain

Indy Brew Battle, 25 entries
Matt Anderson, Indianapolis, IN

Big Muddy Monster Brew Fest Home Brew Competition, 93 entries
Rick Henson, Percy, IL

New South Brew Off, 163 entries
Jacob Marcek, Clarksville, TN

Dubim Yourself - Biratenu, 8 entries
Tony Fall, Jerusalem

QUAFF COC - American Amber & Brown, 8 entries
Harold Williamson, San Diego, CA

CRAFT Homebrewer of the Year Competition 2, 5 entries
Donald Aldea, MI

OCTOBER 2018

Oktober Fest Santiago 2018, 51 entries
Francisco Geronimo, Santiago, Dominican Republic

O'Zapft Is!, 218 entries
Kevin Foster, Chamblee, GA

Alaskan Homebrew Competition - Autumn Pour, 109 entries
Jamey Barlow, Waxhaw, NC

ASH Fall Classic 2018, 199 entries
Andy Lutz & Stuart Siegel, Scottsdale, AZ

Valhalla: The Meading of Life, 100 entries
Daniel Cowan, Glen Burnie, MD

Colorado Startup Brews, 42 entries
Robert Johnson, Denver, CO

The Great Pumpkin, Cider, and Fall Beer Competition, 9 entries
Joel McGormley, Zionsville, IN

Fresh Hop Competition! 14 entries
Aaron Schulz, Bloomington, IL

Smoke in The Valley, 34 entries
James McMahon, Waterbury, CT

Brixtoberfest, 211 entries
Jeff Landers, Chicago, IL

Hob Nob Brew Oktoberfest Homebrewer Competition, 5 entries
Orin Clark, Saint Helens, OR

Terrapin Home Brew Fruit IPA Competition, 96 entries
Christopher Riley, Lexington, NC

Anchor Town Invitational Homebrew Competition, 47 entries
Mike Fisher, Anchorage, AK

II Copa Kylix de Hidromel - Caseiros, 49 entries
Wagner Amorin, Florianópolis, Brazil

Copa Concerva-PR - Etapa de Campo Mourão, 43 entries
Flávio Henrique Zanin Meneguetti, Maringa, Brazil

Concurso 5º Festival da Cerveja Carioca - Acerva Carioca, 62 entries
Claudio Furtado Cosentino, Rio de Janeiro, Brazil

2018 MUG Competition, 200 entries
Doug Vande Velden
Northshore on Tap, 30 entries
Benjamin Tate, Slidell, LA

Good Beer Homebrew Competition, 53 entries
Douglas Wilhite, Salisbury, MD

May the Best (Wo)Man-Darina Win!, 30 entries
Brian Whalen, Dartmouth, NS

CPARC Homebrew Festival & Competition, 20 entries
Jeremy Winn, Mechanicsburg, PA

Michigan Mead Cup, 142 entries
Matthew Weide, Minneapolis, MN

Oktobersbest Homebrew Competition, 185 entries
Jason Massing, Cincinnati, OH

The Sower's Cup, 441 entries
Chester Smith, Des Moines, IA

Lights Out! Dark Beers Only Competition, 157 entries
Dave Frombach, Poulsbo, WA

Jacktoberfest, 38 entries
Chris Hawkins, Brandon, MS

NoVA Homebrew Competition Classic, 192 entries
Omar Al-Nidawi, Washington, DC

2018 Oregon Brew Crew Fall Classic, 274 entries
Dan Wright with co-brewer Kevin, Hillsboro, OR

13th Annual New England Regional Homebrew Competition, 433 entries
Ian Anderson, Swampscott, MA

Oktoberfest in October, 69 entries
Jameson Beaver, Tampa, Florida

II Concurso Homebrewer de Córdoba, 62 entries
Eduardo Aragonés (Historical) & Juan Picón (Clásicas), Almería, Spain

Ida Grove Wine & Bier Contest, 51 entries
Craig Samek, Sioux City, IA

SOBA National Homebrew Competition, 675 entries
Jimmy Henderson & Brett Houliston, Dunedin, New Zealand

Brew Brighton: Brew Local, 18 entries
Lewis Hamilton, England

Schnapp Hans Cup, 164 entries
Kevin Last, Cedarburg, WI

DECEMBER 2018

V. Concurso Nacional del CCCUY, 156 entries
Federico Fernández, Montevideo, Uruguay

A Campfire in the Woods, 15 entries
Sean Murphy, Charleston, SC

Concurso Casa OLEC 5 Anos, 154 entries
Alison N. Gomes, Belo Horizonte, Brazil

MCM Homebrewer of the Year Q4, 7 entries
Ryan Moore, Garden City, MI

JANUARY 2019

RISOFF19 - A Fundraiser for the Fight against Cancer, 30 entries
Kyle Kiely, St. Louis, MO

Big Beers, Belgians & Barleywines Festival, 300 entries
Torre Ahlberg, Longmont, CO

Winterbrew 2019, 265 entries
Ryan Walker, Chicago, IL

Concurso de Delícias da Tradição Alemã 36° Festa Pomerana, 20 entries
Matheus Rauh, Pomerode, Brazil

St. Cloud Craft Beer Tour Homebrew Competition, 34 entries
Brent Wilkerson, Two Rivers, WI

Batailles des Bieres Homebrew Competition, 33 entries
Joe Thibodeaux, Baton Rouge, LA

SCB Annual Competition, 60 entries
Anna Moe & Neil Page, Ry, Denmark

Copa San Arnulfo Invierno, 24 entries
Luis Aguilar, Guadalajara, Mexico

2019 Doug King Memorial Homebrew Competition, 90 entries
Jerald Pike, Thousand Oaks, CA

El Dorado County Fair Homebrew and Commercial Competitions, 162 entries
Dylan Cusack, Dixon, CA

Four Leaf Brewing's Capture the Tap Competition, 36 entries
George Turner, Warren, MI

DOZE Club Competition, 18 entries
Max Brown, Antioch, CA

Copa Fermentados del Sur, 74 entries
Matias Nahrwold, Villarrica, Chile

Minivashlim 2019, 34 entries
Vladislav Skorik, Haifa, Israel

Copa San Arnulfo Invierno 2019, 19 entries
Mario Merino

FEBRUARY 2019

KLCC Brewfest Homebrew Competition 2019, 258 entries
Russell Berger, Portland, OR

21st Domras Cup Mead Competition 2019, 194 entries
Nathan Steigman, St. Paul, MN

SBL Beauty Pageant, 8 entries
Dave Goodell, Richmond Hill, GA

All American Homebrew Competition, 332 entries
Garrett Bergquist, Matthews, NC

LIBME February Pro-Am 2019, 32 entries
Justin Hansen & Mark Williams, Manorville, NY

BeerYamina, 120 entries
Gil Sonnenreich, Haifa, Israel

Great Northern Brew Ha Ha, 246 entries
Tom Roan & Nancy Bowser, Fargo, ND

1° Concurso Imperio do Cervejeiro, 15 entries
Johann Braun, Blumenau, Brazil

Rhapsody in Brew, 61 entries
Timur Snoke, Pittsburgh, PA

Orange Country IPA Classic, 42 entries
Bill Pierce, Huntington Beach, CA

Hogtown Brewers February 2019 Intraclub Competition, 15 entries
Kevin True, High Springs, FL

Stout Bout 2019, 97 entries
Isaac Miller, Portland, OR

Homebrew Alley XIII, 416 entries
George Cayea, Port Washington, NY

BRRR Fest Home Brew Competition, 24 entries
Robert Olsen, St. Louis, MO

Portland Mashing Maineiacs Ground Hog Day Competition, 87 entries
Ramsay Hoguet, Boston, MA

I Ciruelo BrewBand Cup, 65 entries
Gabriel Velasco Plasencia, Canary Islands, Spain

UK National Homebrew Competition, 327 entries
Josh Smith, London, UK

West Coast Brewers IPA Comp & Swap, 13 entries
Michael Priest, Perth, Australia

KCBM 36th Annual Competition, 539 entries
Christopher Morrisey, Kansas City, MO

Mashed In 2019 Homebrew Competition, 37 entries
Dan DeKalb, Norman, OK

Continued >

ON THE WEB
For an up-to-date calendar of AHA and BJCP events, visit the Events section of HomebrewersAssociation.org

Blount County Brewoff, 42 entries
Joe Edidin, Maryville, TN

3rd Annual SheBrew Homebrew Competition, 215 entries
Jessica Hanley, Portland, Oregon, OR

Beerfest, 187 entries
Mikko Pludra, Melbourne, Australia

Bluff City Brewers Extravaganza!, 288 entries
David Byer, Hot Springs, NC

2019 Monsters of Malt Homebrew Competition, 74 entries
Mark Brzezinski, Batavia, Ohio

Peach State Brew Off, 370 entries
Jordan Morgan, Alpharetta, GA

2019 GEBL IPA Bracket Challenge, 89 entries
Matthew Hibbs, Auburn, WA

Cowtown Yeast Wranglers Homebrew Roundup 2019, 459 entries
Brandon Hart, Calgary, AB

2019 Garrison Home Brew-Off, 29 entries
David Pepper

War of the Worts XXIV, 652 entries
Jack Robbins, Warrington, PA

Romancing the Beer, 335 entries
Tricia and Jamie Gallant, San Diego, CA

JBLM Homebrew Competition, 257 entries
Charles MacAluso, St Helens, OR

Third Annual Northern Arizona Homebrew Competition, 30 entries
Tim Godin, Cottonwood, AZ

5th Annual Hammond River Brewing Home Brew Competition, 18 entries
Matt Stevers, Fredericton, NB

MARCH 2019

Bockfest, 57 entries
Eric Carman, Oxford, OH

Damned in Black Imperial Stout Homebrewing Contest, 20 entries
Lorenzo Maviglia, Piacenza, Italy

Winterfest, 129 entries
Philip Mountain, Las Vegas, NV

QUAFF COC - American Pale v. American IPA, 19 entries
Kevin Masaryk & Kazuko Mazaryk, San Diego, CA

Lancaster Iron Brewer VII, 237 entries
Don Lewis, Hartly, DE

Shamrock Open XXIV, 316 entries
Chris Compton, Columbia, SC

Wolfgang Cup 2019, 20 entries
Paul Nolan, Cape Town, South Africa

Fur Rondy Homebrew Competition, 43 entries
Mike Cragen, Anchorage, AK

Good Robot FemmeBrew, 20 entries
Brittany McAloney, Halifax, NS

Lethbridge Werthogs Beer Competition, 207 entries
Chelsea Tessier, Edmonton, AB

LIBME March Pro-Am 2019, 31 entries
Gregg Kelley, Farmingville, NY

2018 Bert Grant Competition, 18 entries
Dennis Nagy

Green Flash & Kirk's Brew American IPA Homebrew Competition, 23 entries
Justin Cermak, Gordon Coke, Jeremy Fischer & Jay McConnell, Lincoln, NE

Cascade Brewers Cup, 301 entries
Jim Dunlap, Woodinville, WA

Kona Brewfest Rocket Rod Homebrew Competition, 89 entries
James Brogan, Mililani, HI

12th Annual Virginia Beer Blitz, 336 entries
Joel Miller, Glen Allen, VA

Liberty Home Bock & German Fest, 77 entries
Tim McKee, Cincinnati, OH

2019 Washington Mead & Cider Cup, 115 entries
Tim Leber, Kent, WA

Garden State Homebrew Competition, 269 entries
Karl Weiss, Wharton, NJ

29th Annual Hudson Valley Homebrewers Competition, 478 entries
Eric Wassmuth, Lagrangeville, NY

Krausen Cup, 241 entries
Mark Rockwood, Eugene, OR

3rd Annual West Plains BrewFest Homebrew Competition, 16 entries
Andrew Littleton, Rogersville, MO

Lager Than Life, 91 entries
Mark Charlwood, London, United Kingdom

Drunk Monk Challenge, 693 entries
Joe Kotvan, St. Charles, IL

March Mashness, 129 entries
Ryan Stack, St. Cloud, MN

Champion of the Pint, 296 entries
Jeff Muse, St. Louis, MO

IBD Scottish Section Home Brew Competition and Exhibition, 38 entries
Adrien Texereau, Edinburgh, Scotland

Hogtown Intraclub Lager Competition, 12 entries
Bill Edwards, Gainesville, FL

Conical Cup, 81 entries
Richard Hogg, Hawley, PA

Celebrity Deathmash 2019, 102 entries
Ray Bilyk, Southgate, MI

Hop Idol 2019 Homebrew Contest, 105 entries
Dan Schlegel and Frank Hammack, Hillsboro, OR

California State Fair Homebrew Competition, 838 entries
Jordan Reed

Lupuleros Spring Challenge 2019, 10 entries
Alfredo Eguiza, Noemí Herrera & Ramon Moreno, Zapopan, Mexico

The Western NY Homebrew Competition - "Amber Waves of Grain," 414 entries
Mark Zambron, West Seneca, NY

5th Annual Stout Smackdown, 65 entries
Na Seung Yob, Daegu, South Korea

Mazer Cup International - Amateur, 700 entries
James Davis, Centennial, CO

Suwanee Beer Festival HomeBrew Competition, 206 entries
Zane Oliver, Atlanta, GA

Snake Saturday Irish Competition, 29 entries
James Scrogin, Lansing, KS

THC Club Only - Hybrid Beers, 11 entries
Harrison Roberts, Tucson, AZ

Márciusi sörforradalom, 219 entries
Daniel Śledzikowski, Dabrowa Górnicza, Poland

Robot Brewing Homebrew Competition, 80 entries
David Somers

West Coast Brewers; Session or Saison, 21 entries
Tim Mains, Perth, Australia

Concurso Asociación de Cerveceros Caseros Españoles (ACCE), 150 entries
Antonio Francisco Fernández

Betsisa 2019, 125 entries
Elad Talbi, Tel Aviv, Israel

IBU Open, 365 entries
Dustin Borror, Des Moines, IA

Match Beer ACCE 2019, 60 entries
Expat team

Charlie Orr Memorial Chicago Cup Challenge, 449 entries
James Todd, Frankfort, IL

Star City Homebrew Throwdown, 114 entries
Rudy Lyon, Roanoke, VA

Concurso Hop Fest de Cerveja Caseira, 50 entries
Jonas Geiss, Guarulhos, Brazil

DC Homebrewers Club Cherry Blossom Competition, 222 entries
Kevin Kiernan, Washington, DC

3rd Annual Port City Plunder, 252 entries
Benjamin Pulley, Charlotte, NC

NHC, National Competition, 495 entries
Oisin Dorgan, Kilkenny, Ireland

Los Angeles Belgian Brew Challenge, 74 entries
John Ford, Fort Myers, FL

The Connecticut Homebrew Club Competition, 18 entries
Paul Hayslett, Guilford, CT

Campionato nazionale MoBI - tappa I, 80 entries
Jacopo Deola, Italy

MCM Homebrewer of the Year Q1, 10 entries
Dan Kukuk, Grosse Point, MI

Scorpion Homebrew Competition, 80 entries
Charles Brown, Sykesville, MD

Equinox Mead Competition, 32 entries
Jeff Rhame, Eagle River, AK

Brooks Brewing / CRAFT Club Competition, 7 entries
Dan Fick, Berkley, MI

APRIL 2019

Where's your EDGE Homebrew Pro/Am, 37 entries
Ted Martinez, Ontario, OR

Fools and Fans Festival, 56 entries
Nick Grenfell, Johannesburg, South Africa

ON THE WEB
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Delightful as the warm glow of a sleepy mountain village, Dark Munich brings a stunning red hue and full-flavored finish to your craft. **Wunderbar!**

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COUNTRY MALT GROUP

Ah, summer. What better time of year to enjoy a black, luscious, boozy imperial stout? We're big proponents of drinking what you like when you like—sometimes that means weizen in winter and stout in summer. For those who appreciate a hefty, inky stout any time of year, our judges have evaluated two extraordinary high-gravity seasonals: Sierra Nevada Narwhal and Oskar Blues Ten FIDY.

"A black hole of burly malt flavor, Ten FIDY is made from immense amounts of big, dark malts … resulting in a giant, →

→ opaque, cosmic beer entity," says Oskar Blues. Ten FIDY pairs over-the-top viscosity with notes of chocolate, cocoa, caramel, and espresso. Munich and caramel malts add depth, and oats add heft to this burly, 38 SRM, 65 IBU, 10.5% ABV sipper.

In recent years, Oskar Blues has released a number of variations on this classic, including barrel-aged renditions. But original Ten FIDY stands well on its own, no accoutrements necessary.

The other heavyweight champ, Narwhal, brims with coffee, licorice, baker's cocoa, roast grain, and a hint of wood smoke, with 10.2% ABV and 60 IBUs from Magnum and Challenger hops. Pale, caramel, and honey malts are colored deep black with chocolate, Carafa III, and roast barley.

"Narwhal Imperial Stout is inspired by the mysterious creature that thrives in the deepest fathoms of the frigid Arctic Ocean," says the brewery. "Aggressive but refined with a velvety smooth body and decadent finish, Narwhal will age in the bottle for years to come."

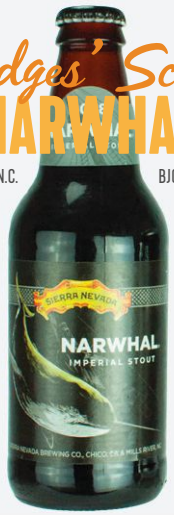
If you've had the foresight to tuck away a few bottles or cans of these sinfully strong stouts in your beer archives—and both of these beers take very well to a year or three of cellaring—taste along with our judges as they delve into their dark and heady secrets.

Judges' Score

NARWHAL

Sierra Nevada Brewing Co., Chico, Calif. & Mills River, N.C.

BJCP Category 20C Imperial Stout



AROMA

Malty aroma with notes of roasted barley, coffee, and chocolate malt. Plenty of ethanol. Light, earthy hop aroma and moderate dark-fruit esters. No DMS. No diacetyl. All well balanced, showing off the full spectrum of imperial stout complexity. **11/12**

APPEARANCE

Black and opaque. Rocky, dense, brown head with excellent retention. A beautiful beer. **3/3**

FLAVOR

Roasted malt flavors are lighter than in the aroma. Soft coffee and chocolate notes. Ethanol is dominant but supported by firm bitterness and moderate fruity plum and prune esters. A low, balancing, earthy hop flavor adds to overall complexity. Some lingering bitterness in the finish. A very well-balanced imperial stout. **17/20**

MOUTHFEEL

Medium-full body. Lightly chewy mouthfeel is somewhat lighter due to high alcohol presence. High alcohol warming. **4/5**

OVERALL IMPRESSION

A very drinkable and inviting imperial stout. Malt complexity delivers coffee and chocolate notes. Hop aroma and flavor add to the complexity, as do the fruity esters. Alcohol, while not hot or fusel, is a bit too assertive, though it does contribute a sweetness and fruitiness that lighten the mouthfeel from firmly chewy. Additional body and mouthfeel would put this in the stratosphere. Would pair well with a soft triple-cream blue cheese or chocolate cheesecake. **8/10**

TOTAL SCORE 43/50

AROMA

Moderate malt at first: dark bread, substantial roast, some anise, and a slight coffee note. As it warms, low notes of dark fruits, prune, and plum emerge, plus some low bittersweet chocolate and a slight smoky, hammy tone. No notable hop aroma. Moderate alcohol sweetness. **10/12**

APPEARANCE

Color is the deepest brown, almost black. Opaque, dark and inky. Foam is a thick, medium tan color with a rocky, almost mousse-like texture. Excellent head retention. **3/3**

FLAVOR

Medium high maltiness leads with dark bread tones, slight caramel, bittersweet chocolate, a tinge of coffee, plus some char. Bitterness is medium high, with a moderate herbal hop flavor and a low roast bite that lessens the smoothness. Alcohol is moderate, perhaps with some higher alcohols. No esters. **16/20**

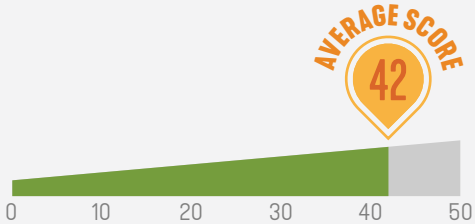
MOUTHFEEL

Medium-full body with medium carbonation. Mouthfeel goes from smooth and silky to roasty astringency that lingers. Alcohol warming is a little bigger than moderate and leaves a semi-dry finish. **4/5**

OVERALL IMPRESSION

Assertive, big, and somewhat boozy, this imperial stout has layers that invite you to spend time tasting it as it warms and evolves. Malt complexity could use a bit more depth, while roast level would best be trimmed back a bit. Will likely age well. **8/10**

TOTAL SCORE 41/50



Judges' Score
TEN FIDY

Oskar Blues Brewery, Longmont, Colo., Brevard, N.C. & Austin, Texas | BJCP Category 20C Imperial Stout

AROMA
Initial impression includes moderate notes of vanilla and bourbon, with molasses and a little soy sauce. Moderate roasted notes recall roasted coffee and dark chocolate. Medium-high dried fruit esters, mainly raisins and prunes. Noticeable ethanol has a touch of solvent. No hop character. **10/12**

APPEARANCE
Very dark, but not opaque. The head has moderately high retention that is better than most high-alcohol beers. Good clarity. **3/3**

FLAVOR
Malt character dominates, with bitter chocolate, coffee, and molasses, enhanced by raisins, dates, caramel and toffee. Medium bitterness is not quite enough to balance the malt and alcohol. Some oxidized notes of sherry, soy sauce, and port. Medium finish has lingering sweetness, alcohol, and roasted malt. Much like a cross between an imperial stout and an old ale. **16/20**

MOUTHFEEL
Rich mouthfeel with pronounced residual sugars. Alcohol is apparent, but does not have the light solvent notes found in the aroma. Dark malts add a touch of acidity. **4/5**

OVERALL IMPRESSION
This sample is a complex example of an imperial stout, more British than American, with some old ale character. The focus is on malt complexity, with oxidation providing complementary dried fruit and molasses notes. The alcohol helps lighten the body, but the finish is still on the sweet side. It could be slightly drier, but it's well crafted and a pleasure to taste. **7/10**

TOTAL SCORE 40/50

AROMA
Strong roasted coffee with significant alcohol. Dark chocolate, a slight metallic note. Moderate piney hop character. Light, creamy sweetness. Grainy base, toasty notes, very light fruitiness. Seems clean. **9/12**

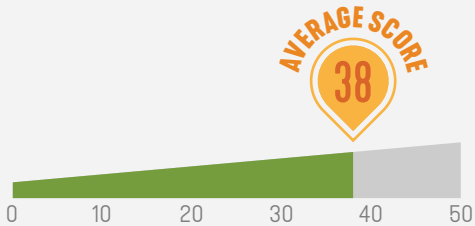
APPEARANCE
Tall head of cascading tiny brown bubbles, almost like a nitro pour. Jet black, opaque. Creamy, mousse-like head persists and laces glass. **3/3**

FLAVOR
Strongly roasty, bitter, and boozy. Strong coffee flavor with dark unsweetened chocolate. Bitter from hops and grain. Clean fermentation character, but substantial alcohol lingers. Roasty, bitter aftertaste. Piney, herbal hops clash a bit with the roast. Very light esters. **14/20**

MOUTHFEEL
Full body. Medium carbonation. Quite creamy. Rather warming to hot. Some astringency. The heft is welcome; the heat, not so much. **3/5**

OVERALL IMPRESSION
Alcohol heat adds to bitterness and makes it harder to appreciate the malt. The roast is very bitter, like unsweetened chocolate and coffee grounds. Sweetness in the aroma does not come through in the flavor. Maybe it will mellow with time, but it seems overly aggressive to drink young. It's a little better when warmer but still drinks too hot. **7/10**

TOTAL SCORE 36/50



JUDGING
One way beer judges check their palates is by using commercial "calibration beers"—classic versions of the style they represent. *Zymurgy* has assembled a panel of four judges who have attained the rank of Grand Master in the Beer Judge Certification Program. Each issue, they score two commercial beers (or meads or ciders) using the BJCP scoresheet. We invite you to download your own scoresheets at bjcp.org, pick up a bottle of each of the beverages and judge along with them in our Commercial Calibration.

OUR EXPERT PANEL
Includes Dave Houseman, a Grand Master VI level judge and competition director for the BJCP from Chester Springs, Pa.; Sandy Cockerham, a Grand Master V level judge from Indianapolis, Ind. and an associate exam director and Midwest Representative for the BJCP; Scott Bickham, a Grand Master IV judge from Corning, N.Y., who has been exam director or associate exam director for the BJCP since 1995; and Gordon Strong, a Grand Master X judge, principal author of the BJCP Style Guidelines, and president of the BJCP board who lives in Beavercreek, Ohio.

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The Independent Craft Brewery Seal is your assurance that the beer you're holding was crafted by a small, independent, traditional brewery.

ON THE WEB
Sierra Nevada Brewing Co.
sierranevada.com

Oskar Blues Brewery
oskarblues.com

BJCP Style Guidelines
bjcp.org

Illustrations by Terry McNerney


Oktober
Oktober
CAN SEAMERS

Amigo the Devil

By Kristen Kuchar

Many people spend their lives trying to find one thing that they are both passionate about and can do well. Danny Kiranos found his early on. Actually, he found two—brewing beer and making music. Kiranos, known as Amigo the Devil on stage, tours the country playing to sold-out crowds, sometimes with a unique beer specially designed for the show. He makes music like he makes beer—with undeniable creativity, curiosity and an innate desire to explore and discover. →

Photo © Justin Pope

Amigo the Devil brews an unfiltered blend of folk and dark humor into his music.

Danny's homebrew is hard to classify, his music even more so. Whether you call it Southern Gothic, Dark Folk, Murder Folk, or something else, Amigo the Devil's clever, morbid humor weaves through tracks such as "I Hope Your Husband Dies," "Dahmer Does Hollywood," and "Cocaine and Abel."

Kiranos says it's easy to see how beer and music mesh on the surface. People drink beer and listen to music, and music plays at most taprooms and breweries. But there is more to the intersection of these two worlds, he believes. Beneath the surface, he says, the two cultures are related as non-traditional paths.

"Music and beer are both alternative industries," he says. "When you tell someone you're a brewer or a musician, it's not the same thing as telling them you're a banker. Neither are standard professions. Both have an intrigue to them." In his experience, both are also creative activities that are somewhat risqué.

"I know a lot of brewers who are musicians and, likewise, musicians who are interested in brewing, or actually brew when they aren't on the road," Kiranos says. "It's one of those things that doesn't seem to have an explanation. Maybe it's because both produce a cool, creative product. Or maybe it's pure circumstance."

But whatever the reason, he's happy that the two mix so well. "I don't know what I would do without both," he says. Danny's homebrewing inspires his music and is something he considers to be his total escape.

"Brewing is the only time I get to not think about anything else," he says. "It's a mental rest, and without that regenerative time, I wouldn't be able to do what I do musically," he explains. "The creative side of the music wouldn't exist without the alone time of brewing."

Kiranos's earliest memory of beer was at a brewpub with his dad. "I saw all these big tanks, big to me at least, and I remember wondering, 'What do you do with that?'" He and his dad got a chance to chat with the brewer, and that experience stuck with him and continued to pique his curiosity about brewing.

Years later when the young musician was touring, while browsing the refrigerated area of a gas station, he noticed one beer standing out from the sea of macro brands: Arrogant Bastard. "I didn't know any beers outside of those staples existed, and I realized this was an entire category of beer I didn't know about," he remembers.

Craft-curious Kiranos wanted to venture into this subcategory and discover what he was missing out on. He realized the easiest way to learn about craft beer was to make it himself. He started at the first place he could think of—his local library in Miami. There, he found two or three books and began to learn how beer was made at home. "I had no idea what I was doing and had some complete failures," Kiranos recalls. "I didn't understand the concept at the time," he says. "I was going to the grocery store and buying things that said *barley* on them," he laughs.

Kiranos kept at it, even though he described his early brewing days as "a mess." His friends were also learning about beer, and even while touring, he started getting a real knowledge of styles. This was all happening at a time when he was debating a career to pursue outside of music. He knew he didn't want to attend a traditional college, and while he loved beer, he wasn't old enough yet to do anything with it. Culinary school seemed like a good alternative. "I figured I could apply what I learned about flavors, textures, and ingredients to brewing," he says.

From there, Kiranos set out for San Francisco, where he took a job at ThirstyBear Brewing Co. and learned a great deal about brewing. Wanting to take his skills to the next level, he enrolled in an intensive year-long brewing program, starting in Chicago at the Siebel Institute, and then on to Munich, Germany.

"It was a lot of fun and a hell of an experience," he says, though, he admits there was still much to learn about the beer industry beyond the technical side. "I thought I would learn more from going to brewing school than I would from actually brewing, but it turns out that was not entirely accurate," he says.

Kiranos took his newfound brewing education to Stone Brewing in San Diego. "It was a whole different experience in the big production," he says. "But whenever I could, I was still homebrewing and helping little brewpubs."

While Stone offered Kiranos the opportunity to brew with the big dogs, the time he spent there brought something else to the table. It was at Stone that his direction completely shifted. While working the night shift, he had quite a bit of downtime and started playing music again, something that had been on hiatus for him up until

Dragon of the Black Pool

Batch Volume: 10 US gallons (37.9 L)
Original Gravity: 1.038 (9.5° P)
Final Gravity: 1.016 (4° P)
Bitterness: 15 IBU
Color: 17 SRM
Alcohol: 4.2% by volume
Efficiency: 59%

FERMENTABLES

10 lb. (4.54 kg) Maris Otter pale malt
3 lb. (1.36 kg) black rice
2 lb. (907 g) brown malt
2 lb. (907 g) flaked oats
1 lb. (0.45 kg) pale chocolate malt

HOPS

1.5 oz. (42 g) East Kent Goldings, 5% a.a. @ 60 min (15.3 IBU)

WATER

Ca 100 ppm, Mg 5 ppm, Na 35 ppm, Cl 60 ppm, SO_4 50 ppm, HCO_3 26 ppm

YEAST

White Labs WLP090 San Diego Super Yeast

BREWING NOTES

Conduct a cereal mash with the black rice, 10 oz. (284 g) of the Maris Otter, and 5.5 qt. (5.2 L) water in a small brew pot. (See "Brewing with Rice" in the May/June 2017 issue of *Zymurgy* to learn how to perform a cereal mash.)

As the cereal mash nears completion, mash in the remaining grains with 18 qt. (17 L) water at 152°F (67°C) in your mash tun. When the cereal mash is complete, allow it to cool to approximately 152°F (67°C) and then add it to the main mash. Hold the combined mash for 60 minutes at 152°F (67°C).

Lauter, sparge, and collect wort. Boil for 60 minutes, adding hops as indicated. Ferment at 65°F (18°C) for one week or until specific gravity stabilizes at or near 1.016 (4° P). Bottle or keg with 2.5 vol. (5 g/L) CO_2.

Owing to the lack of readily available black rice extracts, partial-mash and extract formulations of this recipe are not recommended.

then. "All this time I had completely given up music," he says. "But I started messing around with it again."

It was also an experience that made him recognize that what he really loved was homebrewing. "I realized that the production thing wasn't really my forte, even though I have a lot of love for that environment," he says. "For me, I missed working on smaller batches in confined spaces," he says.

While he was embracing his passion for music again, he planned to move to Orlando and open a brewery. "We had all of the equipment sitting in storage, the paperwork, the building, and it all fell apart at the last minute," he says. But it was that unexpected event in Orlando that sparked his decision to go all in with his music career.

Even after eventually moving to Austin to pursue music, Orlando's community continues to stick with him. "There are so many people that are doing amazing work to build up the craft beer scene in that area," he says. He fondly recalls brewing small batches with Brent Hernandez, owner of the popular Redlight Redlight, a 50-liter (13-gallon) brewhouse and beer bar in Orlando. "It felt like the perfect mix between homebrewing and pub brewing: big enough to share with the public but small enough to experiment," he says. "It really revitalized my brewing enthusiasm."

Even while touring now, Danny still combines the two passions that showcase his incredible talent.

"I'm able to collaborate with friends to make a special beer for shows and tours," he says. For a recent show, he collaborated with Ten10 Brewing Co. in Orlando to make a drink specifically for a nearby sold-out show at live music venue Soundbar: Guyana Punch, a Flavor-Aid hard seltzer.

Kiranos speaks of music the same way he speaks of homebrewing—with insight, enthusiasm, and a willingness to take risks. Homebrewing has taught Kiranos how to roll with the punches.

"I've had some real failures," he says, describing some past homebrewed creations. "I had this incredibly dumb idea to make a tobacco pale ale," he says. He had previously made a tobacco chocolate mousse that turned out great, so why not incorporate the same unique ingredient into beer? Unfortunately, he grossly miscalculated the nicotine content and ended up with nicotine poisoning, prompting a dump of the whole batch.

Many of his homebrew creations, like the tobacco beer, are inspired by food and his culinary background. One of his all-time

Avocado Saison

Batch Volume: 10 US gallons (37.9 L)
Original Gravity: 1.061 (15° P)
Final Gravity: 1.021 (5.4° P)
Bitterness: 26 IBU
Color: 7 SRM
Alcohol: 6.1% by volume
Efficiency: 70%

FERMENTABLES

9 lb. (4.08 kg) Maris Otter pale malt
4 lb. (1.81 kg) flaked unmalted wheat
4 lb. (1.81 kg) floor-malted wheat
3.5 lb. (1.59 kg) Vienna malt
1.75 lb. (794 g) Golden Naked Oats
4 oz (113 g) Cara Bohemian malt

HOPS

0.8 oz. (23 g) Legacy, 8% a.a. @ 60 min (11 IBU)
0.5 oz. (14 g) Legacy, 8% a.a. @ 15 min (3.5 IBU)
0.5 oz. (14 g) Styrian Goldings, 5.4% a.a. @ 15 min (7 IBU)
2 oz. (57 g) Styrian Goldings, 5.4% a.a., whirlpool 15 min (5 IBU)

YEAST

Saison yeast

OTHER INGREDIENTS

6 firm avocados, cubed (2 weeks in secondary)

BREWING NOTES

Mash at 152°F (67°C) for 1 hour or until an iodine test confirms starch conversion (a longer mash may be needed to fully convert the unmalted wheat). Lauter, sparge, and collect wort. Boil for 60 minutes, adding hops as indicated. Ferment at 67°F (19°C) until specific gravity stabilizes. Rack to secondary, add avocado, and condition for 2 weeks. Bottle or keg with 3 vol. (6 g/L) CO_2, taking care to leave behind the floating layer of avocado oil when racking.

PARTIAL-MASH VERSION

Reduce Maris Otter pale malt to 4 lb. (1.81 kg) and Vienna malt to 1 lb. (0.45 kg). Mash with remaining grains for 60 minutes at 152°F (67°C). Drain and sparge with 175°F (79°C) reverse osmosis water to desired boil volume. Dissolve 3.75 lb. (1.36 kg) Maris Otter and 2 lb. (907 g) Vienna malt extract syrups in the resulting wort and proceed as above.

favorite homebrews has been his Avocado Saison. “I was really worried about the oil content, and I thought it would completely mess with all the residuals,” he says. He opted to cube the avocado, which was not too ripe and still pretty solid, smashing it ever so slightly. “I figured that way the fat content wouldn’t be so heavy,” he explains. “It just ferments out, and it dries out the beer a lot,” he says. The result is an earthy, dry saison he loves.

He has brewed beer with mushrooms, and even crustaceans. “One of the fun, gimmicky beers I did was, when everyone was doing oyster stouts and lobster beers, I did a sea monkey beer with brine shrimp,” he says. It was added to a big, bold, overly sweetened stout. “You can’t pick it out. It’s more of a briny, light salt addition,” he describes. The shrimp balanced out the intense sweetness, and the nuttiness really came through. “It worked. Would I do it again? No. But it worked,” he laughs.

He has also brewed with Vegemite, the thick, brownish-black spread that’s a staple in Australia. His motivation for that particular brew was simple curiosity about whether the addition would lend negative (meaty) or positive (molasses) flavor attributes. “I was ready for that one to fail,” he says. “It turned out to be a nice surprise, with a lot of molasses.”

All his brewing is fueled by curiosity. “It’s the same reason I don’t live anywhere for more than a year,” he explains. “I want to keep moving, keep trying. I’m extremely curious by nature,” he says.

Nowadays, his go-to homebrew is lambic-style ale. It’s his favorite kind to drink, but there are other advantages. “I live on tour for a few months at a time,” he says. “I don’t need the patience of sitting and waiting for it,” he admits. Danny cellars it in a barrel while he’s away, and it’s ready to drink when he gets back home.

Fortunately, brewing is literally in the air at his Texas home. Danny lives just about 10 miles away from famed farmhouse brewery Jester King. “We’re stealing their air, and they don’t even know it,” he jokes.

Homebrewing has positively influenced Kiranos’s music and his view of life. Besides the creativity and the amazing friendships he’s made brewing, troubleshooting is his favorite takeaway. “You really learn how capable or incapable of you are with problem solving,” he says.

He points out that brewing is always going to be an imperfect situation, unless it’s totally automated. He also encourages new brewers not to lose motivation if they can’t afford a ton of high-priced equipment. “On the technical side, I’ve learned that fancy equipment doesn’t matter,” he says. “Don’t rush out to buy the most expensive items. It takes away from learning from your own intuition,” he says.

“I think my favorite experiences involve the scramble to solve a dilemma, realizing what is truly detrimental or what could be a funny problem that gets resolved,” he says. Brewing has taught him to be more patient, take situations in stride, and always try to come up with a solution, instead of just dumping a batch.

His advice to new homebrewers, or to homebrewers who feel overwhelmed, is that homebrewing is overwhelming and brewers need to learn to embrace that.

“Don’t let it scare you. There will always be something to continually learn. … That’s what makes it great. It’s the overwhelming nature of brewing that is the most exciting part of it. It’s endless. Why would you want to have a hobby that has an end?”

Kristen Kuchar is a Colorado-based writer and editor covering craft beer. She has contributed to CraftBeer.com, **Beer Connoisseur, Beer Advocate, Brewing News,** *and many other publications.*

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Brewin' in a Schoolie

Photo courtesy of Steve Ruch; © Getty/kevinjeon00 [bus]

Some say, "When life hands you lemons, make lemonade." I say, "Hogwash!" (Yes, I know: washing a hog is messy. I just say it. I don't do it.)

Due to circumstances I won't bore you with, other than to say the knife wound in my lower back has nearly healed, my wife and I found ourselves moving 360 miles and two states away, downsizing from nearly 900 square feet to an old school bus of less than one-third the size that we're converting to a tiny house: a schoolie.

Our new living arrangement presents me with several homebrew obstacles. Some folks say, "They're not obstacles, but opportunities." I say, "Some folks are nuts and should keep their big mouths shut."

Having to seriously downsize my homebrewing apparatus and expectations, I (temporarily?) gave up all-grain brewing, returned to extracts, and shrunk my batches to 2 gallons (7.6 liters). I donated my brewing books and inventory of homegrown hops at a couple of ORCA homebrew club meetings. And I recycled a load of empty bottles and ruthlessly eliminated a bunch of other items that were just taking up space.

With no running water to our schoolie, I fill a 5-gallon (18.9-liter) Better Bottle at the main house and schlep it as needed. Having reduced my immersion chiller to a dust collector, I now chill by making high-gravity wort and mixing in ice-cold water. For cleaning, I snagged a bunch of samples of Craft Meister Alkaline Brewery Wash at Homebrew Con 2018 in Portland. A tip of the hat to Denny Conn for the heads up about this product's cold-water capabilities.

The only electricity we currently (no pun intended) have is provided by an extension cord on the far end of a 15-amp circuit, so even if we had room for a full-size stove, there's no way to operate it. But we do have a propane stove for heating a gallon or less of water (always use a propane stove in a well-ventilated area).

I don't even have the room for a minifridge, and I can't afford a dedicated temperature controller. On rainy or cloudy days and nights, our under-insulated schoolie ranges from 46 to 58°F (7.8 to 14.4°C), which works for lager yeast. Luckily, rainy, cloudy days and nights are quite frequent here; all I have to do is anticipate the next stretch of such weather. Remember, the weather forecast is your friend.

The cost of living in our new locale is taking a bigger bite of my pension than I was used to, leaving me with less discretionary money. So, I listed some items up for sale on ORCA's Facebook page. The equipment I sold financed enough malt extract for several batches, bought enough craft beer to tide me over, and helped free up valuable space.

Once I win the lottery I'll have water and electricity run directly to the schoolie. (Note to self: buy a lottery ticket.)

My first batch was simple: one extract, one hop, and yeast. Then, feeling confident about no-boil brewing, I got a bit daring and conjured up a simple no-IBU pale ale/lager (see We Don't Need No Stinkin' IBUs on page 9 of this issue of *Zymurgy*). It turned out so good that I'm brewing it again for the July 5 Red, White, and Brews Beer Fest in downtown Crescent City, Calif. This year, they're including a homebrew contingent for the first time.

Good beer can be brewed in (way) less than ideal conditions. So, if life gives you a swift kick, don't get mad. Get brewin'.

Steve Ruch lives in Crescent City, Calif., and has been homebrewing for 20 years.

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