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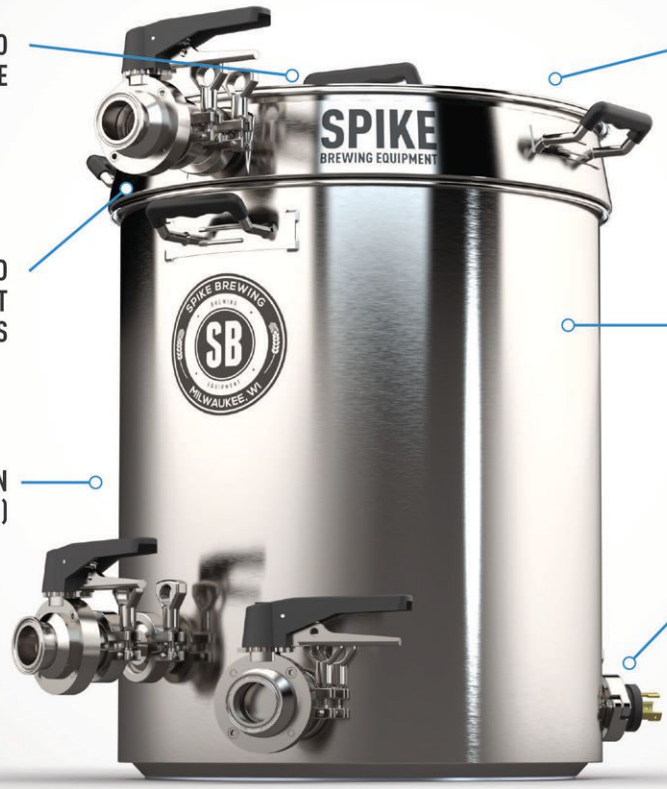

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ASK THE STAFF

What have you been binge-watching during lockdown?

Gary

Can't say I've been binge-watching anything, but I'm more familiar with our DVD collection now. I am severely missing baseball!

Megan

Re-watching some classic movies, favorite so far being *Spirited Away*. Also finishing up *Schitt's Creek*.

Duncan

Deadwood. I always heard it was a great show but never had the time to get into it. I've got the time now.

John

I've been going back in time and watching each year's Academy Best Picture nominees.

Dave

Currently alternating between *Poldark*, *Vikings*, and *Drunk History*.

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EDITOR'S *Desk*

BY DAVE CARPENTER

More than One Way

As if COVID-19's effects weren't already enough to deal with, now brewers face a shortage of CO_2. Much of the carbon dioxide used in commercial breweries is a byproduct of industrial ethanol production, and a great deal of that ethanol usually goes to gas pumps. But with less demand for gasoline, less ethanol—and, thus, less CO_2—is being produced.

For more than a decade, the Environmental Protection Agency (EPA) has required that oil refineries blend biofuels such as ethanol into the gasoline they produce for motor vehicles. The fraction of ethanol in most standard gasoline is about 10 percent by volume (E10), but many of today's autos can use a higher fraction of about 15 percent ethanol (E15). Flex-fuel vehicles can even use ethanol fractions as high as 85 percent (E85).

For years, small refineries that could demonstrate a financial hardship have been eligible for Small Refinery Exemptions (SREs) from regulations surrounding minimum ethanol content. However, since 2017, the number of annual EPA-granted SREs has grown by a factor of four. As the number of exemptions has increased, the demand for fuel ethanol has fallen.

Ethanol production was already down before the global pandemic struck, but then COVID-19 forced Americans to stay home. We drove less, which reduced demand for gasoline and, consequently, for industrial ethanol. This dramatic fall in demand prompted many fuel ethanol manufacturers to halt production altogether.

With reduced ethanol production comes reduced carbon dioxide production. Carbon dioxide is clearly essential to beer, but the food manufacturing and meatpacking industries also depend upon the vital gas for their operations.

In a letter dated April 7, 2020, the Brewers Association (parent organization of the American Homebrewers Association)—in a coalition that also included the Compressed Gas Association, the National Pork Producers Council, the Beer Institute, the National Turkey Federation, the North American Meat Institute, the National Cattlemen's Beef Association, and the Renewable Fuels Association—urged Vice President Mike Pence to offer emergency assistance that would encourage industrial suppliers of carbon dioxide to resume production. Without intervention, production of carbon dioxide may remain low, and shortages could ensue.

This is the case at press time, and the future of industrial CO_2 remains uncertain, both for your favorite breweries and for all of us as homebrewers. There is, though, more than one way to skin a cat. (Why our feline friends have become targets of so much bromidic flaying I shall never understand, for there are also myriad ways to peel a potato, shear a sheep, and husk a hazelnut. Leave the poor cats out of it, I say.)

We homebrewers have more flexibility in our processes than commercial breweries enjoy. To the best of my limited knowledge, there's not currently a shortage of dextrose or sucrose. Whether you bottle or keg your beer, it's easy enough to add a bit of priming sugar at packaging to create natural carbonation (unless you filter your beer).

Granted, kegs still need CO_2 to push finished beer—even naturally carbonated beer—out of the faucet and into the glass. But if carbon dioxide prices become too high, or if suppliers are unable to keep up with demand, it's nice to know that you can always prime and bottle until the storm passes. We don't have to be constrained.

There are other ways to get gas, so to speak. Spunding and cask conditioning both involve sealing up actively fermenting beer to capture escaping CO_2 and provide carbonation. Cask conditioning is pretty much the same as bottling with priming sugar, except it takes place in a single serving vessel instead of within a small battalion of bottles.

Spunding requires a pressure-capable fermenter—think a stainless conical or Corny keg—and an adjustable pressure-relief valve that you dial to a desired pressure. Instead of priming with sugar, you close up the fermenter a few points shy of your expected final gravity, and you'll get about 1 volume (2 g/L) of CO_2 for every 2 specific gravity points (0.5°P) of residual extract. When the interior pressure begins to surpass the magic number, the valve cracks and allows excess CO_2 to safely escape.

In both cases, the beer will gradually go flat unless you serve all of it in one sitting, which makes it a great option as we plan for the day when we can finally get together and share beer again.

In this issue of *Zymurgy*, contributor Chris Colby takes a look at the science behind CO_2, which, as we have learned, is as fundamental to great beer as the four ingredients anointed by the Reinheitsgebot.

Dave Carpenter is editor-in-chief of Zymurgy.

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BREW WITH YOUR BREW
Brewers and baristas often start their days similarly—before the sun rises, coffee in hand. We don't know who first had the idea to mix coffee with beer, but we're glad they did. From roast to extraction, learn how to infuse your beer with the best of the bean.

By Brandon Whalen

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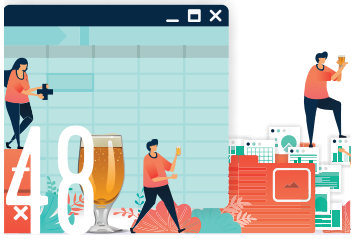
CARBON DIOXIDE: IT'S A GAS
Odorless, colorless, and tasteless, carbon dioxide is a simple molecule—just two oxygen atoms connected to a central carbon atom—but its interactions with water, beer, and other gases can be complex and interesting. Your beer wouldn't be the same without it.

By Chris Colby



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HOMEBREWING, ONE SPREADSHEET AT A TIME
What goes on behind the scenes in those "black box" brewing calculators? How do they go from a list of malts and hops to values for gravity and bitterness? Building your own calculator is easier than you think, and it can teach you a great deal about your beer.

By J.B. Zorn

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IN A GREAT LAND
Long before most Americans had ever heard of social distancing, Alaskans knew staying home was often a sensible thing to do. Venturing out into the winter without a good reason to do so could be hazardous. Like many of us, they homebrew to stay connected. We can all relate to their stories.

By Efraín Villa

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Cover Photo
Luke Trautwein

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July/August 2020

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

ON THE WEB
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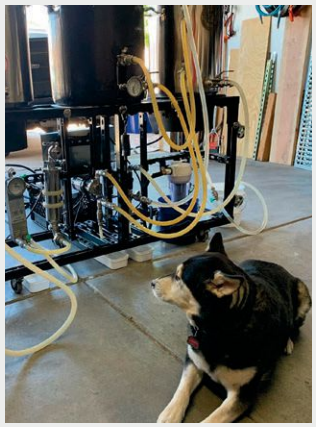
You're already familiar with *Saccharomyces cerevisiae* and *S. pastorianus*—ale and lager yeasts. Now, meet *Lachancea*, a yeast that simultaneously produces alcohol and lactic acid. Isolated by Dr. Matthew Farber at Philadelphia's University of the Sciences and manufactured by Lallemand, Philly Sour can yield a pleasantly sour beer in as little as 7 days. Expect it to produce notes of red apple, peach, and honeydew. Philly Sour is available to homebrewers in 11-gram sachets and to professionals in 500-gram packs.

Club News

THE WORTHOGS' VIRTUAL BIG BREW

Several members of the Worthogs homebrew club of New Mexico virtually brewed together on May 2 in celebration of Big Brew, the American Homebrewers Association's annual event to recognize National Homebrew Day. The Worthogs collectively made 35 gallons (132.5 L) of beer and 5 gallons (18.9 L) of melomel (fruit mead). This year, club members practiced social distancing and brewed separately, but together. Read more about this year's virtual Big Brew in From the Glass in this issue of *Zymurgy*!



Photos courtesy of Lallemand; Worthogs; Kiley Gwynn; Brett Bengford

Vote for 2020's Best Beers in America

It's time for *Zymurgy*'s annual Best Beers in America survey, and we need you to vote! The survey will open in July, so watch your email for an invitation. All participants are entered in a drawing to win AHA swag. Head over to HomebrewersAssociation.org after you receive your invitation to vote for your favorites. The winners—and a few clone recipes—will be revealed in the Nov/Dec 2020 issue of *Zymurgy*. Cheers to this year's best beers!

Competitions in the Days of COVID-19

BY JOHN MOORHEAD, AHA COMPETITION MANAGER

The ideas presented here are only suggestions that organizers should consider when deciding whether or not to hold a competition; they are not guidelines to condone doing so. Organizers should continuously monitor local, state, and federal restrictions, as well as guidance from the Centers for Disease Control and Prevention and the World Health Organization. There are many variables, and the situation is as fluid as beer running from a faucet left open.

Many homebrew clubs host competitions, but with the novel coronavirus handcuffing our normal way of life, most competitions have been canceled through June. By the time this article reaches your eyes, restrictions may have been extended well into summer, but at press time, August through the end of 2020 appears to be a quite active competition season. So, what should organizers consider when hosting a competition moving forward?

PRIORITIZE VOLUNTEERS AND ENTRANTS

The health and safety of all competition personnel, including the host location's employees, are paramount. Organizers will need to reimagine how groups in a competition can work together with limited contact to decide if a competition is feasible. They must thoroughly consider how stewards interact with judges, how judges interact with one another, and whether the host location is adequately set up to make everyone feel comfortable. It is imperative to provide safety measures like personal proactive equipment (e.g. face masks and gloves) and sanitation supplies (e.g. hand sanitizer and disinfecting wipes) whenever possible.

Photo courtesy of Crystal VanGelder

OPERATIONS, LOGISTICS, AND PLANNING

The usual run-of-the-mill approach must be scrutinized, and organizers should evaluate the planning and operating of competitions through a health-and-safety lens. Judges may need to be recruited earlier. Participants' comfort levels must be taken into account, as should the ability for shipping and drop-off locations to handle packages and take the appropriate precautions. Check-in and sorting will need to be reconsidered (e.g. sanitizing each bottle when unpacked), as will the way in which beer is delivered to judges and feedback to entrants.

Organizers will have to understand that such operational and logistical changes necessarily affect oversight of quality and integrity. These changes should be clearly communicated to everyone involved.

NEW EXPECTATIONS

With any changes to your competition, expectations are going to shift. Organizers should first ask what is considered a success under the current circumstances and clearly communicate new expectations in the rules and regulations. These shifts could affect the budget, entry fees, number of bottles needed, expectations on feedback, competition timeline, overall entry count, who can touch entries, how bottles are delivered, and how judging will be conducted.

In the balance of all this must be local, state, and federal guidelines and restrictions. As guidelines and restrictions change, so must your competition, and public health restrictions may well determine the fate of your competition despite your organizing team's best efforts.

JUST SUGGESTIONS, NOT ANSWERS

Organizers should continuously monitor health and safety circumstances in their area when deciding whether—and how—to host a competition. Here are a few creative and alternative suggestions (not guidelines):

1. Virtual judging
2. Mini best-of-show only judging
3. Offset seating
4. Limited handling of entries and documentation
5. Clear cleaning and sanitation protocols
6. Limited judge sessions to avoid mealtimes
7. Small satellite judging (if permissible and advisable)
8. Reduced entry count
9. Increase in number of bottles needed

AN EXAMPLE SCENARIO

Let's say you hold a 300 to 400 entry competition that is a marquee event for your club and crucial to the club's budget. With social distancing and concerns of safety, the organizing team wants to make sure to hold the competition with safety as the top priority.

The team discusses what a successful competition looks like, weighs options, and decides judging will be done virtually. With lack of oversight and the risks of judging an entry from two different bottles, expectations are clearly communicated to entrants and judges before payment and registration.

With limited judging capacity, the judge coordinator recruits early, but judge sign-up is nonetheless down 25 percent. The organizing team cuts entry count to 150 and asks entrants for three bottles to accommodate the lower judge turnout and complexities of virtual judging.

All entries are consolidated at a drop-off location, and safety and sanitation protocols are followed. Everyone is required to wear masks and gloves, and each bottle is sanitized before check-in and sorting.

The judging timeline is extended two weeks, and judges are assigned a category to virtually complete with another judge. A case of entries is dropped off at each judge's location with all the necessary documentation compiled. Organizers give the judge pair clear expectations on how to store and treat their entries, as well as a timeframe in which to complete their categories and choose winners. There is no mini best-of-show.

Once a category is complete, judges scan in scoresheets to a shared folder along with the other required documentation, and results are returned to entrants by email. After all categories are judged, organizers choose three judges for the best-of-show panel and drop the remaining bottles off at each judge's location to be evaluated virtually.

ORGANIZER DISCRETION ADVISED

Life as we know it has come to a screeching halt. The novel coronavirus has led to unprecedented social distancing protocols and shelter-in-place mandates that have effectively shut down large gatherings for the foreseeable future, freezing homebrewing meetings and events in the process. The decision of whether or not to host a competition lies solely with the organizing team, and there should be no regret in postponing or canceling a competition if the circumstances aren't safe.

Active Dry Yeast

WHAT HOMEBREWERS NEED TO KNOW

By José Pizarro, Kevin Lane, and Marcelo Cerdán of Fermentis

If you want to get a group of homebrewers all fired up, just raise the subject of active dry yeast (ADY). It won't be long before you hear a lot of conflicting ideas about how it works and how to use it. For example, one raging debate on the internet is whether it's best to rehydrate ADY before pitching. Check out this page—and especially our website—to learn what you need to know about ADY from a unique and eye-opening point of view: that of a manufacturer.

THE ORIGINS OF ADY

Brewing yeast strains have gone through a long domestication process, driven by brewers throughout history, who essentially generated all the diversity that exists in this industry today. Over hundreds of years, it is the brewmasters who have mostly driven the evolution and diversification of yeast strains, often without even being aware they were doing so.

This range of diversity is now safeguarded in yeast banks, and the manufacturer's mission is to screen for the most useful strains available and deliver them to the market. Active dry yeast is one of the latest innovations in the industry: the first yeast biomass culture was dried in the early 1970s for the baking industry. High-purity ale brewing yeast was first dried in 1995, followed by lager yeast in 1996. Since then, ADY has come a long way in quality and popularity.

WHAT IS ADY AND E2U™?

Active dry yeast, as the name implies, is a dry yeast that, when rehydrated, becomes reactivated and able to ferment wort sugars, as well as contribute flavors and aromas. ADY is known for having many advantages for brewers, including a long shelf life, greater economy, no need for propagation or starter preparation, no need for quality management equipment, increased flexibility, greater reliability, and consistent quality.

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The fact is, you can pitch directly, with no need to rehydrate. Testing shows no discernible difference in the quality of your brew either way. For those who still want to rehydrate, you can relax and use the technique that best fits your process. Of course, there are limits to how you use these living organisms, so always use the recommended temperature range for pitching and be sure to follow our other simple usage recommendations.

SO MUCH MORE TO KNOW!

To learn more about shelf life tips, yeast recycling, pitch rates, the production process, yeast purity, detailed results of testing, and our amazing range of yeasts for fermented beverages (wine, cider, beer, distilled spirits, and more), visit fermentis.com or download the Fermentis App, available in Apple's App Store and on Google Play.

Photos © Getty/videofe

BREW OVER

In Anita Hawkins's article "In Praise of Small Things" in the May/June 2020 issue, we incorrectly said, "A starter culture is not unnecessary," which makes it sound like you need a starter. You don't. It should have read "A starter culture is not required." So, don't even start.

BREWMANCE

Beer Documentary

BREWMANCE
DIRECTED BY CHRISTO BROCK

We could all use a feel-good movie right about now, and very little can make you feel better than beer. *BREWMANCE*, a project from filmmaker Christo Brock, follows two groups of Long Beach, Calif., homebrewers who take the leap from kitchen to career: father-and-son team Dan and Jesse Sundstrom (Ten Mile Brewing Co.) and former Reel Big Fish trombonist Dan Regan (Liberation Brewing Co.). Homebrewers will recognize and relate to the challenges and successes of these startup brewers who disrupt life as they know it to build new lives from scratch.

Featuring such brewing luminaries as Vinnie Cilurzo, Ken Grossman, Jim Koch, Randy Mosher, John Palmer, and Charlie Papazian, *BREWMANCE* also tells the story of the American craft beer movement that started in the 1970s and continues today. If beer is your passion, *BREWMANCE* will inspire you to brew more and brew better.

To learn more and stay up to date on the premiere, head over to brewmancemovie.com.

Photo courtesy of *Brewmance*

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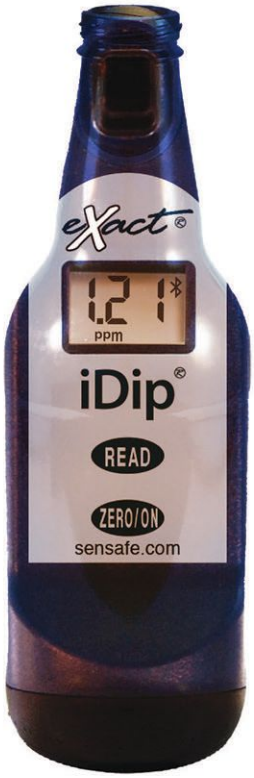

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FROM THE *Glass*

BY GARY GLASS

Homebrewing in a Pandemic

I hope this issue finds you healthy and safe. With most of us working remotely or not working at all, we're spending a whole lot more time at home. I have to say, I've never been more grateful to be a homebrewer. In the first two months of life under stay-at-home orders, I brewed more than in any previous two-month period in my 27 years as a homebrewer. I suspect I'm not alone in that experience.

With so many of us stuck at home, reporters are looking for stories covering the things people can be doing at home. At the AHA, we have heard from many media outlets looking to cover homebrewing as a fun activity to do during the coronavirus pandemic. In April, the coverage generated from those AHA interviews had 439,192,338 impressions, which is 56 million more impressions than all AHA-generated homebrew coverage in 2019! Helping promote homebrewing through the media is just one of the things we can do for the hobby as a national/international association. Your membership makes that outreach possible.

Our local homebrew supply shops have had to adapt to life during a pandemic. Since homebrew supply shops sell supplies for food- and beverage-making, most, though not all, have been able to stay in business. In a survey we conducted of shops in March and April, 19 percent of shops indicated they had closed entirely. Seventy-seven percent had shifted to taking phone, email, or online orders for curbside pickup. If your local shop is offering such services, please consider helping them out and calling in an order for the ingredients for your next batch for pickup or delivery—I'm sure your local shop owner will appreciate your business.

Our local breweries have also had to adapt. Many, if not most, of the breweries in the country do the majority of their sales over the bar in their own taprooms, and stay-at-home orders have had a dramatic impact on their businesses. Access to customers has become a major challenge for breweries that don't package

in cans or bottles for off-premises sales through retailers. We can support those breweries by buying beer to go for curbside pickup in growlers or crowlers. Since I have a home draught system, I have bought a couple of kegs from my closest taproom brewery, even though I'm pretty well stocked on homebrew. I want to make sure they are still in business when I can finally go back to enjoying their beer from their bar.

Practicing social distancing obviously affects homebrew clubs as well, as gathering together for in-person meetings isn't possible. Many clubs have taken to doing virtual club meetings, and the AHA staff have been doing our part to help. In April, the AHA staff participated in 50 virtual homebrew club meetings. It's been fun and uplifting to be able to provide some education to club members and get some very welcome (virtual) social interaction.

HOMEBREW CON/HOMEBREW CON ONLINE

On May 5, the coronavirus pandemic forced the AHA to announce the cancellation of our in-person Homebrew Con 2020 event, which had been scheduled to take place in Nashville, June 18–20. Thankfully, we were able to move to a digital format and conduct Homebrew Con Online over the same dates we had for Nashville. Homebrew Con Online featured 19 educational seminars plus a keynote address delivered by Bailey Spaulding, homebrewer and founder of Jackalope Brewing Co. Also included were a virtual expo where attendees could interact with homebrew equipment and ingredient suppliers, vendor demonstrations, happy hours, and meet-ups.

While I am disappointed we were not able to gather together in Nashville, I am grateful that technology afforded us the opportunity to gather virtually and allowed the AHA to spread homebrew knowledge and camaraderie, despite being largely confined to our homes.

Thank you to all of the AHA members who attended Homebrew Con Online, and thank you to all of our speakers and sponsors! I hope to see you (in person) in San Diego June 17–19 for Homebrew Con 2021.

AHA STAFF

The American Homebrewers Association is a division of the 501(c)(6) not-for-profit Brewers Association (BA). In addition to Homebrew Con and the National Homebrew Competition, the Brewers Association hosts the Craft Brewers Conference for professional brewers; a beer-and-food event called SAVOR that takes place in Washington, D.C., each spring; the World Beer Cup international beer competition; and the Great American Beer Festival (GABF), which includes a competition and public festival.

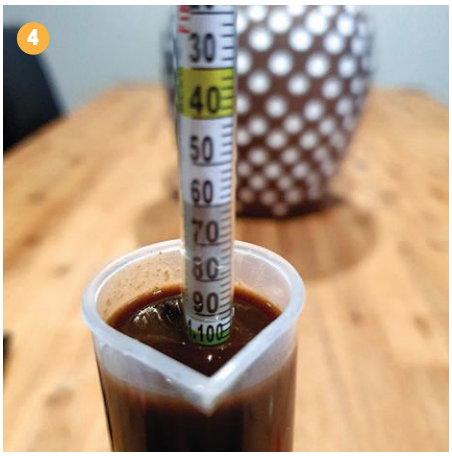
Needless to say, events are a big part of what the BA does, and those events make up a large portion of our total annual revenue. Within a span of just over two months, the BA canceled or significantly altered all of the events we had planned for this year. As a result of the shortfall in event revenue, this spring the BA laid off 23 percent of our workforce, including two full-time AHA staff members.

Now, more than ever, we need homebrewers to support the association that supports the homebrewing community. I am grateful to you for your membership. If you think the AHA is an organization worth supporting (and I sincerely hope you do), please consider encouraging your fellow homebrewers and homebrew club members to join. Those new members will reap the many benefits of membership, and they will be supporting our mission to empower homebrewers to make the best beer in the world.

BIG BREW RESULTS

Annually, the AHA Big Brew event, which is our way of celebrating National Homebrew Day (May 7), sees greater participation than anything else we do. In a typical year, homebrewers would gather at local sites to brew together. With the threat of COVID-19 looming, getting together to brew wasn't in the cards this year. Instead, we took Big Brew virtual and had thousands of individual homebrewers pledge to brew on Saturday, May 2. The result was an overwhelming success. Spanning 66 countries (new record), 4,841 homebrewers pledged to take part in this year's Big Brew, brewing up an astounding 31,338 gallons (118,627 liters) of homebrew (new record).

Thanks to all of the participating homebrewers who made the 2020 virtual Big Brew a worldwide success!



1. Ron Mitchell (Rainy Day Brewing @rainydaybrewery) and Greg Eslinger (Hoppy DAWG Brewing @hoppydawg) socially distanced co-brewing Porch Hound Vienna Lager.
2. Six gallons of hazy DIPA with Ekuanot and Mosaic hops by Shawn Myers. @bminusshow
3. The yeast strain starting to work through the sight glass in Jared Savage's Big Brew. @savagehomebrewery
4. & 5. Mark Bothe brewed up a Russian imperial stout that is currently aging on bourban-soaked oak cubes, vanilla beans, and cacao. He is planning to drink it during next year's Big Brew! @three_boats_brewing

HOMEBREW CLUB INSURANCE

I know many AHA members also belong to homebrew clubs. One of the ways the AHA supports homebrew clubs is through the AHA's club insurance program, which offers U.S.-based, AHA-registered homebrew clubs affordable general and liquor liability insurance, as well as a directors and officers insurance option. Such insurance coverage is typically too expensive for clubs to afford individually, but the AHA works with West's Insurance to collectively offer clubs very reasonably priced 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 clubs' 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 into HomebrewersAssociation.org and clicking MY ACCOUNT at the top of the page.

In the 2019–2020 enrollment period, 450 clubs obtained coverage and the AHA reimbursed the insurance premiums for 69 clubs.

The 2020–2021 club insurance enrollment period is open July 1 through September 1, 2020. 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.

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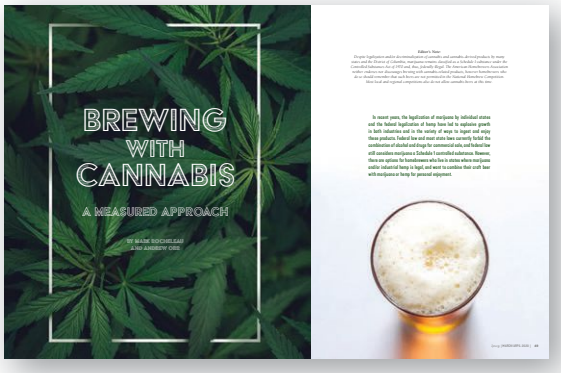


March/April 2020 *Zymurgy*

***Dear* Zymurgy,**
I waited next to my mailbox for my March/April 2020 *Zymurgy* ever since I read the AHA email previewing the "Brewing with Cannabis" article. First, I want to say *thank you* for exploring, in a scientific way, a controversial subject that will no doubt generate a good deal of flak from more traditional brewers. Please don't allow that to restrict your willingness to explore unusual ingredients in brewing.

Second, I would like to congratulate the authors, Mark Rocheleau and Andrew Orr, on their clear writing and scientific approach, no doubt one of the first in this field.

As the article details, the real challenge is to accurately control heat during the extraction step. I used an electric stove with two Pyrex dishes and two digital thermometers. The larger dish contained canola oil, and the smaller contained vegetable glycerin and 3.5 grams of decarbed cannabis. It worked beautifully, but it was tedious to keep from overheating. The result was half a cup of cannabis-infused glycerin that was like maple syrup in color and thickness. Next time I will use a sous vide method to accurately maintain heat during the extraction process.

My only question is "where do you buy your cannabis?" In Colorado, purchases are typically 3.5 to 7 grams, (1/8 to 1/4 oz.). Prices for 22% THCa flower run about $25 to $45, respectively. And 28 grams (1 oz.) is typically $85, not $400. You didn't have to extrapolate—you could have just visited a dispensary and looked at a menu.

There are two legal sources of cannabis in Colorado: medical and recreational dispensaries. The difference is a 25 percent "sin tax" on recreational marijuana in addition to the normal 8 percent sales tax. Medical marijuana in Colorado is only subject to the 8 percent sales tax. The first 40 million dollars in excise tax from recreational sales goes to education statewide. The rest goes into the state's general fund.

I say thank you again and again. Following many unsuccessful attempts to combine cannabis with food and beverages, I learned about decarboxylation, the conversion of THCa to THC, a step I won't miss in future efforts.

Bob Tittle
Pitkin Ct. Brewery
Aurora, Colo.

Author Mark Rocheleau responds: *We purchase cannabis recreationally at various locations, depending on strain, product variety, and necessity to refill stock. The large range per ounce was derived from the ability to purchase wholesale versus the need to purchase smaller quantities, such as individual grams, to accumulate 1 ounce. That portion of the text was meant to show that dry hopping 1 ounce of flower compared to 1 ounce of hops has dramatically different economic constraints.*

We do find that the consistency and quality of the decarbing process drastically affects the cannabis effect. If the mixture gets too hot too quickly or doesn't efficiently convert the THCa to THC, the effect and length of high vary.

We'd be interested in hearing how the sous vide method works in the extraction process. Online information about homemade equipment is limited, and to do it with enough precision to obtain consistent results, you'd need to spend thousands of dollars in lab equipment. If there is a way to easily obtain this consistency in household equipment, that certainly helps with the quality of the tincture and final product!

Continued >

Photo © Getty/Romolo Tavani

***Dear* Zymurgy,**
I was disappointed in Cody Christman's letter in the May/June 2020 issue of *Zymurgy*. I don't think he represents many members or readers who he says find marijuana "repulsive." While I personally do not partake, as a Colorado resident, I don't agree that legalization has caused a major increase in harder drugs, skyrocketing violent crime, etc.

I enjoy every issue of *Zymurgy*, and while I might not want to try every style of beer or travel to every beer destination, sometimes it's OK to simply skip an article. Different strokes for different folks, but one thing we all can agree on is to relax, don't worry, and have a homebrew!

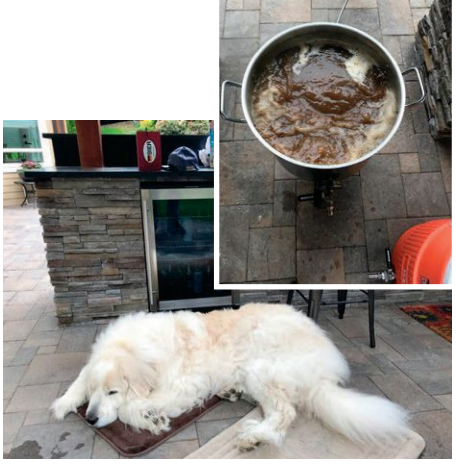
Sincerely,
Stu King
Lakewood, Colo.

THE BEST ASSISTANT BREWERS

I'm a longtime member, and I love the magazine and resources the AHA has available! I have been meaning to submit a photo of my brewing assistant for two years and remembered to take a photo this month.

This is my brewing assistant, Patton. Today we made a Bavarian Pilsner to have ready for our Michigan summer. Patton loves being outside on brew days and helping in any way he can, although he sometimes gets jealous if my time is spent reading *Zymurgy* instead of giving him pets. Thanks!

Philippe J. Ledent
Lansing, Mich.



I brewed the 1627 Jesuit Beer from the March/April 2020 issue ("The Original Belgian Abbey Beers" by Roel Mulder). My supervisor seemed happy with brew day.

Neal Ryan
Vancouver, Wash.

This is my faithful brewing assistant, Howie. He loves brew day because he knows fresh spent-grain dog treats are coming soon after! His favorite treats come every fall when I do my pumpkin brown ale. Cheers!

Chris Wall
Parker, Colo.

Here's Ginny (named after the youngest Weasley) smell-testing my grisette. At five months old, she's still learning the game. But, her curiosity will stand her in good stead I think.

Cheers, Mark Foisy
Evanston, Ill.

I keep seeing other dogs participating in the brewing process. Here's our dog, Otto, shepherding the brew kettle.

Thomas Wilk
Livonia, Mich.

This is my six-year-old Siberian Husky, Simba. He likes to remind me on brew day to relax and not worry (and, if having a homebrew, don't leave it unmanned within his reach).

Mike Banos
Indian Peaks Alers – *Longmont, Colo.*

DEAR *ZYMURGY*
Send your Dear *Zymurgy* letters to zymurgy@brewersassociation.org. Letters may be edited for length and/or clarity.

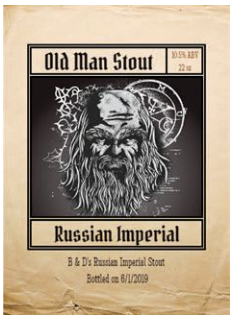
HOMEBREW LABEL SUBMISSIONS

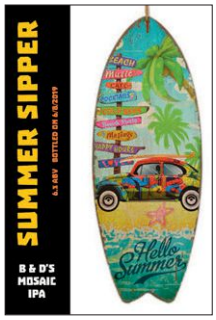
My wife and I have been brewing together now for a couple of years. We were preparing to have a honey Irish red for Saint Patrick's Day, but our party and everything else was canceled thanks to COVID-19. The whole country seemed to be on code red, and our love of dark humor led us to name the beer COVID Red.

Denny d'Alelio
Burke, Va.

I came up with my homebrewery name, Dueling Corgis Brewing Company, as a way to show my love for my dogs while also sharing my beers. I often have just as much fun coming up with new dog-themed names for my beers as I do putting together the recipe for my next brew! I came up with my own brewery logo and then incorporated photos of my dogs in each label that I design. At least once a year, I have a special barrel-aged (BA) batch that gets an extra treatment of bottle wax to complete the presentation. Here are some of the bottles from my latest Belly Rub BA Imperial Stout release: the batch and the bottles turned out great!

Drew Templeton
Iowa Brewers Union (IBU)
Mitchellville, Iowa



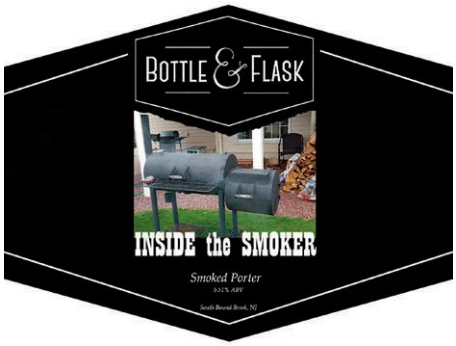


My wife and I are brand-new homebrewers, and for the past six months we have jumped wholeheartedly into every aspect of homebrewing. We enjoy creating labels and names for our beers as much as we enjoy brewing them together.

Who doesn't love a good stout? We felt like we needed a label on the outside of Old Man Russian Imperial Stout that captured the age and complexity of the beer on the inside. This beer exceeded our expectations and has become our signature brew.

We wanted a great beer for barbecues with family and friends. Summer Sipper Mosaic IPA practically named itself, and when my wife stumbled across this image, it just seemed perfect! It couldn't have been easier pairing the beer and the label for this IPA.

Ben Marrujo
Riverside, Calif.



We all know food can bring you back to old times and mom's home cooking, but can you achieve that with beer? My beer is inspired by memories of my past or flavors that I loved. Those, in turn, inspire the names and labels. I like to relate taste to experience by including a real photo on the labels.

Inside the Smoker Porter was an obvious choice: I used smoked grains in the beer, and I was also smoking a brisket at the time I brewed it. Best Friends Stout comes from a classic combination of chocolate and cherries. The image is of my sister's pug taking my place at the Thanksgiving table.

I have homebrewed for 12 years and have been an AHA member for two.

Brian Abolins – *Union, N.J.*

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!

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Kimchi

Photo © Getty/Nungning20

By Amahl Turczyn

Like sauerkraut, kimchi is a brined, fermented vegetable that's wildly popular in its country of origin, where it is the national dish of both North and South Korea. It has much more complexity than sauerkraut, however, in that it combines tart lactic-acid flavors with the crisp, crunchy texture of cabbage and radish and the flavorful trio of spicy red chile paste, garlic, and ginger. Sometimes other colorful vegetables are included, such as onions, scallions, carrots, mustard greens, cucumbers, and Asian garlic chives (*buchu* in Korean, *jiu cai* in Mandarin Chinese, or *nira* in Japanese).

Cabbage, specifically Napa cabbage, is now the usual base vegetable for the most popular *baechu* variety of kimchi, but just as there are countless varieties of Japanese-style pickles, you can make kimchi with a range of different vegetables. Lactic-acid bacteria naturally present on cruciferous vegetables instigate fermentation, while salt inhibits the growth of harmful or pathogenic bacteria. Fish-flavored kimchi variants that include fish sauce, shrimp, oysters, and other seafood are most popular in coastal regions of Korea.

One of the most striking aspects of kimchi is the brilliant red color of the gochugaru chile pepper flakes. But while kimchi has been around since at least the Three Kingdoms period (57 BCE to 7 CE), chiles are a New World crop of the Americas that didn't appear in Asia until the early 16th century. For that matter, Napa cabbage wasn't grown in Korea until the end of the 19th century, so this national treasure has evolved quite a bit over the centuries. Korean red chile peppers, *hong-gochu*, vary in heat level and fineness of grind, but are generally in the 1,500 Scoville range, and are fortunately easy to find at most Asian markets.

As with any fermented product, you can take the easy route or make things as complex as you'd like. Thanks to its popularity as a staple food of Korea, making kimchi can be as simple as chopping and brining

the cabbage and then rubbing the leaves with a pre-made paste called *gochujang*. This ubiquitous chile paste is made with *gochugaru*, glutinous rice flour, *mejugaru* (powdered fermented soybean), salt, and barley malt powder.

Salted cabbage and store-bought *gochujang* make a very simple but serviceable kimchi that can be eaten as is or covered and stored at cool temperatures for fermentation if you prefer a tarter, healthier, lactic-acid-bacteria-infused product. It's nice to have this easy, time-saving alternative to the more involved do-it-yourself recipe, so consider the use of store-bought *gochujang*, something akin to following a malt extract beer recipe.

Experienced Korean cooks forgo the store-bought paste and insist on preparing their own *gochujang*, which makes for a more complicated recipe. In the homemade version, rice flour starches are converted to sugars in a warm, two-hour "mash" utilizing enzymes from barley malt powder. If you do it correctly, it's much better than what you can buy in little plastic tubs at the market. Fermented in an earthenware crock, this *gochujang* has elements of umami, sweetness, tartness, saltiness, and spiciness, with a deep, dark red color, similar to a good *mole poblano*, and a rich, heady aroma. It is used as a condiment, marinade, and ingredient in many Korean dishes. The glutinous rice also acts as a thickener that allows the paste to adhere to the cabbage leaves in kimchi. But this long version of making the paste is another ferment for another time.

Since our kimchi will undergo its own fermentation, we will make a quicker, non-fermented version of *gochujang* to mix with the cabbage and vegetables that should still be of better quality than the store-bought stuff. Let's break down the recipe in greater detail. We'll be making a small (4-pound or 1.8-kilogram) batch of vegan kimchi. You are, of course, welcome to add fish sauce or seafood if you prefer.

PREPARING THE CABBAGE

Choose firm, bright-colored Napa cabbage with tightly packed leaves. When making the most common *baechu* kimchi, you need only quarter the cabbage heads lengthwise, brine them, pack the chile paste in between the leaves of each quarter, and ferment the large pieces whole. The large chunks are then sliced into smaller pieces right before they are eaten. Napa cabbages found at Asian markets can be huge, though, so for our purposes, we will chop the cabbage into bite-sized pieces before fermentation.

Start with a 3 lb. (1.36 kg) cabbage. Rinse in cold water to remove any dirt or sand, and then chop lengthwise and remove the core. Cut into small pieces and transfer them to a large bowl. Sprinkle with 3.5 oz. (100 g) of salt and toss to coat evenly. Then continue to toss and mix the salted cabbage every 15 minutes or so while you prepare the other vegetables and mix the *gochujang*.

OTHER VEGETABLES

Wash and julienne the following vegetables and add them to a large bowl:

- ❑ 1 bunch of scallions, trimmed
- ❑ 1 bunch *buchu* (Asian garlic chives, also called *nira*)
- ❑ 1 small Korean white radish (about 8 oz. or 227 g), peeled. You can substitute daikon radish if necessary.
- ❑ 1 medium carrot, peeled (optional)
- ❑ 1 red bell pepper (optional)

GOCHUJANG

In a saucepan, mix 0.5 oz. (14 g) glutinous rice flour with 1 cup (237 mL) water or vegetable stock. The glutinous rice flour is also available in Asian markets, but if you can't find it, just substitute corn starch. Add 1.75 oz. (50 g) salt and cook on low heat, stirring until mixture thickens and begins

Ferment This!

Vegan Kimchi

Batch size: about 4 lb. (1.8 kg)

FERMENTABLES

3 lb.	(1.36 kg) Napa cabbage
3.5 oz.	(100 g) non-iodized salt (to pickle cabbage)
1 bunch	scallions, trimmed and chopped finely
1 bunch	*buchu* (Asian garlic chives), trimmed and chopped finely
8 oz.	(227 g) Korean white radish or daikon, peeled and julienned
1	medium carrot or red bell pepper, peeled and julienned
0.5 oz.	(14 g) fresh ginger root (grated)
1 head	(about 10 cloves) garlic, peeled and minced
½	white onion, grated to a pulp
2 oz.	(57 g) ripe pear, grated to a pulp

OTHER INGREDIENTS

0.5 oz.	(14 g) glutinous rice powder (or corn starch)
1 cup	(236 mL) water or vegetable stock
1.75 oz.	(50 g) salt (to flavor *gochujang*)
1 cup	(115 g) *gochugaru* (Korean red chile flakes)

RECIPE NOTES

Wash cabbage and remove outer leaves if necessary. Using a sharp knife, chop the cabbage into bite-sized pieces, removing core. Sprinkle with non-iodized salt and toss occasionally for an hour or two until cabbage wilts and releases water.

Meanwhile, make the *gochujang* by boiling glutinous rice flour briefly in water until very thick. Mix in remaining red pepper flakes, ginger, garlic, pear pulp, onion pulp, and salt to make a thick chile paste.

Soak salted cabbage in fresh water to remove as much of the brine as possible. Rinse, drain, and add to a large bowl. Add remaining vegetables and chile paste and mix thoroughly until everything is coated.

Pack into a glass or earthenware fermenter, cover, and allow to ferment at cool room temperatures (55–65°F, 13–18°C) or in the refrigerator. Try to keep solids submerged as much as possible and stir gently every few days to release bubbles. When desired level of acidity is reached, package (optional) and refrigerate.

Photos courtesy of Amahl Turczyn

to bubble, about 3 minutes. Wait for the paste to cool, and then finely grate 0.5 oz. (14 g) fresh ginger root and add it. Mash or press the peeled cloves from one head of garlic, mince finely, and add. Grate half a peeled white onion with a standard box grater and add the pulp. Grate 1 oz. (28 g) fresh, ripe pear and add the pulp. Finally, mix in 1 cup (115 g) *gochugaru* Korean red chile flakes. When thoroughly combined, it should form a thick, bright red paste. You can make a double batch of this if you like: it's very useful in Korean cooking and makes a wonderful marinade.

RINSING, MIXING, AND PACKAGING

After tossing your salted cabbage for an hour or two, it should have shed a lot of water and taken on a crisp texture. Now you'll want to get most of that salt out. Soak the cabbage in cold, fresh water or spray it down in a colander, squeezing the pieces to remove as much brine as you can. Drain well, and then add the other vegetables and the gochujang mixture. Wear gloves unless you want to have hot, spicy hands for the next several hours. Then mix the kimchi thoroughly.

Traditionally, kimchi was fermented in an *onggi*, a large, semi-porous crockery jar. (The one you use to make *makgeolli* should work fine—see Beer School in the May/June 2019 issue of *Zymurgy* for more.) Barring that, you can use any large glass fermenter, but avoid plastic: kimchi may stain it red or infuse it with aromatic garlicky goodness.

Cover your fermenter with a lid or plastic wrap, and keep it in a cool, dark place, preferably around 60°F (15.5°C). A refrigerator works fine, too, but it will just take a matter of weeks to ferment rather than days. Monitor fermentation periodically, stirring gently to bring gas bubbles to the surface. As with sauerkraut, try to keep solids submerged as much as possible, as the low pH protects the fermenting vegetables from mold growth.

> "There is no real point at which kimchi is "done"—it will change over time but is delicious at all stages.

Be aware that if you use Mason jars, even clamping the lids down won't prevent liquid from seeping out if you fill them anywhere near capacity, so make sure they are in a tray or pan that will catch the juices. Taste and smell after a few days at 60°F (15.5°C), or after a week or so with fridge fermentation. When the tartness and balance is to your liking, you can scoop the kimchi into sealable bags for long-term storage, or just keep the batch in the fermenter and draw from it as needed.

There is no real point at which kimchi is "done"—it will change over time but is delicious at all stages. Most Koreans will tell you that kimchi never goes bad; it changes in texture and pH, growing softer, tarter, and even slightly fizzy as it continues to ferment. This older form is very popular in soups.

There are hundreds of delicious kimchi recipes online to experiment with once you have the basic process down. As with sauerkraut, just make sure not to cook it if you want to reap the full nutritional benefits. Between the vitamin C and the probiotics, a little every day is said to boost the immune system, improve digestion, and add a bit of healthy fiber to your diet. After fermentation is complete, kimchi has almost no sugar and very little starch, so it's great for diabetics. It also complements a wide variety of other Korean foods, not just steamed rice—although it's great that way, too.

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

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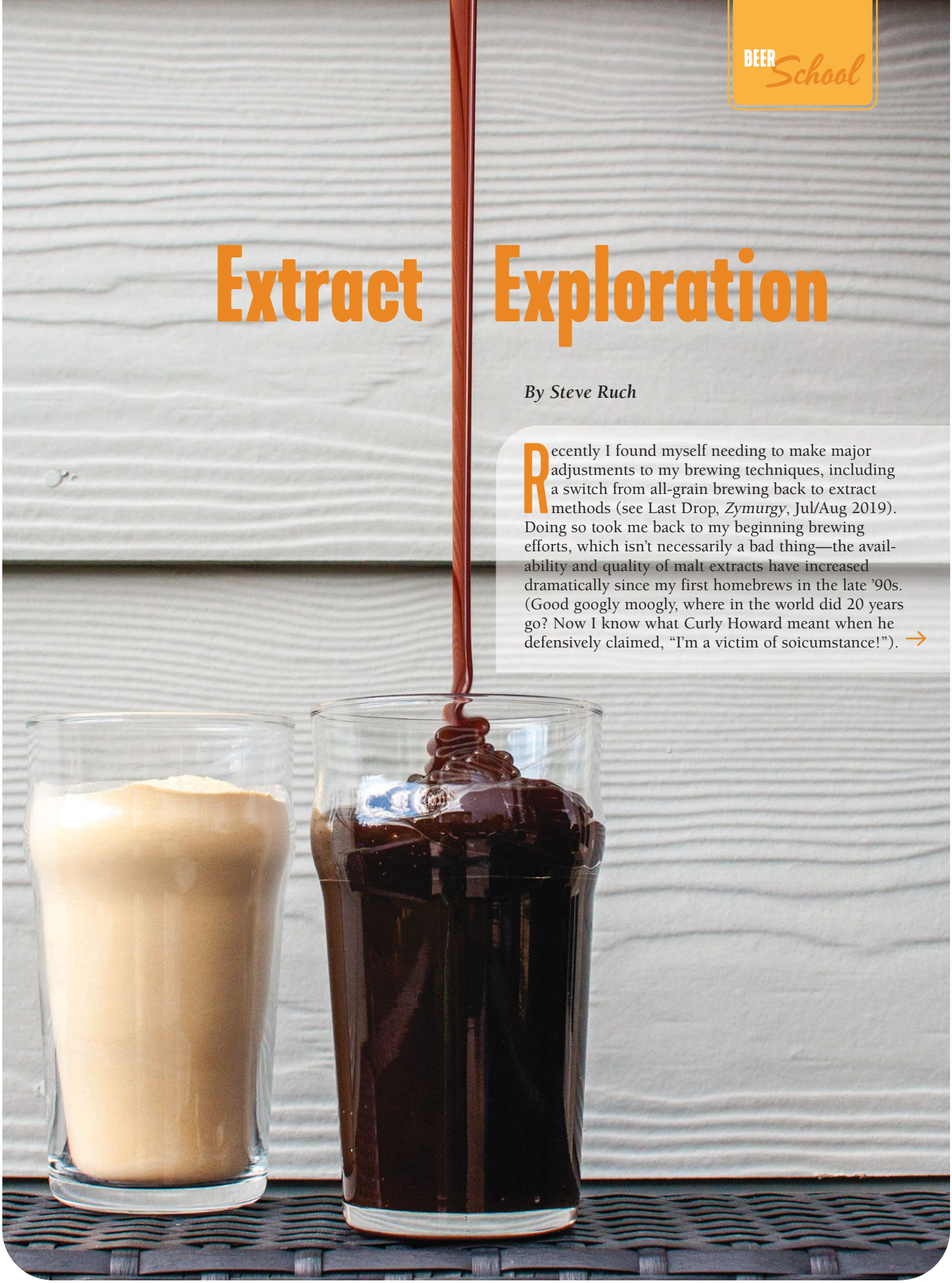
Extract Exploration

By Steve Ruch

Recently I found myself needing to make major adjustments to my brewing techniques, including a switch from all-grain brewing back to extract methods (see Last Drop, *Zymurgy*, Jul/Aug 2019). Doing so took me back to my beginning brewing efforts, which isn't necessarily a bad thing—the availability and quality of malt extracts have increased dramatically since my first homebrews in the late '90s. (Good googly moogly, where in the world did 20 years go? Now I know what Curly Howard meant when he defensively claimed, "I'm a victim of soicumstance!").



GOOD TO KNOW

Extract Abbreviations

CBW
Concentrated Brewers Wort, a registered trademark of Briess Malt & Ingredients Co.

DME
Dried malt extract, sometimes called spraymalt

LME
Liquid malt extract, sometimes called malt extract syrup

Notes on Color
Grain malt color in North America is expressed in degrees Lovibond (°L), while beer color is expressed using the Standard Reference Method (SRM). For most practical purposes, the two are interchangeable. EBC (European Brewery Convention) color is approximately twice the SRM value

Briess's color values for extracts are based on a wort of 8°P, or 1.032 specific gravity, which implies a usage rate of approximately 0.85 pounds of LME per gallon of wort (102 g/L) or 0.71 pounds of dry extract per gallon of wort (85 g/L).

The color values for William's Brewing liquid extracts are based on a usage rate of 6 pounds of liquid extract dissolved into 5 gallons of water, or 1.2 lb./gal. (144 g/L).

As I've gotten older and less energetic, I've found myself contemplating ways to simplify my brewing, which is where the increasing availability of quality extracts and proprietary non-hopped extract blends comes to the rescue. I couldn't have attempted Denny Conn's Wry Smile rye IPA as an extract beer in the late '90s. But now I can.

Since I'm back in the wide world of extracts indefinitely, I wondered just how many different styles of beer I could brew with only extract—no specialty grains—only varying the hops and yeast, IBUs and original gravity. This led me down a rabbit hole of extract exploration as I sought to discover what was in the various products now available to homebrewers.

You can brew drinkable to pretty good beer from extracts alone, but most styles can easily be taken to the next level by steeping one or more specialty malts, or by blending multiple extracts in one brew. The brands listed are those I found readily available, but by no means are the listed examples below exhaustive.

PALE MALT EXTRACTS

Homebrewers can build limitless recipes around pale malt extracts by using pale extract as the primary source of fermentable sugars and steeping specialty malts to gain flavor, aroma, and color. However, for the right styles, one needn't necessarily use steeping grains at all—for many pale ale, pale lager, and wheat beer styles, extract alone can do the job.

Pilsen/Extra-Light

Briess's 2°L CBW Pilsen Light is made from 99 percent Pilsner malt and 1 percent Carapils and is available in both liquid and dry forms. Muntons extra-light LME and DME are made from 100 percent English lager malt.

Beers that can be brewed from Pilsner extract alone include German Pils (see recipe for Uber German-style Pilsner) and Czech pale lager, international pale lager, Australian sparkling ale, Czech premium pale lager, American blonde ale, Munich helles, Dortmunder, Kölsch, Leichtbier, German helles export, pale kellerbier, pale doppelbock, Trappist-style single, tripel and Belgian golden strong ale (with the addition of sugar), and all the iterations of American lager.

Brew This!

Simply Bone Idle

Best bitter

Batch volume: 5 U.S. gal. (18.9L)
Original gravity: 1.040 (10°P)
Final gravity: 1.012 (3°P)
Bitterness: 10 IBU
Alcohol: 3.8% by volume
Color: 6 SRM

EXTRACT
5.5 lb. (2.5 kg) pale ale (preferably Maris Otter) LME

HOPS
1.75 oz. (49 g) WGV (Whitbread Golding Variety), steep 30 min

YEAST
9 g Lallemand London ESB

ADDITIONAL INGREDIENTS
3.75 oz. (105 g) cane sugar to prime

BREWING NOTES
Heat 2 gal. (7.6 L) filtered water to 176°F (80°C), thoroughly mix in half the extract, add the hops, and steep for 30 minutes. Remove the hops, thoroughly mix in the remaining extract, chill, add 3 gal. (11.4 L) water, and pitch the yeast. After two weeks, bottle or keg. Although this is a "bitter," I went for hop flavor and aroma only on this batch, which is why there's no boil, just hot steeping of the hops. I recommend using Maris Otter extract for all British-style beers.

Brew This!

Nilsson

American wheat ale with coconut

Batch volume: 5 U.S. gal. (18.9L)
Original gravity: 1.048 (12°P)
Final gravity: 1.012 (3°P)
Bitterness: 15 IBU
Alcohol: 4.8% by volume
Color: 5 SRM

EXTRACT

6.4 lb. (2.9 kg) wheat LME

HOPS

0.5 oz. (14 g) Wakatu, 7.1% a.a. @ 45 min
0.25 oz. (7 g) Wakatu, 7.1% a.a., steep 30 min

YEAST

11 g Fermentis SafAle K-97
— or —
1 pack Wyeast 1010 American Wheat

ADDITIONAL INGREDIENTS

1.5 lb. (680 g) large chunk dried unsweetened coconut.
6 oz. (170 g) cane sugar to prime

BREWING NOTES

If using liquid yeast, make a starter the day before brewing. Bring 2 gal. (7.6 L) filtered water to near boiling, remove from heat, and thoroughly mix in half the extract. Bring to a boil, add the 45-minute hops, and boil for 45 minutes. Remove from heat and add the steeping hops. After 30 minutes, remove hops, thoroughly mix in the remaining extract, chill, add 3 gal. (11.4 L) water, and pitch the yeast.

After two weeks, add the coconut, and bottle or keg after another week. The amount of coconut is not large, as I'm only going for a subtle coconut flavor. I like using Wakatu with coconut because of the lime flavors it provides. If Wakatu is hard to find, use Hallertauer Mittelfrüh and a bit of lime zest.

Extra-light dry extracts are great to keep on hand for their convenience to brewers of all types. It's easy to prepare a yeast starter using DME, and all-grain brewers who come up short on gravity in the mash can make up the difference by adding a bit of extract in the boil.

Wheat

Wheat malt extracts are made from a blend of wheat and barley. In the case of Briess's CBW Bavarian Wheat malt extract (3°L), the proportion is 65 percent wheat to 35 percent barley. As the name suggests, this is a perfect ratio for brewing Bavarian-style hefeweizen, which by law in Germany must contain at least 50 percent wheat malt. Munton's and Brewer's Best (Coopers) also manufacture wheat malt extracts.

The first beer I ever brewed was an extract wheat beer that tasted like yeast soup. I initially tried to blame the ingredients, but having upped my brew game since those early efforts—I've brewed much better wheat beers since then) —I have to admit it was on me.

American wheat beer is an obvious style that can be brewed exclusively from wheat malt extract, and it makes a great base for all kinds of fruit, spice, or veggie beers (see Nilsson wheat recipe). Bavarian-style weissbier (hefeweizen) is the other obvious choice, but there are many others. Grisette, white IPA, pale weizenbock, wheat wine, Berliner weisse, and witbeer can all be made using this extract, as can many sour, Brett, and wild specialty beers.

A small amount of wheat malt extract added to other recipes can improve head retention thanks to wheat's higher protein content.

Light/Pale

Pale and light extracts are normally made from two-row malt and perhaps a small amount of caramel malt and come available as LME or DME. Briess's CBW Golden Light malt extract (4°L), available as liquid and dry extracts, is made from 99 percent base malt and 1 percent Carapils.

William's Brewing markets a German Pils liquid malt extract made from Moravian Pilsner malt with "a touch of Vienna malt." Used at a rate of 1.2 pounds LME per gallon of water (144 g/L), this extract will create 5 SRM wort. Muntons and Coopers also manufacture light malt extracts—Muntons notes its product is made from 100 percent British base malt.

> "The options for brewing with today's quality malt extracts are virtually limitless.

Light extract can be used to brew most of the same styles as Pilner/extra-light extracts, although the color will be slightly darker. It's also a great choice for American, British, and Belgian pale ales; IPAs of all kinds; British golden ale; cream ale; and pre-Prohibition lager.

American Lager
William's Brewing's American Lager liquid malt extract is made from a 70/30 blend of Pilsner malt and flaked maize to give the light, refreshing crispness associated with American adjunct lagers. It is good in American light lager, American lager, cream ale, and—yes—malt liquor. This extract, used at a rate of 1.2 pounds per gallon (144 g/L), has a color rating of 4 SRM.

Pale Ale
Briess's Pale Ale malt extract (6°L) is produced from 100% pale ale malt and also comes in dried form. Muntons produces a canned Maris Otter LME made from 100 percent Maris Otter malt. William's Brewing also offers a Pale Ale liquid extract, made from European pale ale malt, and a Belgian Pale Ale Extract, made from 90 percent Belgian pale malt and 10 percent Belgian wheat malt. Both are 7°L.

Brew This!

Don't Mess with Texas

American brown ale

Batch volume: 5 U.S. gal. (18.9 L)
Original gravity: 1.055 (13.5 P)
Final gravity: 1.013 (3.3°P)
Bitterness: 40 IBU
Alcohol: 5.6% by volume
Color: 18 SRM

EXTRACT
7.5 lb. (3.4 kg) William's Nut Brown LME

HOPS
0.38 oz. (11 g) Chinook 12.1% a.a. @ 45 min

0.38 oz. (11 g) Simcoe 12.3% a.a. @ 45 min

0.5 oz. (14 g) Chinook 12.1% a.a., steep 30 min

0.5 oz. (14g) Simcoe 12.3% a.a., steep 30 min

YEAST
12 g Fermentis SafAle S-05
— or —
1 pack Wyeast 1056 American Ale

ADDITIONAL INGREDIENT
5 oz. (140 g) cane sugar to prime

BREWING NOTES
If using liquid yeast make a starter the day before brewing. Heat 5.5 gal. (20.8 L) filtered water to near boiling, remove from heat, and thoroughly mix in half the extract. Bring to a boil, add the 45-minute hops, and boil for 45 minutes. Remove from heat, add the steeping hops, and steep for 30 minutes. Remove the hops, thoroughly mix in the rest of the extract, chill, and pitch yeast. Ferment for three weeks and bottle or keg.

Brew This!

Uber

German Pilsner

Batch volume: 5 U.S. gal. (18.9L)
Original gravity: 1.050 (12.5°P)
Final gravity: 1.010 (2.5°P)
Bitterness: 30 IBU
Alcohol: 5.3% by volume
Color: 3 SRM

EXTRACT
5.5 lb. (2.5 kg) Pilsner DME

HOPS
0.5 oz. (14 g) German Magnum, 13% a.a. @ 30 minutes.
0.75 oz. (21 g) Hallertauer Mittelfrüh, 3.5% a.a. @ 10 min
0.25 oz. (7 g) Hallertauer Mittelfrüh, 3.5% a.a., steep 30 min
0.5 oz. (14 g) Hallertauer Mittelfrüh, 3.5% a.a., dry hop (optional)

YEAST
22 g Fermentis SafLager W-34/70

ADDITIONAL INGREDIENTS
5 oz. (140 g) cane sugar to prime

BREWING NOTES
Heat 5.5 gal. (20.8 L) filtered water to boiling, remove from heat, and thoroughly mix in one-fourth of the extract. Return to boil, add 30-minute hops, and boil 20 minutes. Add the 10-minute hops and boil for 10 more minutes. Turn off the heat and add the steeping hops. After 30 minutes, remove the hops and thoroughly mix in the remaining extract. Chill and pitch yeast. After 3 weeks, bottle or keg. Lager if you want, adding the dry hops during lagering if desired.

Pale ale extract can be the base for many beer styles: ordinary bitter (see recipe for Simply Bone Idle bitter), best bitter, and strong bitter are excellent candidates, as are most pale ales and IPAs. American and British barleywines work well with this type of extract. I recommend trying to source Maris Otter extract for British styles for the quintessentially English flavor it provides.

BROWN & AMBER MALT EXTRACTS

Although many brown and amber beers can be brewed by steeping specialty malts and using a pale extract, amber and brown extracts often incorporate grains that must be mashed, such as Munich and rye. Using these malt extracts introduces unique flavors that can't be obtained from steeping grains alone.

Munich

Briess CBW Munich malt extract (8°L) is made from 50% Munich malt, as are the Munich extracts made by most other manufacturers. It is available as LME and DME.

Munich extract on its own makes a good Märzen or altbier. International amber lagers, Czech amber lagers, American amber ales, and dark American lagers can also be brewed with it. By combining Pilsner and Munich malt extracts in varying ratios you can also make Czech amber lager, festbier, Oktoberfest, Munich dunkel, any member of the bock family, and many ales.

William's Brewing's German Gold extract is also made from a 50/50 blend of Pilsner and Munich malts, but the constituent malts are specifically listed as coming from Germany. It yields wort of 7°L.

Rye

Briess CBW Rye (9°L) contains 70 percent base malt, 20 percent rye malt, and 10 percent 40°L caramel malt; it was developed in cooperation with Denny Conn and is only produced in liquid form; no dried version is available at press time. Rye malt extract is ideal for roggenbier, rye saison, and sahti. It also, of course, makes an excellent rye IPA. (For an extract formulation of Denny's Wry Smile, see the Nov/Dec 2019 issue of *Zymurgy*.)

American Red

This liquid malt extract from William's Brewing has a color rating of 9 SRM and is made from a proprietary blend of pale and crystal malts. William's notes that the formulation excludes roasted barley.

Brew This!

All Fuggled Up

English porter

Batch volume: 5 U.S. gal. (18.9 L)
Original gravity: 1.047 (11.8°P)
Final gravity: 1.012 (3°P)
Bitterness: 25 IBU
Alcohol: 4.7% by volume
Color: 20 SRM

EXTRACT
6 lb. (2.72 kg) Briess Porter LME

HOPS
1 oz. (28 g) Fuggle, 5% a.a. @ 60 min
0.5 oz. (14 g) Fuggle, 5% a.a. @ 30 min
0.25 oz. (7 g) Fuggle, 5% a.a., steep 30 min

YEAST
10 g Fermentis SafAle S-04

ADDITIONAL INGREDIENT
4 oz. (113 g) cane sugar to prime

BREWING NOTES
Bring 5.5 gal. (20.8 L) filtered water to near boiling and remove from heat. Thoroughly mix in all the extract and return to heat. Bring to a boil, add the 60-minute hops, and boil for 30 minutes. Add the 30-minute hops and boil for 30 more minutes. Turn off the heat and add the steeping hops. After 30 minutes, remove the hops, chill, and pitch yeast. Ferment for two weeks and bottle or keg.

Amber
Briess CBW Sparkling Amber (10°L) is made from a proprietary blend of malts. Munton's and Coopers (Brewer's Best) produce amber extracts as well. I was unable to convince the manufacturers to reveal the actual constituent grains or their percentages, which suggests that this may be a competitive category!

The beers I'd brew with amber extract are Czech amber lager, international amber lager, alt, amber kellerbier, amber bière de garde, ordinary bitter, best bitter, strong bitter, Scottish light, Scottish heavy, Scottish export, American or British strong ale, old ale, American and British barleywine, American amber, California common, and red IPA.

Porter
Briess lists the ingredients of its CBW Porter liquid malt extract (no DME available) as 81 percent base malt, 8 percent Victory malt, 5 percent 80°L caramel malt, 4 percent chocolate malt, and 2 percent Carapils. Munton's also makes a dark LME from pale malt, crystal malt, and chocolate malt, though I wasn't able to ascertain the specific ratios.

This extract is best used in Baltic porter, robust porter, English porter (see the accompanying recipe for All Fuggeled Up porter), American porter, pre-Prohibition porter, brown IPA, and any number of autumn seasonal beers.

Brown Ale
William's Nut Brown (13°L) liquid malt extract is mashed from a blend of pale, Victory, crystal, chocolate, and other malts for a rich amber color and nutty flavor. It's a good choice for American brown ale (see the recipe for Don't Mess with Texas) or British brown ale, mild ale, and brown IPA. It may also work well for dunkler bock and Munich dunkel.

DARK MALT EXTRACTS

At the darkest end of the spectrum, we have malt extracts that incorporate roasted malts for the blackest of beers. Czech dark lager, dark mild, Irish stout, foreign extra stout, tropical stout, American stout, imperial stout, winter seasonal ale, and London brown ale can all be made from these dark extracts.

Briess's CBW Traditional Dark has a color rating of 30°L and is made from 54 percent 10°L Munich malt, 30 percent base malt, 13 percent 60°L caramel malt, and 3 percent black malt.

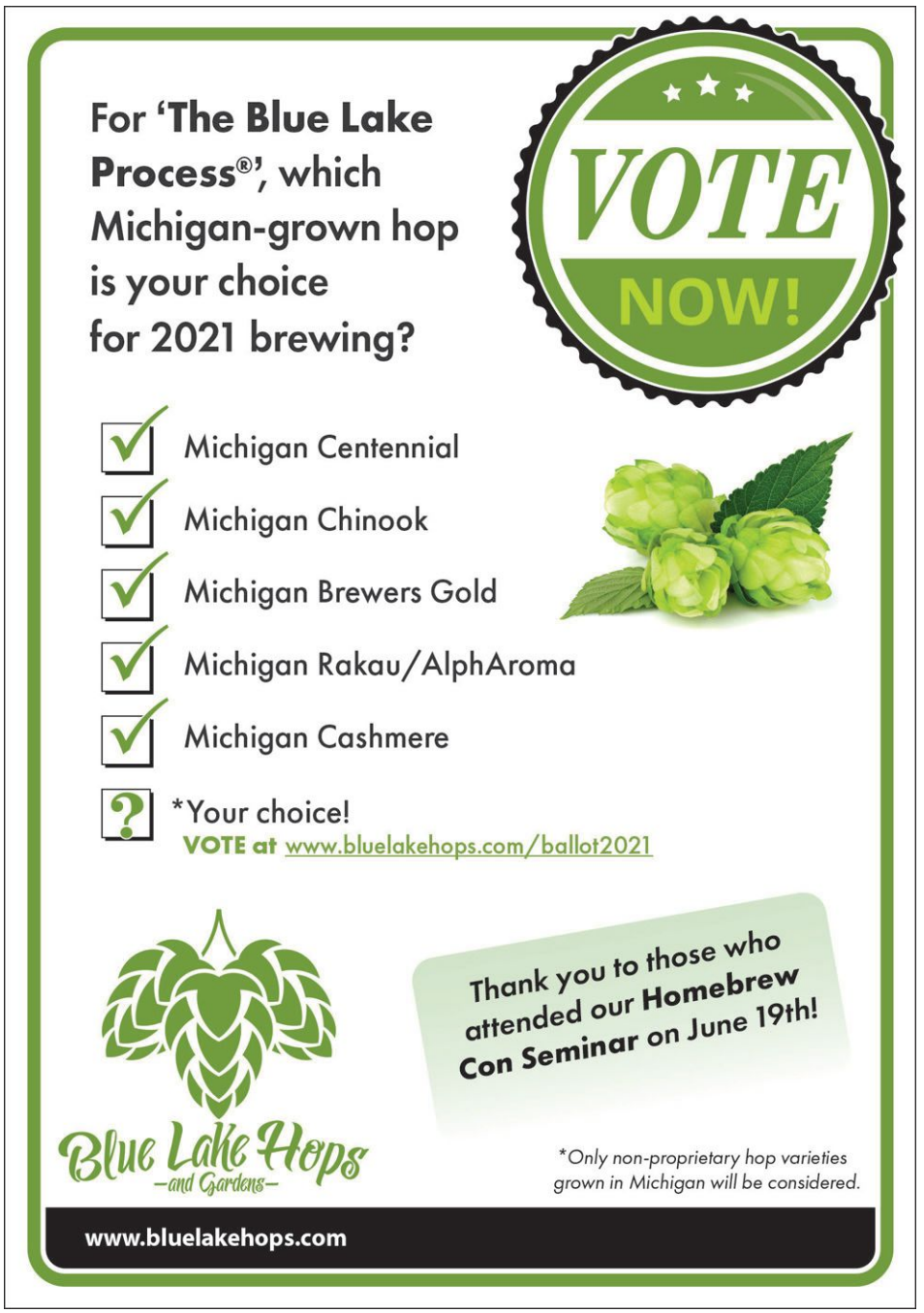
Baltic Black liquid malt extract from William's Brewing is made from 62 percent Belgian Pilsner malt, 25 percent Belgian Munich malt, 5 percent Belgian black wheat malt, 7 percent melanoidin malt, and 1% Belgian Special B malt. Used at a rate of 1.2 pounds of Baltic Black LME per gallon of water (144 g/L), this extract will yield wort of 28 SRM. It gives stout color and body without much roast and is great for schwarzbier, Cascadian dark ale, and British stout, especially milk stout and oatmeal stout.

Coopers (Brewer's Best) also produces dark and extra-dark LME products made from pale and roasted malts, though the specific roast malts—Chocolate? Black patent? Roast barley?—are not given.

CONCLUSION

All-grain brewers, come down off your high horses. Malt extract can turn out very good beer, reduce complexity for spur-of-the-moment brew days, and free up time when you can't brew from grain malts. Combined with hops, yeast, and your own imagination, the options for brewing with today's quality malt extracts are virtually limitless.

***Steve Ruch lives in Crescent City, Calif., and has been homebrewing for more than 20 years. He is a regular contributor to* Zymurgy.**



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BREW WITH YOUR BREW

By Brandon Whalen

BREWERS AND BARISTAS ALIKE OFTEN START THE DAY BEFORE THE SUN RISES, COFFEE IN HAND. SOME, LIKE ME, DRINK IT ALL DAY LONG, FORGOING THE MUCH MORE HYDRATING QUALITIES OF PLAIN WATER.

I don't know who first had the idea to mix this caffeine-laden roasted substance with malty, hoppy, alcoholic delights, but I am glad they did. Perhaps it happened when brewers of both beverages got to chatting. Such conversations often lead to delicious, fun collaborations. →

The evolution of coffee beverages in America has fluctuated greatly. In 1996, David C. Schomer wrote in *Espresso Coffee: Professional Techniques*, "Americans are a health-conscious people, and soon we will reject the drinking of 12–16 ounces of milk a day with our tall latte. … I believe that the culture will evolve into customers ordering less milk."[1]

Of course, the exact opposite has happened. The size of a typical coffee beverage has grown impressively, and with it, the ratio of dairy and syrup to coffee. In the most extreme cases, the resulting beverage bears only the faintest resemblance to what we historically thought of as coffee.

However, just as craft beer has grown, so has craft coffee. Small and local roasters understand that coffee is more than simply dark and roasted. It has myriad other flavors. As with wine grapes, cocoa beans, malted barley, and hops, the location and conditions in which coffee is grown make a difference—terroir influences the flavor of the final product. Coffee is one of the most popular beverages on the planet, so it should be no surprise that the science of cultivar, climate, acidity, age, and roast has a massive following, especially in cities like Portland and Seattle, where there is a boutique coffee shop on just about every block.

Many dark beers have hints of coffee-like flavor due to the use of roasted grains, some of which are roasted in a similar way to coffee. Such styles readily serve as great base beer, as the first coffee beers were likely just British porters or stouts with brewed, cold coffee added directly to the glass. While the most common styles of beer to be brewed with coffee tend to be porters and stouts, imagination is the only limit. Brewers have been making coffee IPAs, blondes, Pilsners, and even sours. (It takes a delicate touch to balance sour and roast enough to create a beer worth drinking, but it has been done.)

CHOOSING A COFFEE

When developing beer recipes, brewers must consider all facets of each ingredient. Different hop compounds and acid levels, yeast ester profiles, and malt flavor and degree of roast are all factors. So, then, why would choosing a coffee be any different? Researching the coffee can be paramount to building a successful coffee beer recipe, and reaching out to a roaster nearby only helps to build knowledge and relationships.

When choosing a bean, it's worthwhile to think about consistency. Is this a beer recipe that you want to repeat? If so, it would be wise to look at a bean and roast that have consistent availability as opposed to a rare estate variety that can be difficult to procure on a regular basis.

ROBUSTA, ARABICA, LIBERICA, EXCELSA

There are four species of coffee cultivated for beverage use:

- Robusta (*Coffea canephora*)
- Arabica (*Coffea arabica*)
- Liberica (*Coffea liberica*)
- Excelsa (*Coffea liberica* var. *dewevrei*)

From there, the categories become further refined. On a global scale, for example, the International Coffee Organization (ICO) divides coffee into four main categories for the purposes of price tracking:

- Colombian mild arabicas include arabica coffees from Colombia, Kenya, and Tanzania.
- Brazilian natural arabicas include arabica coffees from Brazil, Ethiopia, and Paraguay.
- Other mild arabicas include arabica coffees from all other countries.
- Robustas include all robusta varieties.

Liberica coffees, which were popular in the early 1900s, are increasingly difficult to come by. They taste vastly different from more common coffees in that they have strong woody and earthy flavors.

Excelsa has recently been reclassified as part of the liberica family due to its shape and ecology. There are huge differences in flavor, though, and these coffees are described as having a tart fruit character. Excelsa makes up seven percent of the world's annual coffee consumption and is usually blended with arabica.

Most large-scale "macro" coffee is comprised of blends of different beans, mostly of the robusta variety. Robusta is cheaper and more tolerant to disease than arabica,

Photo © Getty/hsynoaban

Brew This!

GRAYSCALE COFFEE VIENNA LAGER

Recipe courtesy Baerlic Brewing Co., Portland, Ore., and Modern Times Brewery & Café, San Diego, Calif.

Batch size: 5 US gal. (18.9 L)
Original gravity: 1.047 (11.7°P)
Final gravity: 1.010 (2.6°P)
Efficiency: 80%
Color: 4 SRM
Bitterness: 22 IBU
Alcohol: 4.9% by volume

MALTS & ADJUNCTS

3.5 lb. (1.59 kg) Weyermann Barke Pilsner Malt
3.5 lb. (1.59 kg) Weyermann Barke Vienna Malt
12 oz. (340 g) Weyermann Munich Type I Malt

HOPS

0.7 oz. (21 g) Tettnang, 5% a.a. @ 60 min
1 oz. (28 g) Tettnang, 5% a.a., whirlpool/steep 20 min

YEAST

Imperial Yeast L26 Pilgrimage

ADDITIONAL ITEMS

2.5 oz. (71 g) Modern Times Black House Coffee (90% Natural Ethiopia, 10% Sumatra)

BREWING NOTES

Ferment at 52°F (11°C) and allow temperature to free rise when specific gravity has fallen to 1.032 (8.1°P). When specific gravity stabilizes at or near 1.010 (2.6°P), lower temperature by no more than 10°F (5.6°C) per day until it reaches 34°F (0°C)

Lager for 4 weeks and then condition finished beer on whole coffee beans for 24 hours before bottling or kegging—more contact time risks extracting green pepper/pyrazine aromas from the coffee.

EXTRACT VERSION

Replace malts with 4 lb. (1.8 kg) Munich liquid malt extract and 2.5 lb. (1.1 kg) Pilsner liquid malt extract. Dissolve extracts in hot reverse osmosis water, bring to a boil, and proceed as above.

and it can have nearly double the caffeine. Robusta is purchased in bulk by large facilities and blended with certain percentages of more specialty roasts. Robusta does not have a wonderful reputation, and many roasters do not market its use in their blends.

Most of the specialty coffee we see is arabica. However, this isn't to say all arabica is specialty. Varietal, ecology, and processing are all factors in what can make it "specialty." It is the most delicate of the four varieties and quite susceptible to blight and pests, but is revered for its wonderful aroma and flavor.

ROAST

Roast levels play a huge role in the flavor of coffee beer. Using darker roasts will yield bigger, bolder flavors, while lighter roasts can be perceived as more subtle and fruity. An experiment conducted by Mayer in 1999 found that roasting coffee from light to dark increases smoky, roasted, sulfurous, and earthy notes.[2] Darker roasts also bring more of the coffee's oil content to the surface, which is why dark roasts appear so shiny. The oxidation of these oils can lend stale notes to beer in a rather short amount of time. Nonetheless, assertive dark roasts can work well and deliver wonderful flavors to the right base beer.

Lighter roasts can deliver nuanced characteristics that many love, but they can also promote a vegetal character if used improperly. Mildly roasted beans are not as "cooked through" as darker roasts, which can leave behind undesirable compounds.

Other compounds are more persistent. For example, 3-isobutyl-2-methoxypyrazine is known for its vegetal "green bell pepper" or "green pea" taste. These pyrazines have ring structures stabilized by nitrogen and are unfortunately not volatile. That means they will not go away during the brewing process. The level of 3-isobutyl-2-methoxypyrazine does not change with roast level, nor is it related to oxidation.[3] Although darker roasts seem to cover up the flavor a bit more, it never goes away.

Contact time seems to have the biggest impact on this off flavor. The longer beer remains in contact with coffee, the more likely we are to pick up these pyrazines on the palate. The coffee extraction method used in the brewing process can influence how much of that vegetal, bell-pepper character makes it into the beer.

EXTRACTION METHODS

The first modern brewing method for achieving a coffee-flavored beer likely consisted of simply adding regular, conventionally brewed joe to the fermenter, brite tank, and/or keg. There are some benefits to

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doing this. In the hot-brewed method, the contact time between water and coffee is so short (think drip coffee) that there is little time to leach out those pesky pyrazines. This method also extracts less acidity, but it does extract more tannins and astringency.

Hot Side Additions

Many brewers used to—and I am sure some still do—add coffee grounds directly to the boil. This can drive off coffee's rich, bold, beautiful character and leave behind a chalky, burnt taste that barely resembles coffee (not to mention wreaking havoc on the wort chiller). If you must add coffee in the boil, at least use a strainer bag.

Cold Side Additions

Minnesota-based Surly Brewing Co. sources coffee from Coffee and Tea Ltd. in the Twin Cities. For its wonderful coffee brown ale,

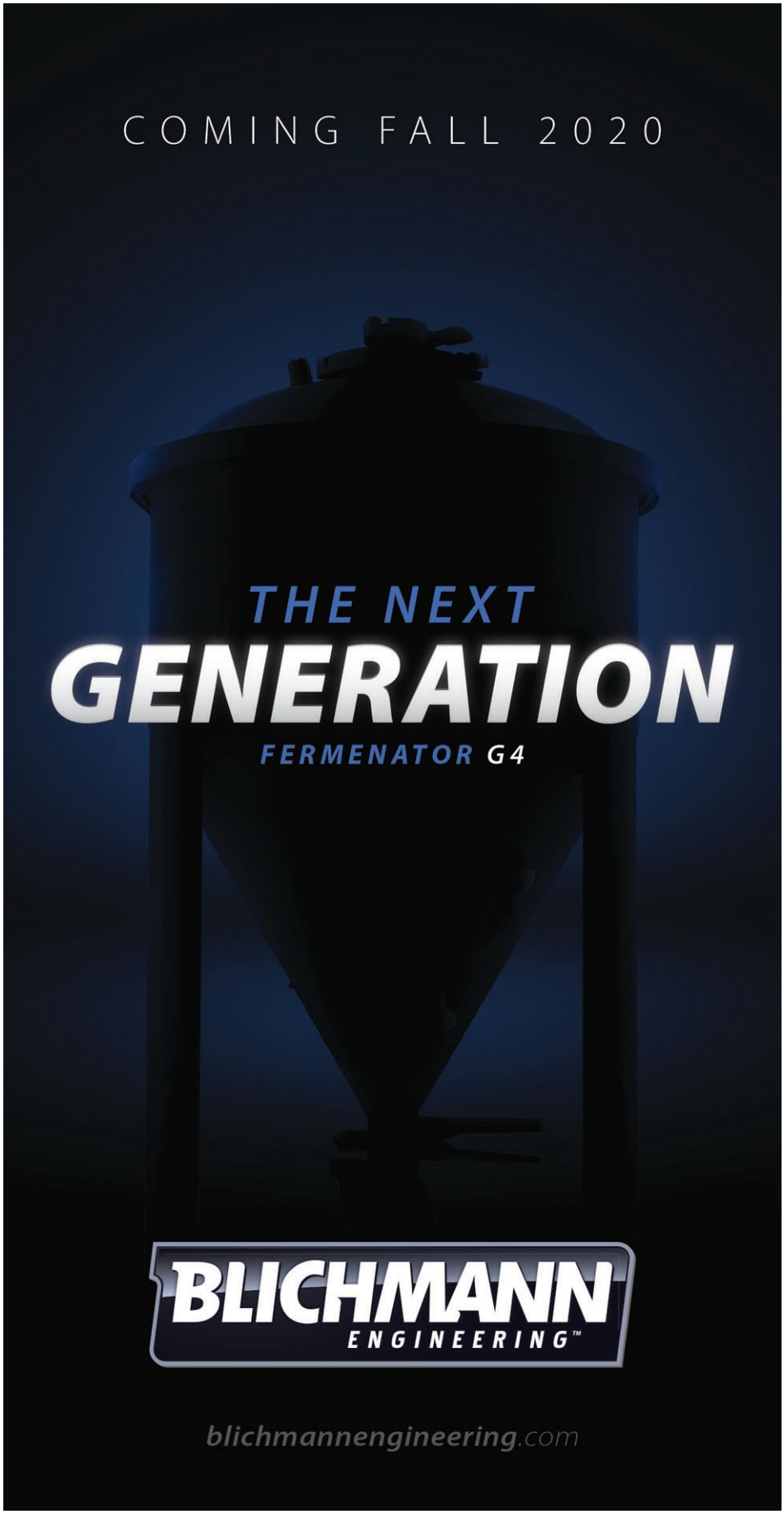
ON THE WEB
Learn more about coffee beer at HomebrewersAssociation.org/ja20.

Coffee Bender, Surly uses a Guatemalan bean from Finca Vista Hermosa.

"This coffee adds a rich, full coffee flavor with notes of dark fruit, chocolate, and low bitterness," says Taylor Friedlander, office administrator at Surly. "We add about two pounds per barrel of coarse ground beans. The process of infusing the coffee mimics that of a cold press extraction."

After the beer has reached terminal gravity they chill it to between 30°F and 32°F (−1°C to 0°C), at which point coffee is added and allowed to cold condition for 24 hours. "The cold extraction allows us to access the rich fruit and chocolate notes of the bean without any of the bitterness and astringency that can be extracted at hotter temperatures," notes Friedlander. After 24 hours, the beer is centrifuged to remove protein, yeast, coffee, and other solids. It is then carbonated and packaged for consumption.

Adding coffee to cold beer lets brewers highlight subtleties that are well known to roasters but only now being recognized in the brewing world. Steadily monitored cold extraction gives beer subtle nuanced coffee



flavors—from pie spice to blackberry—that go beyond the common roast.

Some brewers have found that adding coffee grounds directly to the fermenter can cause racking issues down the line after coffee grounds have settled to the bottom. A good solution is to bag the coffee grounds. This keeps the gritty substance out of our glasses, although bagging the grounds offers less surface contact and can promote stratification—the beer directly surrounding the bag can have more coffee character than beer removed for sampling purposes.

A good way to avoid this problem is to recirculate. Fill an external vessel such as a hopback or Randall with coffee and purge it of oxygen using CO_2 or nitrogen. Then you can use a pump to pull beer from the fermenter, pass it through the coffee-filled vessel, and return it to the fermenter. Even with this kind of setup, you'll have to use your palate to decide when the beer tastes just right and then immediately stop filtering it through the coffee. This adds some guesswork and variability into the mix, which can make it difficult to achieve consistency from one batch to another.

Cold Brew

The gentle process of cold-brew coffee makes it possible to discover subtle, nuanced flavors that can be lost in traditional hot-brew methods. When used with lighter beer styles such as Pilsners and blonde ales, cold brewing can highlight coffee's nutty and light fruit notes without overpowering roast, dark fruit, and bitterness. Making a concentrated cold-brew avoids introducing too much liquid that would otherwise dilute the beer. Brewing up a cold-brew concentrate is how Breakside Brewery in Portland, Ore., does it.

"It is just regular coffee brewed to a very high concentration/strength with the intention of 'cutting it' (usually with milk or water, but in our case beer) before consumption," says brewmaster Ben Edmunds. "We like working with liquid coffee rather than grounds for a few reasons. First, we can de-aerate the cold brew concentrate and inject it directly into the beer. It's

a known quantity and flavor addition. Second, we think we get better shelf stability this way—the coffee is less prone to oxidation. Third, our internal preference is for a less oily/intense coffee flavor, and we've found that the use of beans or grounds tends to throw that character more often."

Color

The creation of balance in light beer styles poses a challenge in and of itself. A brewer may be worried about too bold of a roasted character and, of course, leaching dark color into something as light and delicate as an American light lager. The issue poses no problems for dark beer styles such as stout, porter, black lager, and Cascadian dark ale (remember those?). The issue, of course, comes with the lighter beers where whole beans might be the best route for extracting flavor but not as much color.

As brewers continue to push boundaries, there will no doubt be new methods and innovations in the marriage of beer and coffee. I can't wait to see what the future of this relationship holds.

RESOURCES

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3. Clarke, Ronald., Vitzthum, O. G.. *Coffee: Recent Developments*. Germany: Wiley, 2008.

Brandon Whalen is the head brewer at 13 Virtues Brewing in Portland, Ore. He is a BJCP-certified beer judge, beer writer, and all-around beer nerd. Before brewing professionally, he was an award-winning homebrewer who paid his bills as a chef. He studied brewing chemistry and fermentation science through the University of Oklahoma. Brandon enjoys experimenting with different ingredients in both clean and wild beers.

Brew This!

SURLY COFFEE BENDER

Recipe courtesy Surly Brewing Co.

This oatmeal brown ale with coffee comes from Surly Brewing Co. in Minneapolis. The commercial version uses coffee from Minneapolis's own Coffee and Tea Ltd., but Surly's brewers advise homebrewers to choose a fresh, locally roasted coffee.

Batch size:	5 US gal. (18.9 L)	**Color:**	30 SRM
Original gravity:	1.060 (14.7°P)	**Bitterness:**	35 IBU
Final gravity:	1.018 (4.6°P)	**Alcohol:**	5.5% by volume
Efficiency:	70%		

MALTS & ADJUNCTS

7.8 lb. (3.54 kg) Rahr Pale Ale malt
2 lb. (907 g) Dingemans Aromatic malt
9.6 oz. (272 g) Simpsons Medium Crystal malt
9.6 oz. (272 g) Dingemans Special B malt
5.6 oz. (159 g) flaked oats
5.6 oz. (159 g) Simpsons Golden Naked Oats
4 oz. (113 g) Simpsons Chocolate malt

HOPS

0.7 oz. (18 g) Warrior, 15% a.a. @ 60 min
0.5 oz. (14 g) Glacier, 5.6% a.a. @ 0 min
0.5 oz. (14 g) Willamette, 5.5% a.a. @ 0 min

YEAST

White Labs WLP007 Dry English Ale

ADDITIONAL ITEMS

5 oz. (142 g) Full City–roast coffee, coarsely ground, in secondary

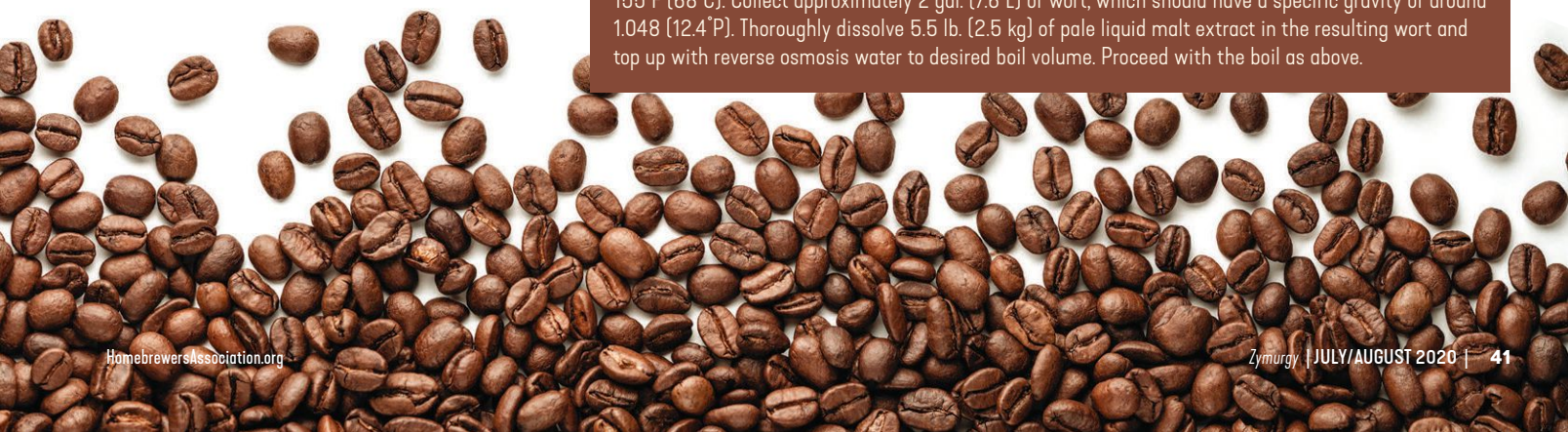
BREWING NOTES

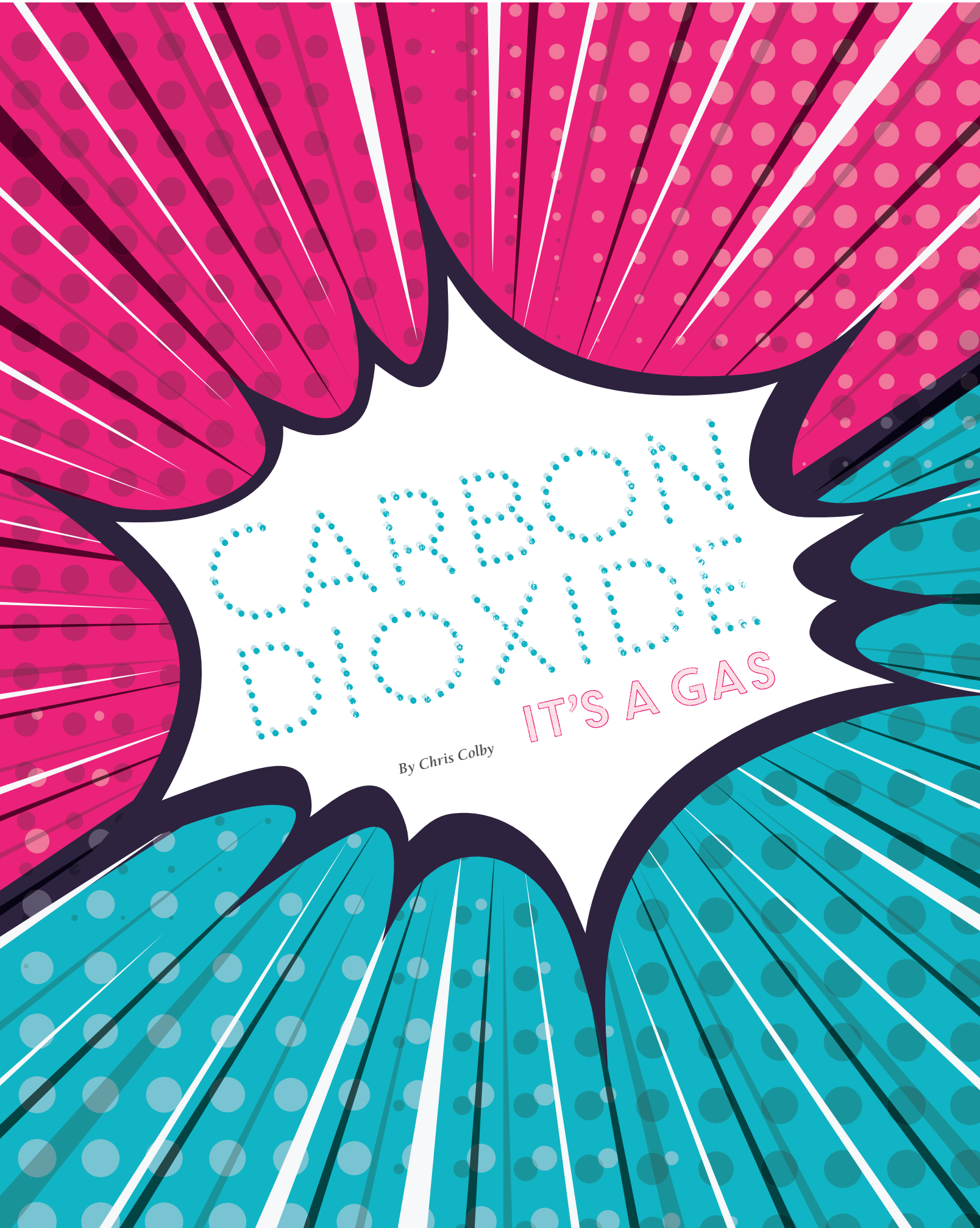
Mash at 155°F (68°C) for 60 minutes. Lauter, sparge, and collect wort. Boil 60 minutes, adding hops as indicated. Cool to 67°F (19°C). Ferment at 67°F (19°C) until specific gravity stabilizes at or near 1.018 (4.6°P).

After fermentation, cold crash if possible and then rack beer off yeast and onto coffee in a CO_2–purged secondary vessel. Let beer sit on coffee for 48 hours, cold if possible, and then rack off the coffee and bottle or keg.

PARTIAL-MASH VERSION

Although there is no extract equivalent for Dingemans Aromatic malt, a reasonably similar beer can be brewed by omitting the Aromatic malt altogether and mashing 2 lb. (907 g) of pale ale malt with the crystal malt, Special B malt, flaked oats, Golden Naked Oats, and chocolate malt for 60 minutes at 155°F (68°C). Collect approximately 2 gal. (7.6 L) of wort, which should have a specific gravity of around 1.048 (12.4°P). Thoroughly dissolve 5.5 lb. (2.5 kg) of pale liquid malt extract in the resulting wort and top up with reverse osmosis water to desired boil volume. Proceed with the boil as above.





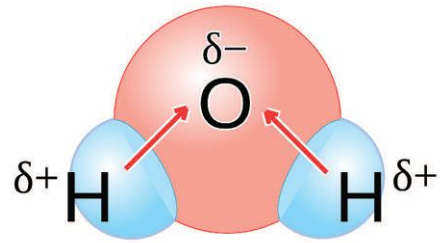
CARBON DIOXIDE

IT'S A GAS

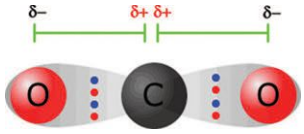
By Chris Colby

The sound of a beer bottle being opened and the sight of rising foam as we fill the glass are among the first things we experience when drinking a homebrew—and both involve carbon dioxide. Carbon dioxide (CO_2) is a simple molecule, just two oxygen atoms connected to a central carbon atom. However, while the molecule itself is simple, the effects of CO_2 in beer are complex.

In a molecule of CO_2, all of the atoms are lined up in a row, so the molecule is *non-polar*. In other words, neither side of the molecule carries a net positive or negative electrical charge relative to the other side. In contrast, water (H_2O)—another simple, three-atom molecule—is polar because the two hydrogen atoms attached to the central oxygen atom are both on the same side of the molecule. In carbon dioxide, both oxygen atoms are double bonded to the central carbon, so CO_2 is relatively non-reactive. (Double bonds take more energy to break than single bonds.) For the same reason, it doesn't ionize easily.



Polarity of a water molecule.



Carbon dioxide is non polar.

Relatively non-reactive is not the same as inert, however, and there are a couple of reactions involving CO_2 that are relevant in brewing. For example, in an aqueous solution, CO_2 reacts with calcium carbonate (the molecule that forms limestone) to produce calcium ions (Ca^{2+}) and bicarbonate (HCO_3^-), two ions that influence mash chemistry. Also, CO_2 reacts with water (H_2O) to form carbonic acid (H_2CO_3). This acid lowers the pH of beer slightly, although the lactic acid produced by brewer's yeast during fermentation is more important in this respect.

DISSOLVED CO_2 IN WATER

When CO_2 is dissolved in water (the majority constituent of beer), most of the CO_2 remains as CO_2—only a small amount reacts to form carbonic acid. The equilibrium constant (K) relating the relative amounts of carbonic acid and carbon dioxide is:

$$K = [H_2CO_3\ (aq)]/[CO_2\ (aq)] = 1.3\times10^{-3}$$

If you are math- or chemistry-phobic, relax: this is easy to understand. It simply means that for every molecule of carbonic acid in solution, there are 769 molecules ($1 \div 1.3\times10^{-3} \approx 769$) of carbon dioxide. In other words, very few CO_2 molecules react with water to form carbonic acid.

Carbonic acid itself dissociates in water to form bicarbonate (HCO_3^-) and a hydronium ion (H_3O^+). And bicarbonate reacts with water to form carbonate (CO_3^{2-}) and a hydronium ion (H_3O^+). The equilibrium constants, K_1 and K_2, for these reactions are

$$K_1 = [H_3O^+]\ [HCO_3^-]/[H_2CO_3] = 2.00\times10^{-4}$$

$$K_1 = [H_3O^+]\ [CO_3^{2-}]/[HCO_3^-] = 4.69\times10^{-11}$$

Again, this is easy to understand if you break it all down. Simply put, when CO_2 is dissolved in water, a small amount reacts with water to form carbonic acid. The carbonic acid, in turn, can give up a proton (H^+)—which reacts with water to form a hydronium ion (H_3O^+)—to form bicarbonate. And the bicarbonate, in turn, can give up a proton (H^+) to form carbonate. (Also, in reality, the protons in these reactions are never free—they react with water as the negative ion dissociates to form the hydronium ion.) So, putting it all together, dissolving CO_2 in water results in a solution of mostly CO_2 and water—with a small amount of other molecules or ions.

It's not quite that simple, though. The propensity for carbonic acid to dissociate, and for bicarbonate to give up a hydronium ion are both pH dependent. In a low pH (acidic) solution, carbonic acid is less likely to dissociate. So, under a pH of 6, a solution of CO_2 and water will be mostly CO_2 and water—with a small amount of carbonic acid (and much less bicarbonate). In a high pH (basic or alkaline) solution, the carbonic acid dissociates readily, and the resulting bicarbonate will easily give up another hydronium ion to form carbonate. So, in a solution with a pH over 11, a solution of CO_2 water will be mostly CO_2 and water—with a small amount of carbonate (and a much smaller amount of bicarbonate).

In between—for solutions with a pH between 7 and 10—most of the carbonic acid dissociates, but the resulting bicarbonate does not easily give up a hydronium ion. So, under those conditions, a solution of CO_2 and water is mostly CO_2 and water, with a smaller amount of bicarbonate (and much smaller amounts of carbonic acid near the low end of this range or carbonate near the high end).

That's a lot to wrap your head around, but the major points are these:

1. If you mix CO_2 and water, you end up with a solution almost entirely composed of CO_2 and water. Carbon dioxide is not very reactive.
2. Depending on the pH, a solution of CO_2 and water will have a very small amount of carbonic acid, bicarbonate, or carbonate. However, all three of these are never present together.
3. The higher the pH, the more likely carbonic acid is to dissociate, and the more likely bicarbonate is to give up a hydronium ion. Both of these actions will lower the pH of the solution, but in a strongly basic (alkaline) solution, the amount of change will be very small.

Incidentally, if you allow pure water to sit out and let the CO_2 in the atmosphere dissolve into it, what do think would happen? Pure water has a pH of 7. So initially, the atmospheric CO_2 would react to form a small amount of carbonic acid. However, because the initial pH was

TABLE 1: RESIDUAL CO_2 AFTER FERMENTATION AT VARIOUS TEMPERATURES

Temperature [°F]	Temperature [°C]	CO_2 [vol.]
50	10.0	1.15
51	10.6	1.13
52	11.1	1.11
53	11.7	1.09
54	12.2	1.08
55	12.8	1.06
56	13.3	1.04
57	13.9	1.02
58	14.4	1.01
59	15.0	0.99
60	15.6	0.97
61	16.1	0.96
62	16.7	0.94
63	17.2	0.92
64	17.8	0.91
65	18.3	0.89
66	18.9	0.88
67	19.4	0.86
68	20.0	0.85
69	20.6	0.83
70	21.1	0.82
71	21.7	0.81
72	22.2	0.79
73	22.8	0.78
74	23.3	0.77
75	23.9	0.75
76	24.4	0.74
77	25.0	0.73
78	25.6	0.72
79	26.1	0.70
80	26.7	0.69
81	27.2	0.68
82	27.8	0.67
83	28.3	0.66
84	28.9	0.65
85	29.4	0.64

Illustrations © Getty/Tatiana Mezhenina; Kekutuban/wikimedia Commons (water molecule); ibchem.com/IB16/Section00-bonding/img/CO2_polarity.gif (CO2 polarity)

TABLE 2: CORN SUGAR (GLUCOSE MONOHYDRATE) REQUIRED TO ADD CARBONATION TO 5 GAL. (18.9 L) OF BEER

Sugar [oz.]	Sugar [g]	CO_2 [vol.] *added* to 5 gal. (18.9 L)
0.25	7.1	0.09
0.50	14.2	0.17
0.75	21.3	0.26
1.00	28.4	0.34
1.25	35.4	0.43
1.50	42.5	0.51
1.75	49.6	0.60
2.00	56.7	0.68
2.25	63.8	0.77
2.50	70.9	0.85
2.75	78.0	0.94
3.00	85.1	1.02
3.25	92.1	1.10
3.50	99.2	1.19
3.75	106.3	1.27
4.00	113.4	1.36
4.25	120.5	1.44
4.50	127.6	1.53
4.75	134.7	1.61
5.00	141.8	1.70
5.25	148.8	1.78
5.50	155.9	1.87
5.75	163.0	1.95
6.00	170.1	2.04
6.25	177.2	2.12
6.50	184.3	2.20
6.75	191.4	2.29
7.00	198.5	2.37
7.25	205.5	2.46
7.50	212.6	2.54
7.75	219.7	2.63
8.00	226.8	2.71

7, the carbonic acid would react to form bicarbonate. But, when the acid dissociates, it gives off hydronium ions—which lowers the pH. And, with a little more math, which I'll skip, you can calculate the pH of water exposed to CO_2 at the partial pressure in our atmosphere. It's 5.65. And incidentally, this is the pH of

Photo © Getty/ValentynVolkov (beer bottle);

rain—or at least it is in regions with little sulfur dioxide and nitrogen oxides in the air. These compounds, often found in industrial pollution, cause acid rain, which often has a pH between 4.5 and 5.

CO_2 IN BEER

Carbon dioxide in beer can come from a few different sources. The first is fermentation. After primary fermentation, the beer is saturated with CO_2. In other words, no more CO_2 can dissolve into the beer unless it's put under CO_2 pressure. The concentration of CO_2 dissolved in a finished beer is a function of temperature: the cooler the beer, the more CO_2 it retains. An ale fermented at 68°F (20°C) will contain 0.85 volumes (1.7 g/L) of CO_2. If the beer is later carbonated to 2.5 volumes (5 g/L) of CO_2—the normal amount in most craft beers—the residual CO_2 from fermentation amounts to a third of the final CO_2 concentration. A lager fermented at 55°F (13°C) will retain 1.1 volumes (2.2 g/L) of CO_2. Although saturated with CO_2, fermented green beer does not taste carbonated.

If you are bottle conditioning your beer and want to carbonate to a specific level, you need to know how much carbonation your "flat" beer contains in order to add the right amount of priming sugar. The amount of residual CO_2 is given in Table 1. Subtract this number from your target level of CO_2 to get how much CO_2 must be added. Table 2 shows how much sugar is required to add various amounts of CO_2. (The sugar is consumed by the remaining yeast in the beer and converted into ethanol, CO_2, heat, and more yeast.)

Carbonation can also be added to beer by storing the beer under CO_2 pressure: higher pressures force more CO_2 into solution. Homebrewers are likely familiar with the chart published by Zahm & Nagel, which shows the concentration of dissolved CO_2 (in volumes) at pressures and temperatures at which the beer could reasonably be stored. Just store the beer at a given temperature and pressure and the CO_2 level will slowly approach the specified value. (Without shaking, it takes at least three days for the level of carbonation to get close to your target.)

As mentioned earlier, cooler temperatures allow more CO_2 to be dissolved. Some say chilling beer before carbonating will speed up the process, but that is incorrect. For starters, carbonated beer in a pressure vessel does not contain anywhere near the amount of CO_2 that could be dissolved into it. More importantly, CO_2, like any gas or solid, dissolves into solution more quickly at higher temperatures. Cold beer can *hold onto* more CO_2, but warm beer *absorbs applied* CO_2 more readily. Chemists would say that the seeming discrepancy highlights the difference between an equilibrium condition (more CO_2 in cold beer) and the kinetics of the situation (the speed at which CO_2 dissolves). Nonetheless, less pressure is needed for chilled beer than for warm beer for a given carbonation level, so carbonating cold avoids approaching the maximum pressure rating of your vessel.

Photo © Getty/LVagovy

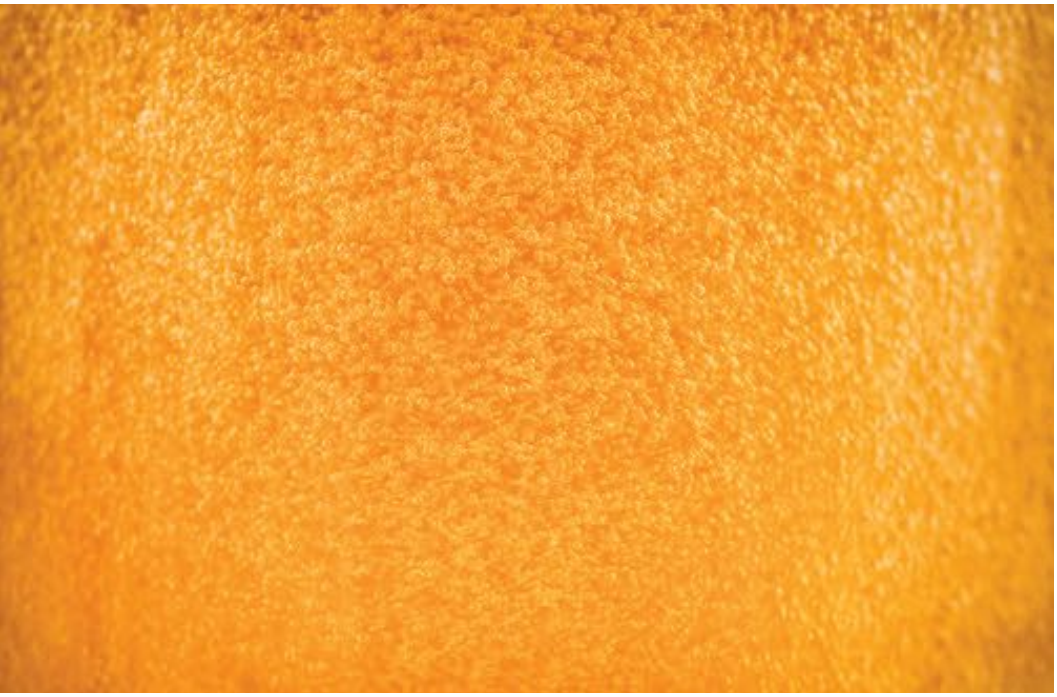


Photo © Getty/assolve

ON THE WEB
Learn more about the current shortages of CO_2 supply in the Editor's Desk on page 3 and on the web at HomebrewersAssociation.org/ja20

DOES CO_2 FORM A BLANKET?

The difference between equilibrium conditions and kinetics is important to answering a question that crops up from time to time—can CO_2 form a "blanket" to protect beer? This idea appears in many early homebrewing sources as a reason that open fermentation does not result in stale beer. This idea has been challenged by homebrewers, who often cite Henry's Law (or another of the ideal gas laws) and say that, in the same container, two gases will mix completely. This is true, but it is also an equilibrium condition. And it takes time for this equilibrium to be reached.

In the case of fermenting beer in an open vessel, CO_2 is continually escaping from the surface of the fermenting beer. Molecules of CO_2 bump into other gas molecules and drive them away from the surface. As such, the concentration of CO_2 right at the surface is very high. And, although this CO_2 will eventually mix evenly with the other gases in the room, that takes time. And during that time more CO_2 will have evolved from the fermenting beer. So yes, fermentation can form a blanket over fermenting beer. It's not impenetrable—in fact a fan blowing over the surface would disrupt it. However, in a still room, the level of CO_2 is going to increase as it gets closer to the surface of the beer.

Carbon dioxide can also form a blanket when it is colder than the surrounding air—for example, when it exits a CO_2 cylinder. A pool of CO_2 in an open vessel or any depression or "trough" can remain reasonably stable for a long period of time, and carbon dioxide's ability to collect is a well-known hazard at commercial breweries. As before, the CO_2 will eventually diffuse into the surrounding air, but this takes time.

The equilibrium condition of an opened bottle of beer is that all the "excess" CO_2—the CO_2 dissolved into it because the vessel was under pressure—will escape and render the beer flat. (As before, this "flat" beer will be saturated with CO_2 at a concentration that depends on the temperature and pressure under which it is stored.) However, this takes a surprisingly long time. For a demonstration of this, open a bottle or can of beer and place it in your fridge. The next day, pour that beer into a glass. If it has not been shaken, it will still produce foam and still taste fizzy, although less so than a freshly opened beer.

CO_2 AND FOAM

If you look at a bottle of unopened beer, it will not have any foam on top. The molecules that form foam are dissolved evenly throughout the beer. It requires CO_2 to bring them to the surface.

As a CO_2 bubble rises through the beer, it collides with other dissolved gas molecules and grows larger. It also encounters *surfactants*, which are "surface-active molecules," or molecules that are attracted to gas-liquid interfaces. Generally, surfactants are large molecules that have hydrophilic ("water loving") and hydrophobic ("water hating") sections. In other words, surfactants have a section that dissolves easily in water and a section that dissolves less easily in water. When the bubble reaches the surface, it's coated with surfactants. These stabilize the bubble and prevent it from popping quickly. Then more bubbles push up the first layers of bubbles from below, and foam is formed.

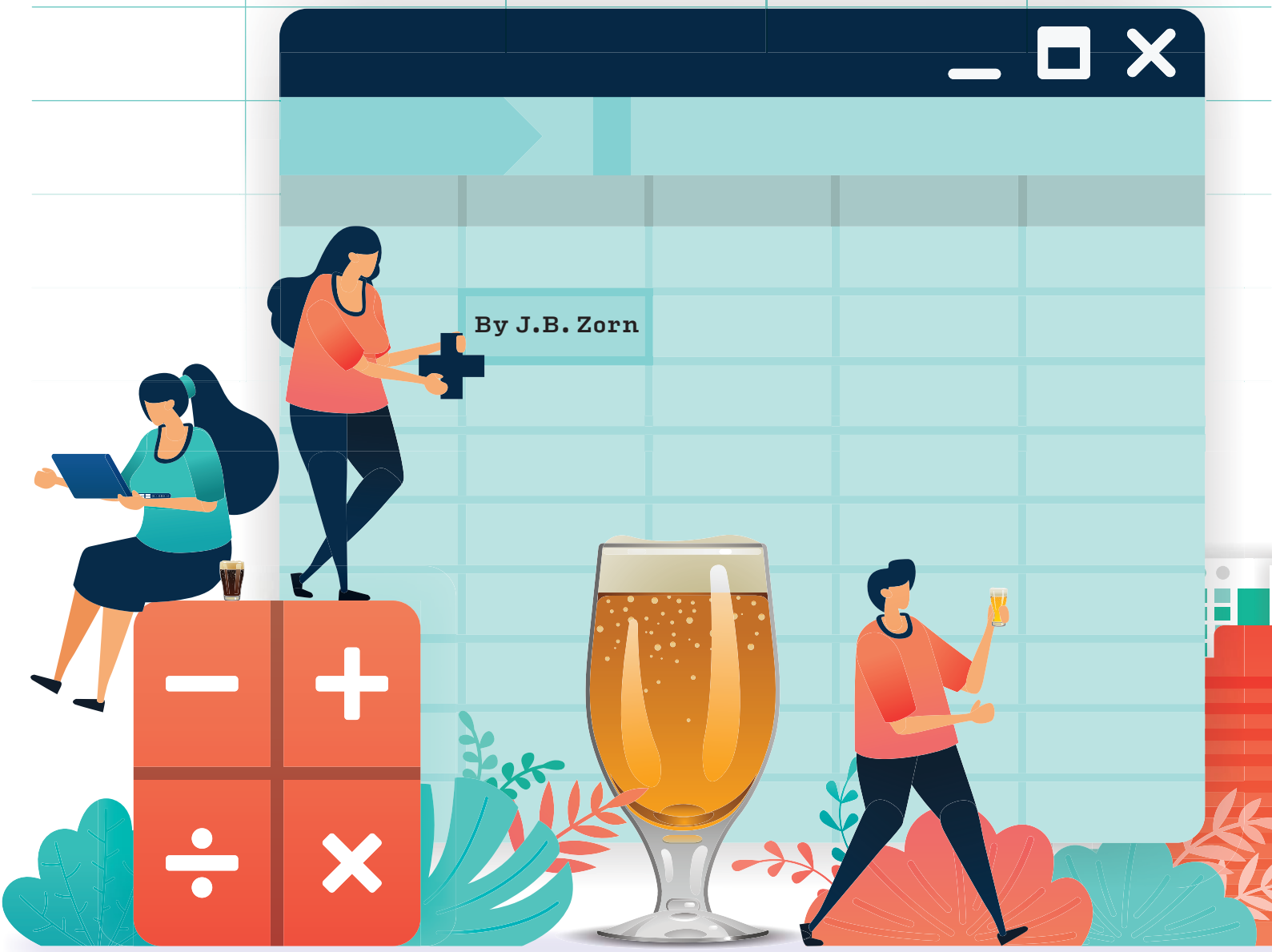
A SIMPLE MOLECULE WITH A COMPLEX ROLE

Carbon dioxide is a simple molecule, but the way it interacts with water, beer, other gases, surfactants, and more can be fairly complex and interesting—something to think about the next time you witness the "pop" of a bottle being opened and watch bubbles rise to the surface.

Chris Colby has been a homebrewer since the early '90s, when he studied molecular evolutionary genetics at Boston University. After receiving his PhD in 1997, he briefly worked in educational publishing before becoming a beer writer and editor. He is the author of* Methods of Modern Homebrewing *(2017),* Home Brew Recipe Bible *(2016), and the upcoming Brewers Publications® title* How to Make Hard Seltzer: Refreshing Recipes for Sparkling Libations *(September 2020). He lives in Bastrop, Texas, with his wife and many cats.

HOMEBREWING, One Spreadsheet at a Time

By J.B. Zorn



Editor's Note:
J.B. Zorn was generous enough to share his brewing spreadsheet with Zymurgy readers, and he recommends downloading it and stepping through it as you read this article. It's available for free at HomebrewersAssociation.org/ja20. Many thanks to J.B. for making this resource available to AHA members!

Whether you're a beginner homebrewer or a BJCP-certified, electric-brew-system ninja, you've likely seen terms like original gravity (OG), international bittering unit (IBU), and alcohol by volume (ABV) on commercial beer labels and in homebrew recipes. Numbers cannot encompass the full range of beer character, but they can communicate a stylistic framework, the broad strokes of a beer's quantitative characteristics.

These numbers offer homebrewers helpful targets for recipe design, trials, and improvements. Unfortunately, the underlying recipe inputs and the calculations needed to predict those stylistic targets are often taken for granted, glossed over, or dismissed as "too technical."

Many homebrewers may not know just how straightforward the basic calculations can be. There are no secret formulas, and you don't need special software. To demystify "homebrew math," I'll walk you through my spreadsheet approach to conquering practical brewing numbers. I promise that you don't need a degree in software engineering or brewing chemistry to go from raw hops to IBUs or customize your own grain bill and mash efficiency to hit a target specific gravity.

BACKGROUND

Soon after starting my brewing journey, I found myself migrating away from making local homebrew shop recipes and toward developing my own recipes based on favorite commercial beers and those found in brewing books. The only calculation I performed was ABV based on hydrometer readings of original gravity (OG) and final gravity (FG).

As my brewing and palate improved, my quest for recipe ownership and creativity expanded, so I started using online calculators to help refine my OG and IBU estimates. But I felt like I was missing the details, assumptions, and limitations. I wanted to peek under the hood of what those "black box" online forms were spitting out. A few specific goals came to mind. I wanted to

1. Edit inputs and calculations to accommodate my on-hand ingredients, match my brewing system, and improve repeatability: how much extra grain do I really need if I switch from batch sparging to brew-in-a-bag?
2. Document and archive my brew day in one place online, e.g., Dropbox.
3. Share recipes more easily: PDF recipe summaries are a lifesaver!

So, I gathered some trusty homebrewing references with in-depth descriptions, formulas, and advice to try to decode what was behind the numbers. It was daunting at first, but with a little trial and error, lots of CTRL–Z, and plenty of collaboration with fellow homebrewers, the resulting calculator has met or surpassed all my homebrewing needs.

This is a work in progress, and it likely always will be. As my brewing system and needs change, I continue to edit and revise, including several updates in the course of writing this piece. Some of the bells and whistles are more valuable than others; here, we will focus on vital statistic calculations and not discuss every little detail.

None of the formulas are uniquely my own, and all are widely available online and in brewing books. The underlying science can be complicated and technical and, while fascinating, it is not essential to understand for improving beer at home. After all, this is a practical hobby, and the goal should be crafting and enjoying great homemade beer.

TABLE 1: BUILDING BLOCKS AND VITAL STATISTICS

Building blocks	Baseline characteristics	Mash	Boil	Fermentation	Quantitative final values
Water	• Water profile • pH • Alkalinity • Batch volume	• Mash thickness			
Malt & wort	• Individual malts & sugars contribute: » Specific gravity » Diastatic power » Color	• Grist composition • Specific gravity • Mash efficiency • Mash pH • Beer color	• Boil time affects: » Batch size » Hops utilization » Original gravity	• Original gravity (OG) in specific gravity, Plato, or Brix	• Final gravity (FG) in specific gravity, Plato, or Brix • ABV from OG & FG • Color in SRM
Hops	• Individual hops contribute: » Alpha acid % » Flavor attributes		• Quantity • Timing • Utilization • IBU contributions		• Bitterness in IBU
Yeast	• Temperature range • Estimated attenuation			• Temperature • Duration (days)	• Apparent attenuation: (1 – FG/OG)

RECIPE INSPIRATION & DESIGN

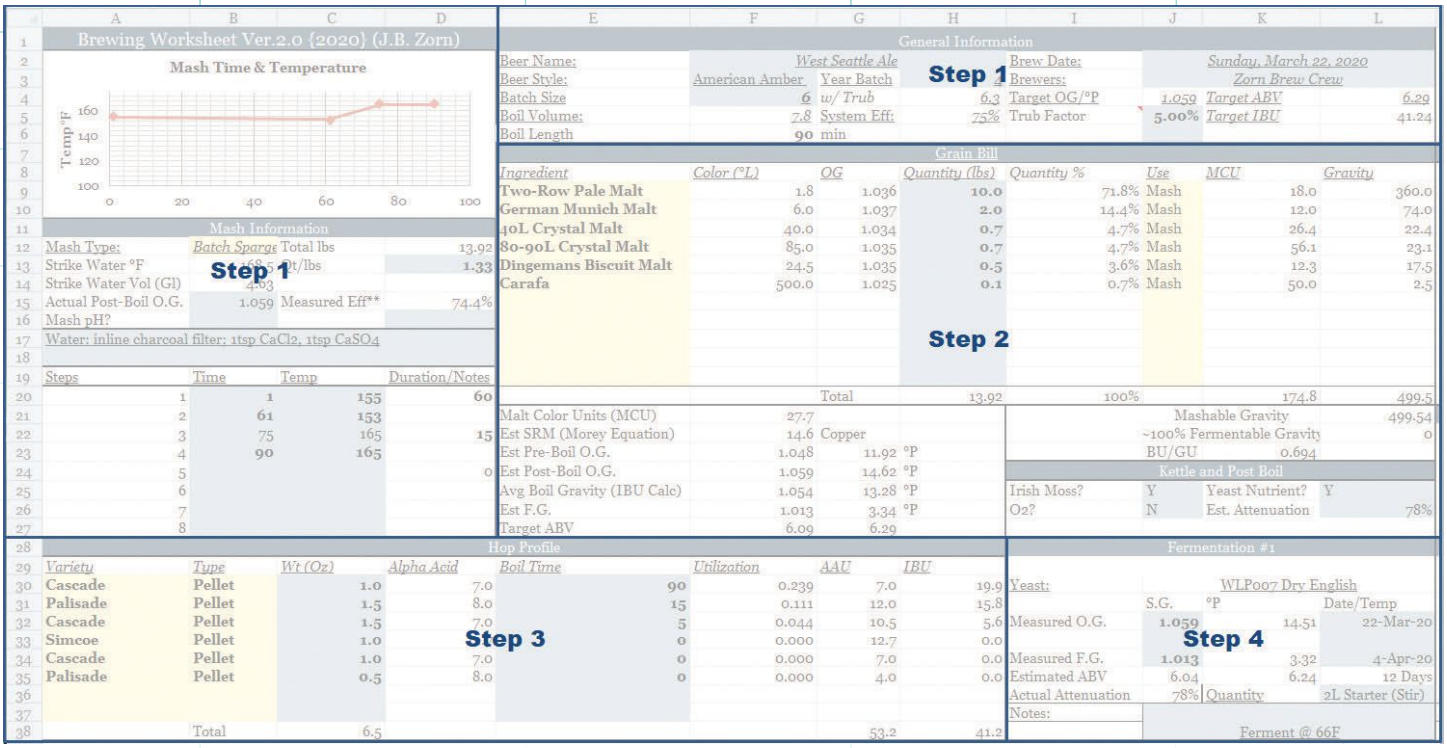
"There is no such thing as a new idea. It is impossible. We simply take a lot of old ideas and put them into a sort of mental kaleidoscope. We give them a turn and they make new and curious combinations."

—Mark Twain

Good recipe design is as essential to making great beer as sound brewing practices such as sanitation. So, please do not confuse accurate calculations with expert recipe design. Before jumping into spreadsheets, you should have a general recipe concept that you're working toward. Here are a few of my go-to sources of inspiration, in no particular order, for recipe design:

- **BREW BOOKS:** There are too many to list, but great resources for brewing calculations include John Palmer's *How To Brew*, Ray Daniels's *Designing Great Beers*, and Randy Mosher's *Radical Brewing*.
- **ONLINE FORUMS AND DATABASES:** The AHA Forum (HomebrewersAssociation.org/forum) is one of many active, helpful online communities of homebrewing enthusiasts.
- **PERSONAL BREW RECORDS:** Ever try to repeat your favorite brews? It's not as easy as it looks—good notes are a must.
- **COMMERCIAL BEER:** Many professional brewers post vital statistics, ingredients, and even malt percentages. You can use that information when designing similar recipes.
- **BJCP STYLE GUIDELINES:** This is a great reference, especially if you are brewing for competition.

FIGURE 1: RECIPE DESIGN IS BEST BROKEN INTO LOGICAL STEPS.



SUMMATION NOTATION

A recurring concept in recipe design is summing the contributions of individual ingredients. Every malt contributes to the original gravity of the batch, and every hop contributes to the final IBU value.

Let's say your recipe has four hop additions and you want to add the IBU contributions of each. Assume you're using a spreadsheet like Microsoft Excel or Google Sheets and that the individual values of those IBU contributions are in cells A1 through A4. You could add them up like this:

=A1+A2+A3+A4

That'll work, but what if you needed to add up all 15 hop additions in a double IPA recipe? That's a lot of typing. Spreadsheets make it easy to sum over ranges using the SUM function,

=SUM(FIRSTCELL:LASTCELL)

where **FIRSTCELL** and **LASTCELL** are the first and last cells in a range over which you wish to add data points. Using our example above with the four hops, you can do the same calculation like this:

=SUM(A1:A4)

Then, when you have to deal with the double IPA's massive hop list, you can just change it to

=SUM(A1:A15)

More generally, you can sum *N* cells in a spreadsheet like so:

=SUM(A1:A$_N$)

The way you express this same idea in mathematical equations is to use sigma notation, so called because the capital Greek letter sigma (Σ) is used. It means the same thing as **=SUM()**, but sigma notation looks fancier and is more general, i.e. not specific to a particular software implementation. In sigma notation, you express the summation of four different values A_1, A_2, A_3, and A_4 by

$$\sum_{i=1}^{4} A_i = A_1 + A_2 + A_3 + A_4$$
$$= \mathrm{SUM}(A_1 : A_4)$$

More generally, you can express the summation of N different values A_1, A_2, A_3 , … , A_N by

$$\sum_{i=1}^{N} A_i = A_1 + A_2 + A_3 + \cdots + A_N$$
$$= \mathrm{SUM}(A_1 : A_N)$$

If it's been a while since your last math class, don't fret when you see a sigma. Just remember it means you're adding up a bunch of things, like contributions from malts or hops.

FIGURE 2: GENERAL INFORMATION.

E	F	G	H	I	J	K	L
General Information							
Beer Name:	*West Seattle Ale*			Brew Date:	*Sunday, March 22, 2020*		
Beer Style:	American Amber	Year Batch	4	Brewers:	*Zorn Brew Crew*		
Batch Size	6	*w/ Trub*	6.3	Target OG/°P	1.059	*Target ABV*	6.29
Boil Volume:	7.8	System Eff:	75%	Trub Factor	5.00%	*Target IBU*	41.24
Boil Length	90	min					

BUILDING BLOCKS & VITAL STATISTICS

"There is only one way to eat an elephant: one bite at a time."
—Desmond Tutu

To walk before we run, Table 1 offers a breakdown of the building blocks, from raw materials (water, malt, hops, and yeast) through to the finished product. Note that some values, like mash pH, are measurements with no calculations involved. Others don't tell the full story: two 8% alpha acid hops may give the same IBU estimate but produce drastically different flavors. For example, Cascade's classic American grapefruit and citrus is qualitatively very different from Challenger's English spice and woodsy notes. Context matters!

Vital statistics are important targets for any recipe, as they encompass, according to the BJCP Style Guidelines, "the general characteristics of the style, expressed in Original Gravity (OG), Final Gravity (FG), Alcohol-by-Volume (ABV), International Bittering Units (IBUs), and Color as expressed in the Standard Reference Method (SRM) …."

The BJCP Style Guidelines are a good reference for target ranges to work toward in the spreadsheet. Here are the BJCP's vital statistics for Style 19A. American Amber Ale, which is the beer style of the example recipe we'll use to illustrate the calculations, West Seattle Amber Ale:

Target Original Gravity:	OG: 1.045–1.060
Final Gravity:	FG: 1.010–1.015
Alcohol:	ABV: 4.5–6.2%
Bitterness:	IBUs: 25–40
Color:	SRM: 10–17

Beware! Math and equations follow. This would be a great time to download the spreadsheet, open it, and follow along.

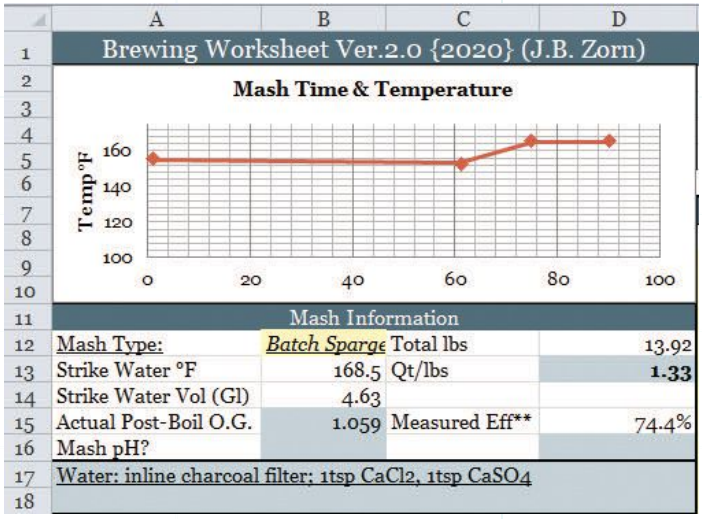
I typically follow each section of my workbook in sequence and then iterate until I hit my desired target numbers. The workbook includes a condensed auto-populated Summary worksheet for sharing and printing, as well as an Admin worksheet for table lookups, ingredient information, and other background references. Overall, the workbook is designed to mimic a hardcopy log and display all the basic brewing calculation inputs in a one-page view (Figure 1).

I use the convention that gray-shaded cells are manual inputs and yellow-shaded cells are drop-down lists that use options fed from the Admin worksheet. After initial setup, each recipe only takes a few minutes to enter and design using this method.

Here are a few tips to better understand my Excel workbook and/or make your own:

- **Avoid scrolling:** It's most convenient to keep relevant information readily available in a one-page view.
- **Don't confuse precision and accuracy:** Most of these formulas provide you with estimates; the difference between 40.29393 IBU and 40 IBU is insignificant.

FIGURE 3: MASHING INFORMATION.



- **Name cells and ranges:** Naming cells and ranges makes it easier to recall on the other sheets. For example, instead of cell `B10`, it's `mashtype`, and instead of `Admin!$C$3:$C$73`, it's `grain`. Select Formula→Name Manager in Excel to manage these.
- **Use lists:** To create drop-down menus (which I've shaded in yellow) for lists and tables included on the Admin worksheet, select Data→Data Validation in Excel's menu to change the validation criteria to allow a list and then set the source to a named range (i.e., grain).
- **Look up values:** To grab a value based on a drop-down list or other cell value, use the `VLOOKUP` function. For example, you might find an individual grain color from the Admin worksheet using `VLOOKUP(E9,Admin! $C$2:$E$74,2,FALSE)`, which just tells Excel, "Take the name of the grain in cell `E9` and look for it in the range `Admin!$C$2:$E$74`. Then, if you find it, return the value in the second column of range `Admin!$C$2:$E$74`, and only return exact matches."

STEP 1: ENTER GENERAL INFORMATION

After you've decided on your vision for your next beer, this is where you plug in basic information (Figure 2). Beyond record keeping, the key calculations are as follows.

Illustrations © Getty/Imam Fathoni; Getty/lumpynoodles (beers)

Brew This!

Bubs & Pops Parti-Gyle

Hybrid imperial pale ale & pale kellerbier *Recipes courtesy J.B. Zorn.*

This recipe uses a parti-gyle technique to make two beers from a single mash. After mashing a large amount of grain, the strong first runnings are collected to form the basis for Pops imperial pale ale. The weaker second runnings are collected to create Bubs pale kellerbier.

If you have two kettles and two burners, you can boil both worts at the same time. Otherwise, bring the stronger wort to a boil as you collect second runnings in a temporary holding vessel and then begin the second boil after you've racked the stronger wort to a fermenter.

Efficiency: 75%

MALTS

25 lb. (11.3 kg) Dingemans Pilsner malt
2 lb. (907 g) German 6°L Munich malt
1 lb. (454 g) Weyermann Carahell malt

WATER

Charcoal-filtered with 1 tsp. each $CaCl_2$ and $CaSO_4$

MASHING NOTES

Mash for 60 minutes at 153°F (67°C) with a mash thickness of 1.33 qt./lb. (2.8 L/kg), followed by a 15-minute mash out at 165°F (64°C). Collect 7.1 gal. (26.9 L) of first runnings in one kettle for Pops hybrid imperial pale ale and then sparge with enough hot water to collect 7.1 gal. (26.9 L) of second runnings in a second kettle or temporary holding vessel for the Bubs pale kellerbier. Boil and ferment each recipe as indicated below.

Pops

Batch volume: 6 gal. (22.7 L)
Original gravity: 1.070–1.074 (17–18°P)
Final gravity: 1.012 (3.1°P)
Bitterness: 60–80 IBU
Alcohol: 8% by volume

HOPS

1 oz. (28 g) Simcoe, 12.7% a.a. @ 60 min
2 oz. (57 g) Cascade, 7% a.a. @ 10 min
2 oz. (57 g) Simcoe, 12.7% a.a. @ 5 min
2 oz. (57 g) Simcoe, 12.7% a.a., dry hop 5 days

YEAST

2 L starter Wyeast 2565 Kolsch Yeast

ADDITIONAL ITEMS

1 tsp. Irish moss @ 15 min.
Yeast nutrient @ 15 min

BREWING NOTES

Boil 90 minutes, adding hops as indicated. Chill wort to 60°F (16°C), pitch yeast, and ferment at that temperature until specific gravity stabilizes at or near 1.012 (3.1°P). Rack to secondary and dry hop 5 days before bottling or kegging.

Bubs

Batch volume: 6 gal. (22.7 L)
Original gravity: 1.048–1.057 (12–14°P)
Final gravity: 1.012 (3.1°P)
Bitterness: 20–30 IBU
Alcohol: 5% by volume

HOPS

1 oz. (28 g) Saaz, 3.5% a.a. @ 60 min
1.5 oz. (43 g) Hallertauer Mittelfrüh, 3.8% a.a. @ 10 min
0.5 oz. (14 g) Hallertauer Mittelfrüh, 3.8% a.a. @ 0 min
0.5 oz. (14 g) Saaz, 3.5% a.a., dry hop 5 days

YEAST

2 L starter White Labs WLP833 German Lager

ADDITIONAL ITEMS

1 tsp. Irish moss @ 15 min.
Yeast nutrient @ 15 min

BREWING NOTES

Boil 90 minutes, adding hops as indicated. Chill wort to 50°F (10°C), pitch yeast, and ferment at that temperature until specific gravity stabilizes at or near 1.012 (3.1°P). Optionally raise fermentation temperature to 60°F (16°C) for the final 2–3 days of fermentation for a diacetyl rest.

Rack to secondary, lower temperature to near freezing, and lager 5 weeks. Dry hop for 5 days before bottling or kegging.

Batch Volume

I typically lose some percentage of the total boil volume to trub, mostly hops material. In my case, it's usually around 5 percent, so I account for that by bumping the batch size up by that amount:

$$V_{batch} = \frac{V_{batch+trub}}{1.05}$$

Boil volume is a handy target to aim for when you collect your wort post-sparge. I adjust it based on batch size with trub and boil length, assuming 1 gallon per hour of evaporation.

System Efficiency and Mash Type

Mash efficiency is usually linked to mash type. My system efficiency estimates range from 60% for brew-in-bag to 80% for fly sparging. Changing the mash type and associated efficiency changes the target OG from a fixed grain bill—from 1.048 to 1.063 in the case of West Seattle Amber Ale—which would be significant in the final beer.

The efficiency value is critical and may take some trial and error based on your mash type, system, and recipe. The best way to determine it is to take consistent notes from one batch to the next and meticulously record the volume and specific gravity you obtain from your mashes (Figure 3).

Strike Water Temperature

The strike water temperature must be higher than that of the first mash rest to make up for heat lost to the dry grain, calculated as

$$T_{strike} = \frac{0.2}{WGR} \times (T_{mash} - T_{grain}) + T_{mash}$$

where T_{strike} is the strike water temperature, WGR is the water-to-grist ratio in quarts per pound, T_{mash} is the desired mash temperature in Fahrenheit, and T_{grain} is the dry grain temperature, also in Fahrenheit.

The remaining recipe statistics (OG, ABV, IBU) require inputs from steps that follow later in the process.

STEP 2: DESIGN YOUR GRAIN BILL

This is where we build the malt foundation of the beer and aim for a grain profile that will hit the style ranges for gravity and color. West Seattle Ale is a fairly classic amber ale recipe of mostly two-row base malt, Munich for richness, a mix of crystal 40 and 80 for color and caramel/toffee flavors, Biscuit malt for slight toast, and a hint of CARAFA for color. Relative grain percentage is an important element in recipe design, especially when scaling to different batch sizes and adapting recipes.

In my spreadsheet, the grist is built from left to right as follows.

1. Select your grain or other sugar source in the yellow-shaded drop-down ingredient menus. The color and OG cells are automatically populated by looking up the values in the Admin worksheet via Excel's `VLOOKUP` function.
2. Enter the weight of each grain. The percentage in the grist is automatically calculated.
3. Select a Use category. Mashing or steeping factors into mash efficiency to calculate the amount of sugar extracted, while selecting Extract for a simple sugar pulls in the full sugar content without considering mash efficiency effects.

Once the grains are selected, you can calculate color and gravity. Color estimates may not be the most significant value but can be useful, especially for competition brewing. Morey's equation for calculating the color of the batch is

$$SRM_{batch} = \frac{1.14922}{V_{batch+trub}} \times \left[\sum_{malt=1}^{N_{malts}} (W_{malt} \times SRM_{malt}) \right]^{0.6859}$$

where $V_{batch+trub}$ is the volume of the batch including trub, N_{malts} is the number of malts, W_{malt} is the weight of each malt, and SRM_{malt} is the color of each malt.

FIGURE 4: GRAIN BILL, SPECIFIC GRAVITIES, AND COLOR.

Grain Bill							
Ingredient	*Color (°L)*	*OG*	*Quantity (lbs)*	*Quantity %*	*Use*	*MCU*	*Gravity*
Two-Row Pale Malt	1.8	1.036	**10.0**	71.8%	Mash	18.0	360.0
German Munich Malt	6.0	1.037	**2.0**	14.4%	Mash	12.0	74.0
40L Crystal Malt	40.0	1.034	**0.7**	4.7%	Mash	26.4	22.4
80-90L Crystal Malt	85.0	1.035	**0.7**	4.7%	Mash	56.1	23.1
Dingemans Biscuit Malt	24.5	1.035	**0.5**	3.6%	Mash	12.3	17.5
Carafa	500.0	1.025	**0.1**	0.7%	Mash	50.0	2.5
		Total	13.92	100%		174.8	499.5

Malt Color Units (MCU)	27.7				Mashable Gravity		499.54
Est SRM (Morey Equation)	14.6	Copper			~100% Fermentable Gravity		0
Est Pre-Boil O.G.	1.048	11.92	°P		BU/GU	0.694	
Est Post-Boil O.G.	1.059	14.62	°P	Kettle and Post Boil			
Avg Boil Gravity (IBU Calc)	1.054	13.28	°P	Irish Moss?	Y	Yeast Nutrient?	Y
Est F.G.	1.013	3.34	°P	O2?	N	Est. Attenuation	78%
Target ABV	6.09	6.29					

FIGURE 5: HOPS SCHEDULE.

	Hop Profile							
28								
29	*Variety*	*Type*	*Wt (Oz)*	*Alpha Acid*	*Boil Time*	*Utilization*	*AAU*	*IBU*
30	**Cascade**	**Pellet**	**1.0**	7.0	**90**	0.239	7.0	19.9
31	**Willamette**	**Pellet**	**1.5**	4.5	**15**	0.111	6.8	8.9
32	**Cascade**	**Pellet**	**1.5**	7.0	**5**	0.044	10.5	5.6
33	**Simcoe**	**Pellet**	**1.0**	12.7	**0**	0.000	12.7	0.0
34	**Cascade**	**Pellet**	**1.0**	7.0	**0**	0.000	7.0	0.0
35	**Willamette**	**Pellet**	**0.5**	4.5	**0**	0.000	2.3	0.0
36								
37								
38		Total	6.5				46.2	34.3

FIGURE 6: ALCOHOL AND ATTENUATION.

Fermentation #1			
Yeast:	WLP007 Dry English		
	S.G.	°P	Date/Temp
Measured O.G.	**1.059**	14.51	22-Mar-20
Measured F.G.	**1.013**	3.32	4-Apr-20
Estimated ABV	6.04	6.24	12 Days
Actual Attenuation	78%	Quantity	2L Starter (Stir)
Notes:			
	Ferment @ 66F		

I like to cross reference SRM values with a table of colors. For West Seattle Ale, the recipe SRM of 14.6 works out to copper.

Original gravity is obtained by multiplying the individual grain quantity by its sugar content, multiplying by the mash efficiency, and then dividing by batch volume. To calculate the original gravity of the batch, we use

$$OG_{batch} = 1 + \frac{E}{V_{batch+trub}} \times \left[\sum_{malt=1}^{N_{malts}} (OG_{malt} - 1) \right]$$

where OG_{malt} is the original gravity contribution of each malt, E is your system efficiency, and the remaining terms are as defined previously.

For the West Seattle Amber Ale, we get an original gravity of 1.059 (Figure 4).

STEP 3: INCORPORATE HOPS

This recipe uses classic American Cascade and Simcoe hops, with some Palisade for a unique twist. The hop addition times aim for a backbone of 41 IBU for this approximately 6% ABV amber ale. You'll notice that it includes a dry hop addition that does not affect the IBU calculation, even though it'll certainly affect the final beer's flavor and aroma.

IBU models and estimates seem to be moving targets for homebrewers. Regardless of the formula used, there can be a sizable difference between the calculated estimate (using any formula) and the actual IBU figure, which most homebrewers never have access to because it involves lab testing beyond the reach of most of us.

Many of the newer hoppy ales rely on late or post-boil additions for massive hop aroma and some bitterness. But, contrary to established formulas that calculate no bitterness from post-boil hops, the latest research shows that late hop additions can contribute significant IBUs in actual measurements. So again, context matters.

I have not incorporated the newer formulas into my spreadsheet. I rely on the Tinseth bitterness model and adjust late hopping according to my desired beer vision and experience.

I built the spreadsheet so that I can select hop variety and form from a drop-down list just as I've done for the malts. Pellets yield on average about 10 to 20 percent more IBUs than whole leaf hops:

$$U_{hop} = 1.65 \times 0.000125^{(BG-1)} \times \frac{1 - e^{-0.04 \times t_{hop}}}{4.15}$$

Here, BG is the boil gravity at the time of the hop addition, t_{hop} is the amount of time that hop is boiled, and e is an irrational mathematical constant (approximately 2.71828 to five decimal places).

The alpha acid potential of each hop addition is given in alpha acid units,

$$AAU_{hop} = W_{hop} \times \alpha_{hop}$$

where α_{hop} is the alpha acid percentage of each hop addition and W_{hop} is the weight of the addition. The IBU contribution for an individual hop addition, then, is given by

$$IBU_{hop} = \frac{75}{V_{batch+trub}} AAU_{hop} \times U_{hop}$$

and the total IBU value is obtained by summing the contributions of all the hop additions:

$$IBU_{batch} = \sum_{hop=1}^{N_{hops}} IBU_{hop}$$

These calculations are illustrated in Figures 5 and 6.

STEP 4: CALCULATE ATTENUATION AND ALCOHOL

West Seattle Amber Ale calls for White Labs WLP007 Dry English Ale Yeast, which offers a nice clean character and medium-high attenuation of about 80%. Like most clean American beers, you could easily substitute other American strains. In the past, I've enjoyed using Rogue's Pacman yeast (Wyeast 1764) for this recipe.

Now that you've dreamt up a vision of great beer, crunched the

numbers for brew day, and made adjustments as needed, the yeast can perform its fermentation magic. It's important to document attenuation and alcohol because additional fermentations and split batches can easily be added by just copying and pasting.

Attenuation is the percentage of available sugars that the yeast consumes and is computed from the decrease in specific gravity from OG to FG:

$$\%\ attenuation = \frac{OG_{batch} - FG_{batch}}{OG_{batch} - 1}$$

For our sample recipe, this works out to 78%.

The simplest equation for alcohol content is

$$ABV = 131.25 \times (OG_{batch} - FG_{batch})$$

but this equation can under-predict ABV for higher-gravity beers. A better, but more complex, estimate for stronger beer is

$$ABV = 76.08 \times \frac{OG_{batch} - FG_{batch}}{(1.775 - OG_{batch})} \times \frac{FG_{batch}}{0.794}$$

For this batch, we calculate 6.2% ABV using the more complex equation.

FIGURE 7: RECIPE SUMMARY.

	A	B	C	D	E	F	G
1	Recipe Summary Sheet (Ver.2.0)						
2	*Beer Name*	West Seattle Ale			*Brew Date/#*	22-Mar-20	#4 of 2020
3	*Beer Style*	American Amber			*Brewer(s)*	Zorn Brew Crew	
4	*Batch Size (Final)*	06.0 Gl		90 min boil	*Target OG/°P*	1.059	14.6 °P
5	*Brewhouse Est Eff*	75%			*Estimated abv*	6.29 % Abv	
6	*Est SRM*	14.6	Copper		*Target IBU*	41.2	
7	Grain						
8	Gravity %	Quantity (lbs)	Ingredient			Strike Temp	168.5 °F
9	72.1%	10.00 lbs.	Two-Row Pale Malt			Strike Volume	4.6 Gl
10	14.8%	2.00 lbs.	German Munich Malt			Mash Thickness	1.33 Qt/Lbs
11	4.5%	0.66 lbs.	40L Crystal Malt			Mash Type	Batch Sparge
12	4.6%	0.66 lbs.	80-90L Crystal Malt			Mash pH	0
13	3.5%	0.50 lbs.	Dingemans Biscuit Malt			Mash Schedule	
14	0.5%	0.10 lbs.	Carafa			155 °F	60 min
15						165 °F	15 min
16						0 °F	0 min
17	Total Lbs	13.92 lbs.		Water: inline charcoal filter; 1tsp CaCl2, 1tsp CaSO4			
18	Hops						
19	1 oz	Cascade	Pellet	7 % AA	@ 90 min	19.9	
20	1.5 oz	Palisade	Pellet	8 % AA	@ 15 min	15.8	
21	1.5 oz	Cascade	Pellet	7 % AA	@ 5 min	5.6	
22	1 oz	Simcoe	Pellet	12.7 % AA	@ 0 min	0.0	
23	1 oz	Cascade	Pellet	7 % AA	@ 0 min	0.0	DryHop
24	0.5 oz	Palisade	Pellet	8 % AA	@ 0 min	0.0	
25							
26							
27	6.5 oz				Target IBU	41.2	
28	Extras						
29	Yeast Nutrient	Y	Irish Moss	Y	O2	N	
30	Fermentation						
31	Yeast Type	Quantity	O.G.	F.G.	Rack Date	Attenuation	Estimated ABV
32	WLP007 Dry English	2L Starter (Stir)	1.059	1.013	4/4/2020	78%	6.24 %
33	0	0	0	0	1/0/1900	0%	
34	0	0	0	0	1/0/1900	0%	
35	Notes						
36	Date		Observation/Comments				

CalcWorksheet | Summary | Admin

STEP 5: SUMMARIZE YOUR BREW AND ADD NOTES

For the sake of sharing and printing, I like to auto-populate a Summary worksheet. This is where I take notes on the beer, which I think is an underrated aspect of brewing. Even if you hit all your numbers, the real goal is understanding how it all translates into the beer's sensory characteristics. We are all biased in some way, so I find my best feedback is from people who don't even know how you brewed it: friends, family, judges, etc. Make notes for incremental improvements of the same or similar recipe: it'll help you a year or more down the road (Figure 7).

FUTURE IMPROVEMENTS AND THOUGHTS

From my perspective, good brewing is about making smart adjustments. Some of the best advice I've been given is to "build a little and test a little" along the way. That includes everything from calculations and brew day processes to fermentation and packaging. Learn from your previous brews.

As I mentioned previously, this approach is a work in process and can always be adapted and improved. I plan to explore a few ideas in the future:

- To better estimate bitterness, I'd like to consider IBU models that include post-boil additions, temperature, and time in the utilization calculations.
- As the father of two young boys, my brew time has become more limited, so I love making two different beers from one mash. I've included a recipe here called Bubs and Pops—what my

kids call their grandparents—which is a recipe for a hybrid double pale ale and pale kellerbier using first and second runnings from the same mash.

- Refractometers are a great way to take quick measurements to make sure your brew day is on track. I hope to troubleshoot the equations for alcohol content using pre- and post-fermentation Brix refractometer readings.
- If you've adopted this spreadsheet or created your own, now you have lots of data available to review and analyze at no extra cost. I've used some crude macros to compile a running brew log that summarizes data into one list (i.e., 2019 Brew Summary), which could be improved in the future.

I hope this simple spreadsheet inspires you to consider news ways of using practical brewing calculations to build and document your own beers. There are many pathways to making great beer—find the one that works for you, and pass it on.

J.B. Zorn is a Certified Cicerone, BJCP judge, 2019 Capitol Hill Homebrew Competition winner, and all-around beer nut. When he's not enjoying beer or music with family and friends, he proudly serves in the US Coast Guard.

Brew This!

West Seattle Amber Ale

American Amber Ale

Recipe courtesy J.B. Zorn.

This recipe was inspired by visits to West Seattle years ago while my wife and I were still long-distance dating. In true Northwest fashion, it takes a classic style (American amber ale) and bumps up the hop flavor and bitterness. You'll notice it hits or exceeds the upper limits for BJCP vital statistics for American Amber Ale, landing somewhere between Amber and Red IPA.

Batch volume:	6 US gal. (22.7 L)	**Color:**	15 SRM
Original gravity:	1.059 (14.6°P)	**Bitterness:**	34 IBU
Final gravity:	1.013 (3.3°P)	**Alcohol:**	6.3% by volume
Efficiency:	75%		

MALTS

10 lb.	(4.54 kg) pale malt
2 lb.	(907 g) German 6°L Munich malt
0.7 lb.	(318 g) 40°L crystal malt
0.7 lb.	(318 g) 80–90°L crystal malt
0.5 lb.	(227 g) Dingemans Biscuit malt
0.1 lb.	(45 g) Weyermann CARAFA Type 3 malt

HOPS

1 oz.	(28 g) Cascade, 7% a.a. @ 90 min
1.5 oz.	(43 g) Willamette 4.5% a.a. @ 15 min
1.5 oz.	(43 g) Cascade, 7% a.a. @ 5 min
1 oz.	(28 g) Simcoe, 12.7% a.a. @ 0 min
1 oz.	(28 g) Cascade, 7% a.a., dry hop 5 days
0.5 oz.	(14 g) Willamette 4.5% a.a., dry hop 5 days

WATER

Charcoal-filtered with 1 tsp. each $CaCl_2$ and $CaSO_4$

YEAST

2 L starter White Labs WLP007 Dry English Ale Yeast

ADDITIONAL ITEMS

1 tsp. Irish moss @ 15 min.
Yeast nutrient @ 15 min

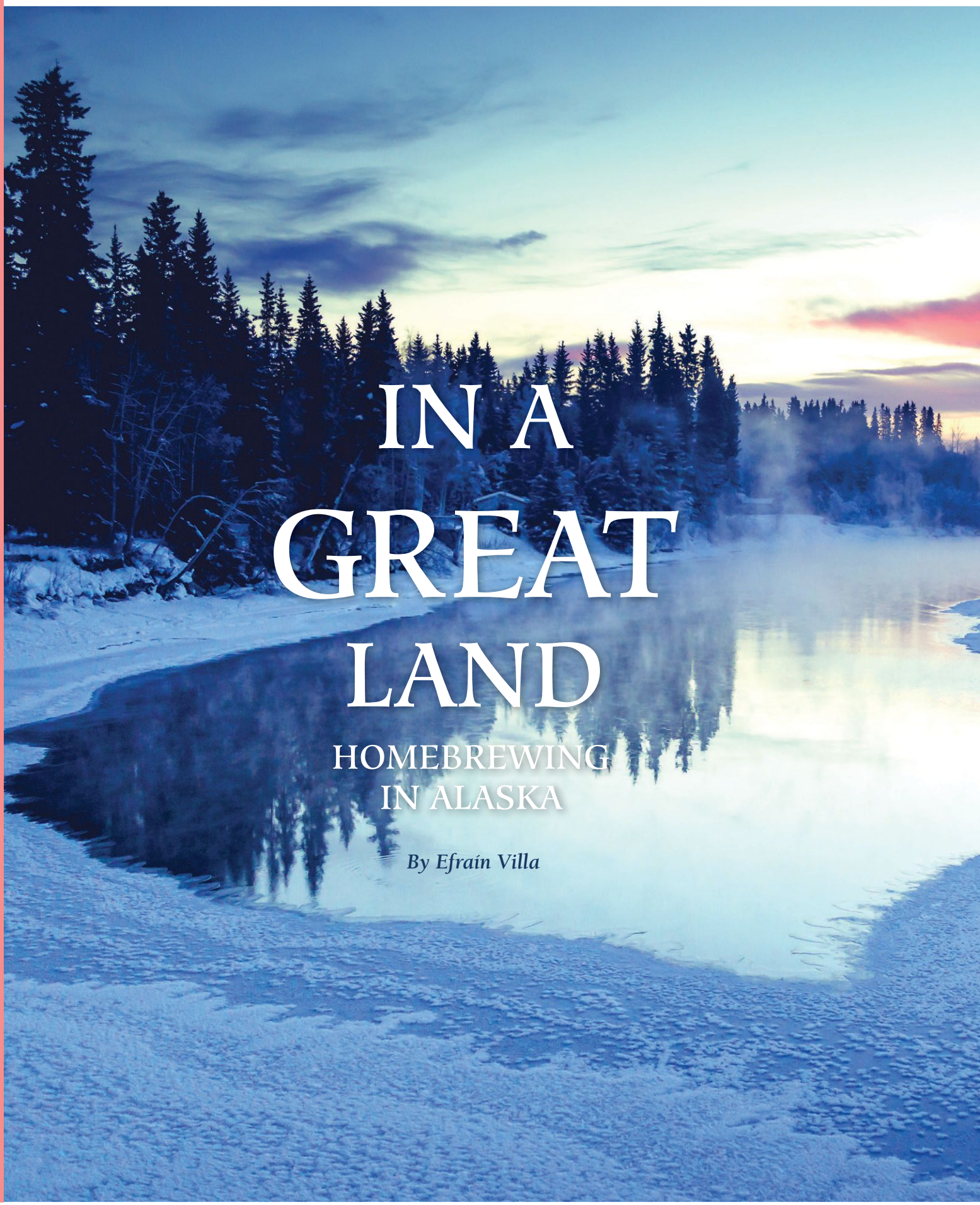
BREWING NOTES

Mash for 60 minutes at 155°F (68°C) with a mash thickness of 1.33 qt./lb. (2.8 L/kg), followed by a 15-minute mash out at 165°F (64°C). Batch sparge with enough hot water to achieve a pre-boil volume of 7.8 gal. (29.5 L). Boil 90 minutes, adding hops as indicated.

Chill wort to 66°F (19°C), pitch yeast, and ferment at that temperature until specific gravity stabilizes at or near 1.013 (3.3°P). Rack to secondary and add dry hops. Condition 5 days on dry hops before bottling or kegging.

EXTRACT VERSION

Replace the pale malt and Munich malt with 7.5 lb. pale liquid malt extract and 1.5 lb. Munich liquid malt extract. Steep the remaining grains, crushed, for 30 minutes at 155°F (68°C) in 2 gal. (7.6 L) water. Remove the grains and dissolve the extracts completely in the resulting wort. Bring to a boil and proceed as above.



IN A GREAT LAND

HOMEBREWING IN ALASKA

By Efraín Villa

The Chena River in Fairbanks, Alaska.

John Netardus is self-isolating.

He has not been outdoors in several days, at least not in the way Alaskans in his community near the Chena River are used to being outdoors. Sure, he goes outside to get his mail, but for the most part, John is hunkering down in his home and avoiding some of his favorite activities, which include hiking, fishing, camping, foraging, and hunting with friends and family. Essentially, he is sacrificing the pastimes that initially lured him out of Central Texas and into this challenging, yet strikingly beautiful, landscape.

John knows that staying home is the sensible thing to do at the moment, since venturing far without an essential need to do so could be hazardous, even reckless. →

Fairbanks.

O.G. SOCIAL DISTANCING

The first headlines mentioning COVID-19 are still weeks away, and terms like "contact tracing," "personal protective equipment," and "flattening the curve" are not yet common parts of the American lexicon. At this time, the biggest peril John faces, should he be foolhardy enough to step outside, is frostbite from baring skin to the air longer than a few minutes.

However, for him and many Alaskans, communing with nature is not just a recreational activity; it is a way of life. Resorting to looking at his surroundings through the barrier of a glass windowpane instead of directly experiencing the setting through touch, smell, and sound feels unsatisfying.

He spots a moose lazily sauntering past his mailbox near the towering snow drifts. "It's just a cow," he thinks, unamused, and gets back to monitoring the kettles steaming atop his kitchen stove. John picked up homebrewing as a hobby to help him weather the −40°F temperatures typical of Alaskan winters.

As he happily engages in social distancing from the comfort of his cozy kitchen, long before anyone knows what social distancing means, he glances at the empty bottles around him and does a quick mental calculation. Comforted by the fact that he is making far more beer than he is consuming today, he grabs another bottle and pops it open with his wedding ring, which is inscribed on the inner side with the date he got married, followed by the words: "John's bottle opener." The ring was made of 10-karat gold so it would withstand its practical function, because wearing an item exclusively for aesthetic purposes seemed wasteful somehow.

Finding ways to make items pull double duty is par for the course when living in an area where ice must be frequently scraped off the inside of one's windshield with a credit card and temperatures drop so low

John's "bottle opener."

that koozies act as mini parkas to protect beer from freezing.

"Alaskans are generally handy and resourceful because we have to be," says John. "Shipping things up here is very expensive and many of us just like making the things we need. It's like a source of pride to use something someone else doesn't want or to go into the garage and find a part you can make work for your purpose."

Even the practice of making beer can be assigned a secondary function. John cools his wort, for example, by taking his hot brew kettle outside and melting the ice accumulating on his deck with it. In the process, the deck gets cleared of stubborn slip hazards and the wort rapidly chills.

The equipment John uses to brew was gathered by scavenging for different components at yard sales and responding to ads posted on Facebook. Although he lives within driving distance of Gavora's Fine Wine & Growler Pub in Fairbanks, a local establishment selling homebrewing equipment and supplies, John still prefers to make his own brewing tools when he can.

"At first I didn't want to invest too much money on equipment because I didn't know I was going to like brewing beer so much," says John. "Until my friends and my dad started telling me how much they loved what I made. I'm missing a lot of stuff, still. Like I don't have a real hot liquor tank or a sparge arm, but I've made my own. I use a gallon jug with holes drilled on the top and that's how I drizzle hot water onto my grains. I have to wear a glove to not get burned, but it works well. I guess I can just buy a sparge arm, but it's more interesting this way."

BREWING IN INTERESTING TIMES

I met John while taking a break from aurora chasing in December. I had stepped into the Midnite Mine taproom in Fairbanks to get a taste of the newest craft beer joint in town, and also to find shelter from what I called a blizzard and locals referred to as "not real snow."

John had approached the owner tending bar to ask him if he could get some brewing tips. "I learned to brew from a book, so there's a lot I don't know how to do the right way," John confessed. "Fortunately, people around here usually try to help each other out."

Photos © Getty/Elizabeth M. Ruggiero (Chena River); FreeVectorFlags.com; courtesy of Efrain Villa

Ted Rosenzweig's homebrew setup.

John's beers.

Local berries are popular homebrew additions.

Highbush cranberries.

I called John up in the spring to follow up on his homebrewing progress. A lot had changed since my winter visit to Alaska. A pandemic had swept through the planet, upending people's lives. In the northern hemisphere, winter had given way to spring, or as many Alaskans call it, "break up," because spring is when the ice sheets begin to break up. Still weeks away was the "green up," the unofficial term Alaskans give to the abrupt interlude that transforms barren tree clusters into majestic green forests and soggy fields into meadows of multicolored blooms.

The century-old spring tradition of participating in the Nenana Ice Classic, an event that predates the last major pandemic, was underway but with some notable changes. This wildly popular annual guessing game lets people try their hand at predicting the exact date and time the Tanana River will thaw enough to swallow up a big tripod attached to a clock. When the tripod falls, the clock stops, marking the time of the "break up." The winner is the one who gets closest to the time of the stopped clock. Last year's prize pot was more than $300,000.

This year, ticket sale deadlines to enter the pool were extended due to the closure of so many point-of-sale outlets. Also, because people who normally record the ticket data were following stay-at-home orders, ticket processing was extended and participants were allowed to mail in their guesses from anywhere in Alaska.

"It's funny how some things are pretty much exactly as always and other things are pretty different," John told me, echoing the sentiment of most people living through the first pandemic in their generation. The sense of community he had mentioned at the Midnite Mine taproom was one of the elements that he found a bit changed.

Like most Alaskan brewers I spoke to by phone, John believed that Alaskans were likely better prepared to withstand pandemic quarantines and other global calamities than "people down in the lower 48" because Alaskans' everyday lives involve contingency routines. They are used to having several weeks' worth of food in freezers and thinking about what-if scenarios that feature inclement weather, earthquakes, volcanoes, avalanches, flooding, and wildfires.

However, the pandemic is a different kind of challenge, John admitted, because the ability to endure collective hardships in many ways has always hinged on community rather than isolation. "We are still very social even in the harsh winter months," John told me. "Maybe especially in the winter months. So that part can be hard about the social distancing thing. When it drops down to the −30s and −40s [°F] for a few consecutive days here, it's just wiser to stay indoors if you can, but even then, we still have family and neighbors come over. I originally took up homebrewing because it let me make something I love while cooped up at home, but sharing the beer with friends and family is what kept me brewing after that first batch. For now, that sharing part is different. It's not really there."

The Great Northern Brewers Club in Anchorage was also finding it challenging to nurture the communal aspect of brewing in a time when socializing in confined spaces had become taboo. The day after the club had conducted its first Zoom teleconference meeting, I spoke to Christophe Venot, a longtime club member.

"That Zoom meeting was awkward," said Christophe. "It was not the best attendance and it was…we can't expect things to be the same. We have work to do to keep engagement up during this time because there's no end in sight to social distancing. But I want to think that some things will remain

John and his beer.

the same; like the gravity of our beers will always be inversely proportional to the length of our daylight."

KEEPING IT LOCAL WITH AN ALASKAN TWIST

As the weather warmed up, many Alaskan brewers took the stay-at-home orders in stride and seized the opportunity to brew more than they might have otherwise.

"It is true that when you're Alaskan, you endure difficulties that make you develop a kinship. We even have our own vocabulary around it, like *cheechako* (newcomer) and sourdough (a hardened local), but we are also fiercely independent," says Dr. Ted Rosenzweig, a surgeon, homebrewer, and owner of Turnagain Brewing in Anchorage. "I think that independence is the character trait that might help Alaskans during the quarantine, and it's also what drives us to find ways to make beer our own, adding an Alaskan twist to the classics."

Dr. Rosenzweig has brewed beer in various parts of the United States, including Arizona and Colorado. He says he always tries to incorporate local ingredients, and in Alaska that has meant creating homebrews with local highbush cranberries, crowberries, and yeasts cultured from alder wood. Other experimental Alaskan brewing ingredients include fireweed, rhubarb, chaga mushrooms, and birch sap. However, the rock star of the state's brewing scene is black spruce tips.

Spruce tips grow in abundance throughout the state, which explains why they have a special place in Alaskan folklore. Their medicinal value, when they are harvested, how they are cut, and even the time of day when they are snipped are topics of great philosophical debate. In brewing, the tiny branches can add a pleasant fruity, citrusy flavor profile to beers when hops are not readily available.

Although hop vines grow exceptionally well in Alaska's 24-hour summer sunlight, in order to produce the conical buds, the plant needs intermittent exposure to darkness, a hard-to-come-by element in the land of the midnight sun. When darkness does come, it brings cold temperatures in which hops cannot thrive. So, without being able to easily produce their own hops, Alaskans do what they do best: find a workaround with what they have at hand.

"Brewers here love using spruce tips, and we even get online orders for them from the lower 48, as well," says Lisa Peltola, owner of Arctic Brewing Supply. The Anchorage business is the largest brewing equipment and supplies dealer in the state. "Our spruce tips are of the Sitka variety, which are harvested and shipped to us from a little island off of Juneau and basically treated like fresh fish in terms of packaging and shipping."

Although Lisa has seen brewing trends ebb and flow in the almost two decades that she and her husband have owned the store, she thinks there is still plenty of room for growth. "We have so many people off the grid and so many of us do a lot of hunting, canning, fishing, smoking, and preserving of foods, basically subsistence living, that I sometimes wonder why brewing is not even more popular here," she says.

THE ESSENTIALS OF HOMEBREWING

In many states' drafts of pandemic stay-at-home orders, food and beverage manufacturers (and in some cases their suppliers) were designated as "essential businesses," which exempted Arctic Brewing Supply from having to close. The store remained open with limited hours and instated strict social distancing guidelines that limited the number of customers allowed in the store at once to just three.

"We are a big part of the local homebrewing community here, and we are happy to do our part to keep our customers safe and still let them have a bit of their normal life when they go home and brew," says Lisa. "And actually, we saw a significant increase in customer traffic when the shutdown went into effect."

While many people were stocking up on toilet paper and yeast for baking bread, homebrewers were trying to ensure they would have enough yeast and other provisions to brew through the shutdown. "When I found out stores were going to close, I went and bought a bunch of grain, hops, and yeast so I could be brewing every weekend," says James Strzempka, a fire department dispatcher in Anchorage who brews with a small club called Suds of Anarchy. "Actually, I would be hunkered down and brewing even without a shut-

James Strzempka's brew den.

down because break up is a very muddy time in Alaska to be outside, and winter makes my garage door freeze shut if I create too much steam in there."

Josh Largent, a contracting specialist in the Air Force, agrees that springtime is the best time for brewing in Alaska, although for different reasons. "I brew outside in the winter even when it's forty below zero, but my boil (off) rate is very extreme and it's hard to even see the boil because of the wall of steam," says Josh. "I also have to keep shaking my propane tank to keep it flowing when it's that cold, and because the mash tun gets so cold, you have to overshoot your mash temperature when you add your grains to make up for the equipment temperature."

Josh would brew in the summer were it not for a legendary Alaskan foe. "Mosquitos where I live are no joke in the summer, and I am from Florida, so I know mosquitos," he says emphatically. "I've never seen anything like it. They can take down a caribou! So, the spring is good, it's warmer, and you only have to watch out for moose."

Josh thinks the pandemic has made him get more creative about the ways in which he can expand his network. When the shutdowns were announced, he went to a nearby distillery and got 30 pounds of homegrown, 2-row grains in exchange for some of the freshly brewed beer he planned to make with it.

John, too, found partnerships in unlikely places. In addition to befriending local brewers such as Talon Hobbs at Midnite Mine, he has discovered that Gavora's will let him use a grain mill they have attached to a drill if he buys something. Actually, he says they have never put any conditions on his use of the mill, but he always buys something to show his gratitude.

Seven batches after the very first batch that got him hooked on brewing, John wonders about his track record, which includes two bad batches, one of which he still hopes to repurpose somehow. "I'm usually a firm believer of 'save the drink,' but since I don't think sour brown ales are a thing, because they're really gross, I'll figure out something else to do with it," he says.

Brew This!

Spruced Up AK Pale

Spruce tip pale ale

Recipe courtesy Lisa Peltola.

Lisa Peltola has been a member of the Great Northern Brewers Club since 1992 and is a lifetime member. She is co-owner of Arctic Brewing Supply in Anchorage, Alaska. The spruce tips in this recipe come from Gustavus, Alaska, and are picked by Harvey "the twig master."

Batch volume: 6 US gal. (22.7 L)
Original gravity: 1.058 (14.3°P)
Final gravity: 1.012 (3.1°P)
Color: 7.5 SRM
Bitterness: 31 IBU
Alcohol: 6.1% by volume

MALTS & ADJUNCTS

11 lb. (4.99 kg) Crisp Maris Otter
12 oz. (340 g) British crystal malt, 45 L
8 oz. (227 g) Carapils malt
4 oz. (113 g) flaked oats

HOPS

1.25 oz. (35 g) Cascade hops, 8.2% a.a. @ 60 min
0.5 oz. (14 g) German Hüll Melon pellets, 5.6% a.a. @ 0 min

WATER

Anchorage tap water filtered through a charcoal filter

YEAST

Wyeast 1056 American Ale Yeast (starter recommended)

ADDITIONAL ITEMS

5.5 oz. (156 g) Sitka spruce tips @ 60 min
1.25 oz. (35 g) Sitka spruce tips @ 40 min
1 tablet Whirlfloc @ 40 min
1 oz. (28 g) Sitka spruce tips @ 0 min
10 g Clarity Ferm, added to primary

BREWING NOTES

Mash 90 minutes at 152°F (67°C). Lauter, sparge, and collect wort. Boil 60 minutes, adding hops, spruce tips, and Whirlfloc at the indicated times. Chill to 68°F (20°C) and pitch yeast.

Ferment at 68°F (20°C) for 7 days. Rack to secondary and condition for 7 days before bottling or kegging.

EXTRACT VERSION

To make a 6-gallon batch using malt extract, replace the Maris Otter malt with 6 lb. (2.72 kg) light dried malt extract and omit the flaked oats. Steep the crystal and Carapils malts for 30 minutes at 155°F (68°C) in reverse osmosis water. Remove grains and completely dissolve the malt extract in the resulting wort. Top up with reverse osmosis water to desired boil volume and proceed as above.

ENGLISH ALE OPTION

Ferment using White Labs WLP007 Dry English Ale Yeast instead of the American Ale Yeast to achieve a target final gravity of 1.010 (2.6°P) and an alcohol concentration of 6.4% ABV.

While the airlocks of John's homebrewing kit gurgle away, he sits back and relaxes at home. "The blooping sound is therapeutic," he muses. "It's random, interesting, and calming to listen to; it's sort of like watching a campfire. Cavemen must have enjoyed staring at campfires for entertainment thousands of years ago, right?"

Definitely.

Regardless of how much our world changes, the important things remain the same.

Efraín Villa is a photographer, actor, writer, communications strategist and global wanderer. His endless quest for randomness has taken him to more than 50 countries on five continents. Villa's English- and Spanish-language work appears in diverse publications, including* AARP The Magazine, TravelWorld International, *and NPR's* Weekend Edition. *While not running his communications consulting firm in Albuquerque, he is busy devouring exotic foods in faraway countries and avoiding adulthood while wearing the least amount of clothing possible. More can be found on his website, AimlessVagabond.com.

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Sweethearts Revenge 2020

Colorado's largest local AHA/BJCP-sanctioned homebrewing competition

By Amahl Turczyn

Sweethearts Revenge, Colorado's largest local AHA/BJCP-sanctioned homebrewing competition, was held on Leap Day, February 29, 2020, at Grimm Brothers Brewhouse in Loveland, Colo. Organized and operated by the Weiz Guys homebrew club, Sweethearts is held every February. This year, the competition had 478 entries in 39 medal groups for beer, mead, and cider. Competition organizer Philip Lafleur said entrants were primarily from Colorado, Nebraska, and Wyoming, but there were entries from as far afield as Massachusetts and California. Participating judges also came from afar. Noted Lafleur, "One of our judges was a brewery owner from Panama."

ENTRY COUNTS BY LOCATION

Location	Number of entries
Alabama	1
California	4
Colorado	431
Florida	1
Massachusetts	3
Nebraska	18
Wyoming	20
Total United States	**458**
International (2 countries)	20
Total entries	**478**

The Weiz Guys club started in 1996 and held regular meetings in a rotation of members' basements and living rooms, remembers Lafleur.

"In 2010, Grimm Brothers opened, and they invited our club to move our meetings to their brewery. In 2012, under the leadership of then-president Ric Cunningham and vice president Cy Bevenger, the club began transforming into the educational and charitable organization that it is today. A lot of members who are now senior leaders of the club became members during that time. In the past two years, these senior members have stepped back to allow a new generation to hold leadership positions. In that time, the Sweethearts competition entry levels have jumped. We used to get 350 to 370 entries. Now we get over 500. This year we reached 500 entries two weeks before the entry cutoff date."

Sweethearts Revenge has been around for some time, and from its inception it has been a Valentine's Day–focused event, relates Lafleur.

"After some not-so-positive experiences in which the Weiz Guys organized competitions for other groups, we decided to start our own competition. In 2014, Derek Heersink was president and Marco Olivio was the first Sweethearts competition coordinator. We had a bunch of good brewers, and the interest in competing was growing. We tried to pick a date that would work both with our Loveland community's culture but also not interfere with other competitions. Loveland is well known for Valentine's Day, so we decided to have our competition associated with our city's accompanying community events. We also wanted to make this event special, so we decided to make barrel-stave tap handles for the awards."

Sweethearts Revenge has many aspects that make it unique, including a special entry category for the Valentine's Day theme. "Any type of Valentine's Day–themed beer, mead, or cider is accepted," Lafleur continued. "Bitter, sour, sweet, catty … Entrants create a beverage with the flavors that represent their feelings about Valentine's Day or their Valentine. These brews are judged in a best-of-show format. Entry is free with the coupon code VALENTINES. For this category, there is a special Valentine's Day prize for getting first place: a sash and tiara."

But that's not the only innovative special category. "New for 2020, Sweethearts Revenge had a special 'local brew' category. Any type of beer, mead, or cider was accepted that was made entirely of ingredients from Colorado or Wyoming. These brews were also judged in a best-of-show format. The prize for winning this category

The first Sweethearts Revenge poster.

was a basket of locally sourced hops, base malt, character malts, and yeast."

Rather than having food catered, Sweethearts has a potluck lunch for all of the volunteers between the first and second rounds of judging on Saturday. "In addition to saving money, the potluck serves as another creative outlet for the club," he believes, "and has become a competition in itself where club members can express their culinary creativity."

The Sweethearts barrel-stave medals are also unique, but they take a lot of time and effort to produce. "As the competition is pretty

Photos courtesy of Phil Lafleur, John Gowthrop.

Brew This!

Bière de Garde

Recipe courtesy Nick Lockwood, Longmont, Colo.
2020 Sweethearts Revenge best of show

Batch volume: 10 US gal. (37.9 L)
Original gravity: 1.076 (18.4°P)
Final gravity: 1.010 (2.6°P)
Estimated efficiency: 76%
Bitterness: 30 IBU
Color: 14 SRM
Alcohol: 8.8% by volume

MALTS

21.5 lb. (9.75 kg) Weyermann Pilsner malt
2 lb. (907 g) Weyermann Munich Type I malt
1 lb. (454 g) Dingemans Special B malt
8 oz. (227 g) flaked oats

HOPS

0.75 oz. (21 g) Magnum, first wort
3 oz. (85 g) Tettnang @ 30 min

OTHER INGREDIENTS

1 tablet Whirlfloc @ 10 min
1/2 tsp. yeast nutrient @ 10 min
2 lb. (907 g) D-45 Candi Syrup, 3 days into primary

YEAST

Imperial B48 Triple Double

BREWING NOTES

Mash at 151°F (66°C) for 60 minutes, lauter, and sparge. Add first wort hops and boil 90 minutes, adding remaining hops, Whirlfloc, and yeast nutrient as indicated. Chill wort and ferment at 70°F (21°C) until terminal gravity is reached, adding Candi Syrup 3 days into fermentation. Lager at 35°F (2°C) for 8 weeks.

PARTIAL-MASH VERSION

Reduce Pilsner malt to 2 lb. (907 g). Mash with remaining grains at 150°F (66°C) for 45 minutes or until full conversion of starches. Rinse grains, dissolve 15.25 lb. (6.92 kg) liquid Pilsner malt extract thoroughly in reverse osmosis water, and top up to desired boil volume. Proceed with boil as specified above.

large, we use nearly all of a barrel to make enough medals for each year," Lafleur said. "They are branded with the competition logo and location. We typically make 150 for all of the category, special category, BOS beer, BOS mead/cider, and pro-am medals."

Getting volunteers to judge and steward can be difficult for large competitions, but Lafleur credits his club's plan to rise to the occasion by providing some fantastic lottery prizes as incentive. "In order to encourage more volunteers this year, we had a drawing for some really great swag. The top prizes were two 5-gallon spirits barrels from NOCO Distillery and a large counterflow chiller from Ruby Street. Entries into the drawing were earned by volunteers based on the number of sessions they judged or stewarded—one entry for each session. I think this is what put us 'over the top' getting enough volunteers to support the competition."

Apart from those prizes, competition organizers turned to 41 sponsors to donate some amazing brewing equipment to give away to medal winners and volunteers. "It seems like nearly every company we asked donated something," Lafleur said. "I was really surprised at what we got. Blichmann gave us huge box that included a Beer Gun and a [BrewVision] Bluetooth thermometer. And for the grand prize, Spike Brewing donated a 5-gallon Flex fermenter."

Community service was not overlooked either and, again, motivation came courtesy of a contest within a contest. "Each quarter, the Weiz Guys choose a different charity to support. This year we raised money for the Larimer County Humane Society, had an underwear and sock drive for the House of Neighborly Service, and a turkey drive for the Larimer County Food Bank. Being the competitive group that we are, this always turns into a competition to see who can donate the most turkeys, underwear, or whatever."

Sweethearts special prize.

Nine Northern Colorado craft breweries played the main role of awarding Great American Beer Festival (GABF) Pro-Am grand prizes, but the one serving as their venue has been their primary supporter. Many of the brewers from these companies had or have their roots in the club.

"The head brewers at Grimm Brothers, Mash Lab, and Verboten are all current or former members of the Weiz Guys," he explained. "Grimm Brothers has been the primary patron of the Weiz Guys since they opened in 2010. Without Grimm there would be no Sweethearts Revenge and no Weiz Guys. Grimm is our home. Not only is Grimm's taproom the venue, but everyone on the Grimm team actively participates in Sweethearts as volunteers. Grimm also sponsors a GABF Pro-Am."

Sweethearts Revenge Pro-Am Breweries
Grimm Brothers Brewhouse
Berthoud Brewing
Brix Brewery and Taphouse
Crow Hop Brewing
Drätz Brewing Company
Loveland Aleworks
Mash Lab Brewing
Rock Bottom Brewing, Loveland
Verboten Brewing

The COVID-19 crisis afforded the Weiz Guys a chance to give back to these supporting breweries and, fortunately, did not affect the competition too much.

"Sweethearts Revenge was held early enough that the COVID-19 pandemic did not affect it. However, once the pandemic hit, the Weiz Guys wanted to support our local breweries that were shut down by order of the state. The club set up tabs at all of the breweries. Members were allotted $50 or $100 based on their level of membership (single or family) to spend at their brewery(s) of choice. In the end, the club donated $1,500 to support these local craft breweries."

The virus also prompted the club to come up with alternatives for future homebrew events. "Competition season ended early this year due to the pandemic," admitted Lafleur. "In order to keep competitions alive, the Weiz Guys are working with Nelson Crowle, the creator of Reggiebeer, to develop a virtual homebrew competition. Nelson has been busily modifying Reggie to make this concept work. We are testing it out now in simulation before we try to go live. For our virtual competition, we are looking at a local hub concept. The hub gathers the beers and sets up the boxes for the individual judges. The judges take their flights home from the hub, judge the beers, discuss, and conduct the mini-BOS on the phone or through teleconferencing software. No contact. No shared bottles. Stay tuned as we work the bugs out."

Best-of-show winner Nick Lockwood has always loved craft beer and eventually got into brewing about three years ago when he and his girlfriend Janti decided to go down to their local homebrew shop and try out a 5-gallon extract kit.

"It was an amber ale," Lockwood remembers, "and we were surprised how easy it was to brew beer. We both developed a passion for brewing after only a few kits. We quickly moved on to all-grain brewing and started the process of slowly putting our system together. We started with a simple brew-in-a-bag setup and eventually built our way up to the electric HERMS system we have now."

Lockwood has always enjoyed recipe development, and draws inspiration from other brewers, both professional and amateur. "I enjoy researching recipes, finding what goes into a certain style, and then turning it into my own take on that style," he said. "There are so many styles I enjoy. I've brewed everything from simple brown ales to barrel-aged stouts and sours. My favorite styles to brew are probably barrel-aged beers. They may take a long time from grain to glass, but they are very rewarding when they're finally ready to drink."

His best piece of advice? Compete. "The one most important tip I could give to any homebrewer is to enter as many competitions as you can. The feedback from experienced beer judges is so helpful in developing and perfecting your own recipe development and brewing processes. Reading BJCP style guidelines while tasting your beer is also helpful in making sure your beer is entered into the correct style category."

Lockwood's best-of-show winner was a lesser-known French style, which after extensive cold conditioning, won over Sweethearts Revenge judges with its smoothness and malt complexity. "The winning beer was an amber bière de garde," he explained. "This is a very hard style to find, which is why I decided to brew one myself. The original goal was to develop this recipe to put into a rum barrel. After a lot of research and recipe building in BeerSmith, I was able to come up with a recipe that was ready to brew. Eventually half the batch would be barrel aged, while the other half was lagered for several weeks. This lagered batch would end up winning best of show."

As for his future brewing goals, he plans to continue homebrewing, perfecting his recipes, and eventually open a brewery of his own.

***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! Some recipes might include a water profile. If you can't (or don't want to) deal with water chemistry, don't worry about it: just go ahead and brew! Extract brewers needn't add minerals to water.

Malt Extract Recipes
Making wort from malt extract is easy.

- Crush specialty grains, if any.
- Place milled grains in a mesh bag and tie it off.
- Steep bag of grains in 150–160°F (66–71°C) water for 30 min. in your brew pot.
- Remove bag of grains from the pot.
- Fully dissolve extract in the hot, grain-infused water (if there are no specialty grains in the recipe, you can skip directly to this step).
- 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 unless otherwise stated.
- 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.

Photo © Jesse James Galarza

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

LTHD – Learn to Homebrew Day

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)

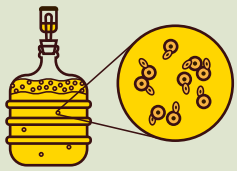
SMaSH – single malt and single hop

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 if you can (traditional but not required).

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 gauge 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

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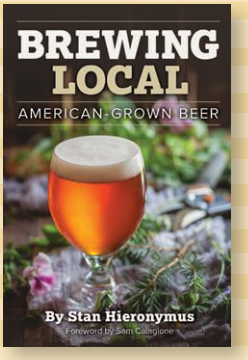

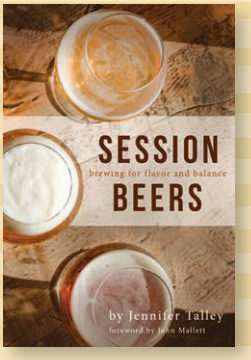

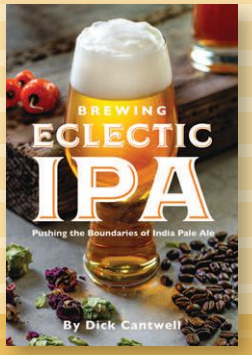

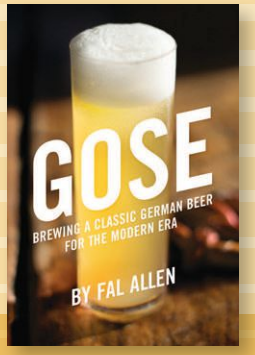

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Sanctioned Competition Program

FEBRUARY 2020

RIBS February Club Competition, 20 entries
Ryan Durgin, Cranston, RI

KCBM 37th Annual Competition, 556 entries
Phillip Abbot, Shawnee, KS

War of the Worts 25, 555 entries
Will Cass, Havertown, PA

Biela Vrana 2020, 129 entries
Ondrej Barcik, Košice, Slovakia

1ª Copa Hidromieles de Latinoamerica, 41 entries
Oscar Gerlach, Temuco, Chile

Romancing the Beer Homebrew Competition, 243 entries
Jamie and Tricia Gallant, San Diego, CA

Peach State Brew Off, 375 entries
David Byer, Hot Springs, NC

2020 Monsters of Malt, 93 entries
Alex Fortuna, Fredericksburg, VA

IPA Classic 2020, 38 entries
Aaron Vieira, Costa Mesa, CA

Four Leaf Brewing Capture the Tap, 39 entries
Scott Vogel, Mount Pleasant, MI

Fourth Annual Northern Arizona Homebrew Competition, 14 entries
Shannon Clark, Flagstaff, AZ

MARCH 2020

Bozeman Brew-Off, 44 entries
Tim Rouse, Chesapeake, VA

City of Thirsts Homebrew Competition, 53 entries
Greg Kirkland, Indianapolis, IN

2020 Washington Mead & Cider Cup, 103 entries
Timothy Leber, Kent, WA

All-American Homebrew Competition, 326 entries
Christopher Price, Louisville, KY

Winters Warmers Homebrew Keg Only Competition, 12 entries
Frank Hiller

Lupuleros Spring Challenge 2020, 10 entries
Mike Aguirre, Zapopan, Mexico

30th Annual Hudson Valley Homebrewers Competition, 393 entries
Andy Cox, Wilton, CT

13th Annual Virginia Beer Blitz, 463 entries
Carter Bundy, Claire Davis & Bryce Carter, Richmond, VA

IX. International Homebrewers Competition - Hungary, 228 entries
Tamás Bereczki, Bocskaikert, Hungary

2020 Dijk Cup HomeBrew SuperB Challege Competition, 31 entries
Vito Tai, Taiwan

The 22nd Annual Drunk Monk Challenge, 635 entries
Jonathan Greene, Wauwatosa, WI

WestCoastBrewers ANZAC comp, 21 entries
Mick Considine, Perth, Australia

DIY Beer *Coopers*, 2020 World Home Brewing Championship, 60 entries
Lee Jae Hee, Seoul, Korea

3ª Copa Cordobesa, 62 entries
Leonardo Salgado, Córdoba, Spain

QUAFF COC C-hops only, 24 entries
Jim Connor, San Diego, CA

Good Robot FemmeBrew 2020, 11 entries
Kim Hart Macneill, Halifax, NS

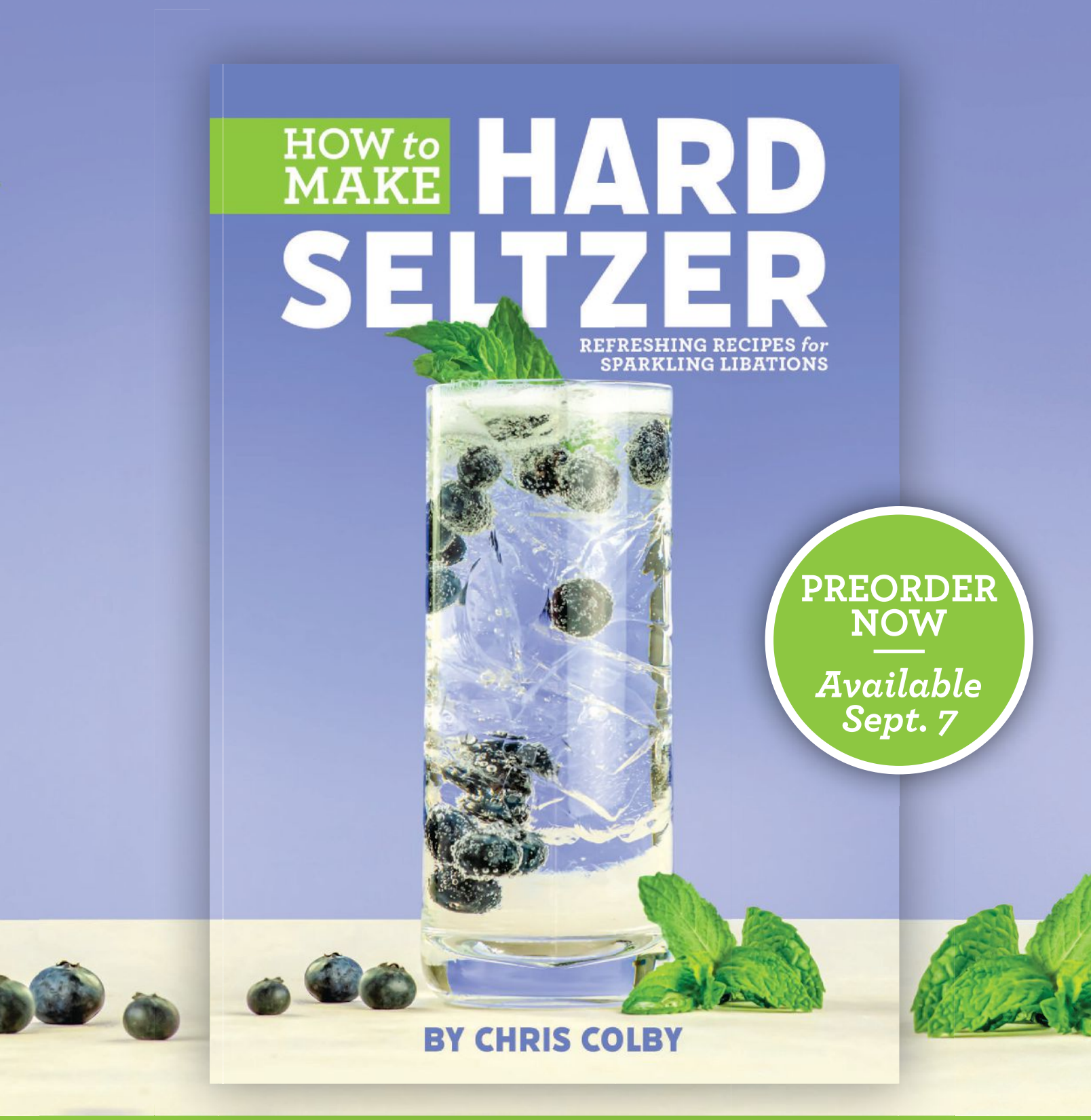
Bluebonnet Brew-Off XXXIV, 1350 entries
Mark Rendon

APRIL 2020

Bruce Street Brewfest, 24 entries
Mike Caylor, Seymour, TN

Amarillo High Plains Drafters Brewing Competition, 15 entries
David Towles, Amarillo, TX

MCM Homebrewer of the Year Q1, 6 entries
Mike Neville, Dearborn, MI



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Kölsch is often called a hybrid style. It's fermented with ale yeast at fairly low temperatures and then cold conditioned like a lager. Kölsch shares much in common with Pilsner, from the primarily Pilsner malt grain bill to its pale color and lager-like smoothness. The two chosen for this Commercial Calibration are American craft interpretations of the classic style, and they each won a medal in the 2019 Great →

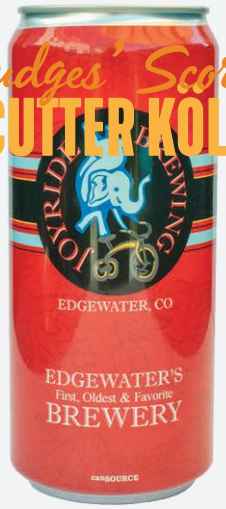
American Beer Festival® in the Kölsch category: Altstadt with the gold medal and Ice Cutter with the silver. Suffice to say, these are two of the best Kölsch-style beers available outside of the style's home city of Köln (Cologne), Germany.

Altstadt Kölsch, from Altstadt Brewing Co. in Fredericksburg, Texas, marries a crisp, well-balanced blend of German malts with just a kiss of hops. At 4.8% ABV, it is light, clean, and refreshing, and it pairs wonderfully with flatbreads, pizza and salad. This flagship also captured a gold medal at the US Open Beer Championship in 2019.

Ice Cutter, from Joyride Brewing Co. in Edgewater, Colo., captures the smooth, dry, yet slightly sweet character of the best examples of the style, with a light, fruity yeast-derived character. Noble hops add a gentle dryness that lends a crisp finish. It checks in at 5.4% ABV, with 25 IBUs and a very pale 3 SRM.

Judges' Score
ICE CUTTER KOLSCH

Joyride Brewing Co., Edgewater, Colo. BJCP Category 5B, Kölsch



AROMA
Initial bready Pils malt with light, noble hop aroma. There are assertive fruity fermentation esters reminiscent of pears and white grapes. Moderate noticeable alcohol is a bit high for style. No diacetyl. No forward DMS, but when the beer warms, the malt takes on a corn-like aroma. **8/12**

APPEARANCE
Light gold color with bright clarity. Rocky white head with fairly good retention. Beautiful beer that's just a little under-carbonated. **3/3**

FLAVOR
Bready Pils malt up front with balancing, medium hop bitterness. Crisp, moderately dry finish. Medium floral hop flavor. Noticeable alcohol presence in flavor, higher than in the traditional Kölsch style. High pear and white grape fruity esters that verge on winey. No diacetyl. No sulfur. Overall clean fermentation. As in the aroma, there is an assertive corn-like flavor similar to that in classic American cream ales. **16/20**

MOUTHFEEL
Medium-light body. Crisp mouthfeel without astringency or lingering bitterness. Mouthfeel has sharp edges and is missing the classic soft palate that is renowned in the Kölsch style. This beer is well-attenuated with moderately high alcohol presence and warming. **3/5**

OVERALL IMPRESSION
Malt aroma is quite high. Fruitiness is also high for style. Bold, not delicate, but still captured the spirit of the style. A bit of oats or wheat malt might soften the palate and round those edges. As the beer warms, excessive corn-like aroma and flavor comes forward. However, this is still a very drinkable beer, easily accepted by beer drinkers used to Pilsners and light lagers. Excellent with a soft pretzel, whether German or Philly. **7/10**

TOTAL SCORE 37/50

AROMA
Slight sulfur initially. Hint of herbal-spicy hops. Mild grainy sweetness with a touch of corn. Clean fermentation character. Fairly subtle and neutral, nothing off. Seems quite fresh. Not stale or oxidized at all. **8/12**

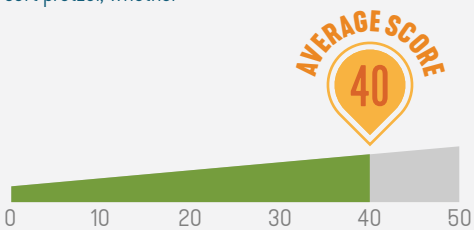
APPEARANCE
Brilliant, gem-like clarity. Pale gold color. Lightly effervescent. Moderate-sized white head with good retention. Tiny bubbles. The clarity is outstanding. Looks perfect. **3/3**

FLAVOR
Initial grainy malt flavor with a light impression of sweetness. Moderate even bitterness. Finishes dry with a malty and lightly corny aftertaste and just a touch of herbal-spicy hop flavor. Clean fermentation with very light esters as it warms. Nothing off. Balance is superb. All the flavors are very fresh. Dry without being too crisp or minerally. **18/20**

MOUTHFEEL
Medium-light body. Medium carbonation. Average strength, not warming. Not astringent or creamy. **5/5**

OVERALL IMPRESSION
Super fresh. Beautiful clarity and color. Has a light mouthfeel and a dry finish without seeming watery. Well-balanced malt flavor and bitterness level with just a touch of hop flavor. Fermentation is very clean, with just a hint of sulfur and esters. The freshness helps it stand out as an outstanding example. Like drinking one in Köln. I could drink a lot of these, in any size glass. **9/10**

TOTAL SCORE 43/50



Judges' Score
ALTSTADT KOLSCH

Altstadt Brewing Co., Fredericksburg, Texas | BJCP Category 5B, Kölsch

AROMA

Light malty sweetness mixed with light sulfur and a quick waft of pear. A quick swirl of the glass liberates a bit more sulfur with more of a winy character. Malt aroma is medium-low and has soft, light graininess and a bit of bread and cracker. As it warms, more pear peeks out at a low level. A tiny bit of honey and toast aroma. Hop aroma is low and floral with a pleasant perfume-like character. Very inviting. **10/12**

APPEARANCE

Color is yellow gold with medium saturation. Very good clarity. A medium-low, finely beaded white head falls quickly, leaving a ring of foam. **3/3**

FLAVOR

Flavor is led by light, winy sulfur and medium-low pear esters with light red apple plus a tinge of generic red fruits. Next, the malt comes quickly on the palate, just below medium intensity, and is grainy with light cracker notes. Smooth, rounded bitterness is medium low, but the dry finish makes this beer seem just a little bitterer. Low hop flavor is a mix of floral and light spicy notes. I get a very subtle grainy flavor at the finish that I find a bit distracting, but it doesn't lessen my enjoyment of the beer. **17/20**

MOUTHFEEL

Medium body with almost medium high carbonation and a very light carbonic bite. It isn't quite creamy, but rather has a rounded sensation on the palate. The finish is dry. I note a tiny bit of grainy astringency at the finish, but I don't notice any alcohol warmth. **4/5**

OVERALL IMPRESSION

This cleanly fermented, well-lagered beer is a very good representation of the style, with nice layers of gentle yeast character with winy notes and apple fruit esters. The sample is fresh, and I detect no oxidation or other defects, save a slight pop of grainy aftertaste. Overall, a lovely beer: I may need to break out a *Stange* and enjoy another on the porch. **9/10**

TOTAL SCORE 43/50

AROMA

Initial aromatics of lightly kilned Continental malts with low intensity. Moderately low sulfur notes have a DMS/creamed-corn character. Very lager-like. Faint floral and light spicy hops notes, but overall character is clean. No perceptible esters or alcohol. **9/12**

APPEARANCE

Brilliant gold, with moderate head retention and a very low crown of foam around the periphery of the surface. Excellent clarity—appears to have been filtered, as per the norm in Germany. **3/3**

FLAVOR

Balanced between malt and hops. The classic biscuit notes of Continental malts are paired with an underlying graininess more prevalent in North American malts. Hops lend a light floral, spicy character and complexity. Esters are very low and indistinct. Bitterness is medium-low, leading to a fairly dry finish. There's just a hint of paper, but the sample seems quite fresh, which can be difficult with such a fragile beer style. **15/20**

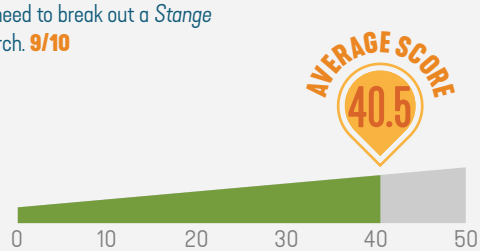
MOUTHFEEL

Very neutral on the palate, with no alcohol warmth or astringency. Medium-low body. Medium carbonation. Very low metallic notes linger in the aftertaste—not unpleasant, but more of a distraction. **4/5**

OVERALL IMPRESSION

A very nice, quaffable example of the Kölsch style. The balance between malt and hops is on point, and the low level of flavor and aroma hops adds complexity without detracting from the balance. Sulfur and mineral aromatics may be a little too lager-like, and light graininess deviates from the soft malt character. But this well-crafted beer is a pleasure to drink and pays appropriate homage to an underappreciated style. **7/10**

TOTAL SCORE 38/50



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 VII level judge and competition director for the BJCP from Chester Springs, Pa.; Sandy Cockerham, a Grand Master VI 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 XIII judge, principal author of the BJCP Style Guidelines, and president of the BJCP board who lives in Beavercreek, Ohio.

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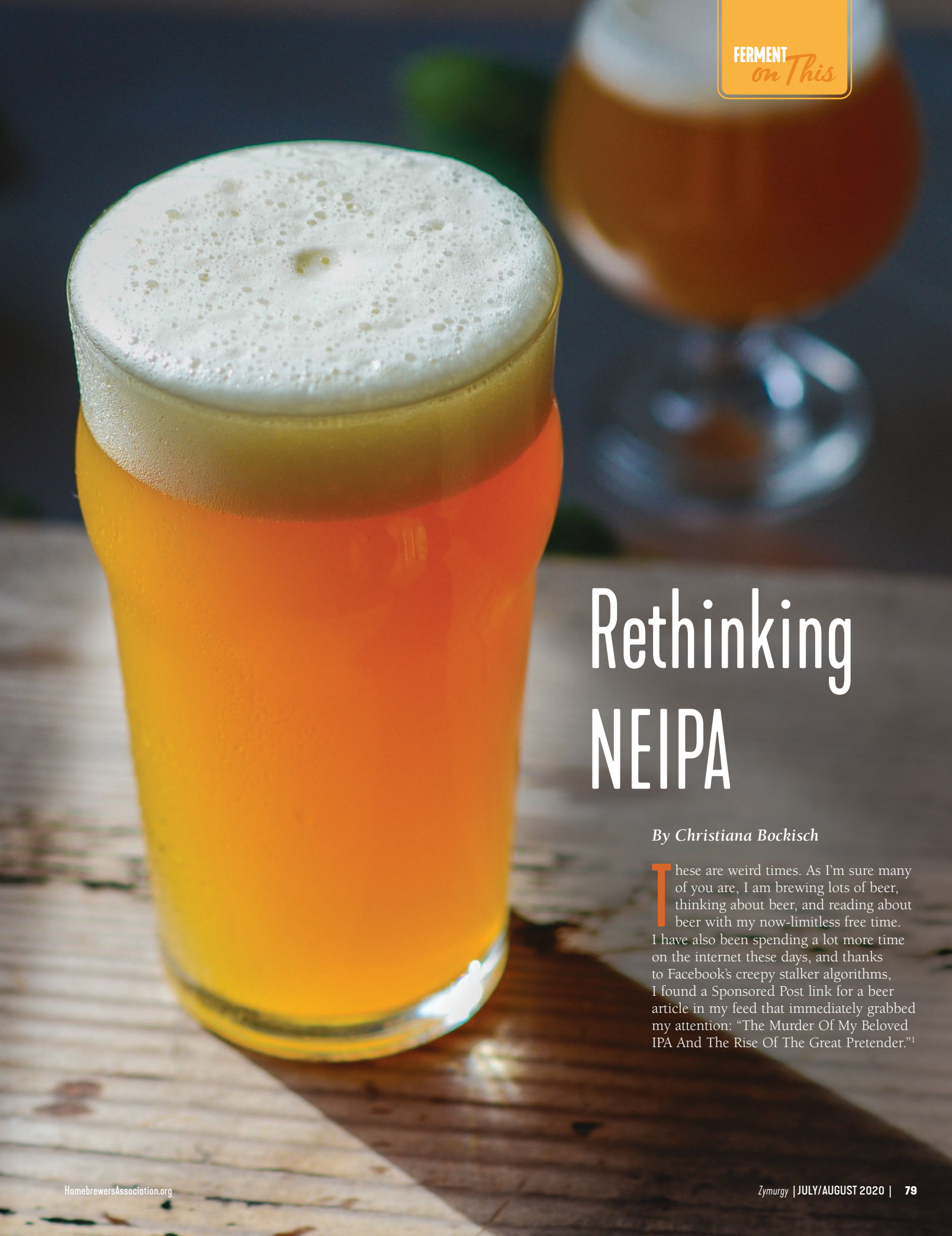
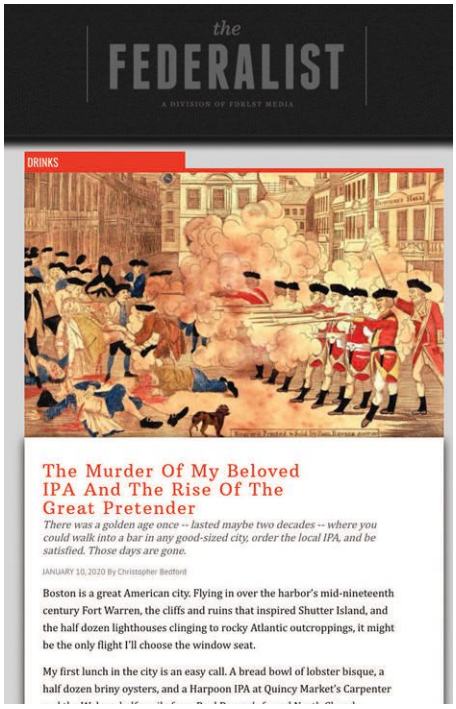


Rethinking NEIPA

By Christiana Bockisch

These are weird times. As I'm sure many of you are, I am brewing lots of beer, thinking about beer, and reading about beer with my now-limitless free time. I have also been spending a lot more time on the internet these days, and thanks to Facebook's creepy stalker algorithms, I found a Sponsored Post link for a beer article in my feed that immediately grabbed my attention: "The Murder Of My Beloved IPA And The Rise Of The Great Pretender."[1]



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DRINKS

The Murder Of My Beloved IPA And The Rise Of The Great Pretender

There was a golden age once -- lasted maybe two decades -- where you could walk into a bar in any good-sized city, order the local IPA, and be satisfied. Those days are gone.

JANUARY 10, 2020 By Christopher Bedford

Boston is a great American city. Flying in over the harbor's mid-nineteenth century Fort Warren, the cliffs and ruins that inspired Shutter Island, and the half dozen lighthouses clinging to rocky Atlantic outcroppings, it might be the only flight I'll choose the window seat.

My first lunch in the city is an easy call. A bread bowl of lobster bisque, a half dozen briny oysters, and a Harpoon IPA at Quincy Market's Carpenter

I thought, *Oh great, here's another bitter* (no pun intended) *IPA fanboy who is taking New England IPAs* (NEIPAs) *as a personal affront to his preferences*. Even though I was sure this article would annoy me, I read it anyway and actually began to agree with the author on some points. The author longs for the halcyon days of clear, crisp, and bitter IPAs and argues that NEIPAs are sickeningly sweet and inferior to his favorite style.[1] While I disagree with the sentiment that all NEIPAs are obnoxious, he is right about one thing. New England IPAs are the Great Pretender.

New England IPAs have nothing to do with a British pale ale making a treacherous journey on a wooden ship to India. They aren't like British or American IPAs in appearance or taste. They lack clarity and palate-wrecking bitterness, instead having strong hop aroma and flavor, more balance between malt and hops, a silky, pillowy mouthfeel, and increased yeast character. Other craft beer articles agree that hazy IPAs shouldn't be categorized as an IPA,[2,3] with one even referring to them as the "Anti-IPA."[3]

After all, hazy IPAs don't match the BJCP description of an American IPA. The guidelines use the descriptor "decidedly bitter" and "long, lingering bitterness" under flavor for American IPA and Double IPA, respectively.[4] New England IPAs do not have this characteristic yet have been lumped in with the catch-all category of Specialty American IPA. American IPAs are already a significant departure from their parent style, and New England IPAs are even more so. The three regional references in the full descriptor, New England–style American India Pale Ale are an untenable mashup that has lost all meaning.

Alternatively, I propose that this style instead be called New England Ale (NEA), in reference to where it originated. New England Ale should be relocated to a subcategory within category 18, Pale American Beers, when the BJCP guidelines are next updated. The bitterness of NEAs is more akin to an American Pale Ale, which resides in category 18. The BJCP even admits on the provisional style guideline page that New England IPA is drifting away from the traditional IPA:

> *Brewers are continuing to innovate and evolve the style, with the style trending towards a less bitter presentation to the point of making a mockery of the term IPA.*[5]

It should not be competing against or directly compared to bitter American IPAs.

New England Ales have been criticized for myriad reasons, including their turbidity and fruit-forward qualities. Some professional brewers refuse to brew them and have claimed they lack balance, with one describing them as "cloying—a mess."[2] One author claimed the style was destroying craft beer as we know it and has homogenized craft beer in general.[6] (It may be important to note that the author of said article also believes that Bud Light drinkers are being marginalized.[7]) Articles and users on homebrew forums have referred to NEAs as over-hyped or a fad.

Can a phenomenon be considered a fad if it's been around for more than ten years? The Alchemist began making Heady Topper, the beer that started it all, in the mid-2000s.[8] Today, more and more breweries are making NEAs, throughout New England and even on the West Coast. The biggest complaint my IPA-hating friends have about IPAs is the bitterness. New England Ales lack the bitterness they dislike. Quite simply, it's not an IPA. Perhaps it was inspired by an IPA, but it has evolved into a completely different style.

Some brewers and beer drinkers insist that all NEAs are wholly undrinkable. Maybe that's really their well-informed →

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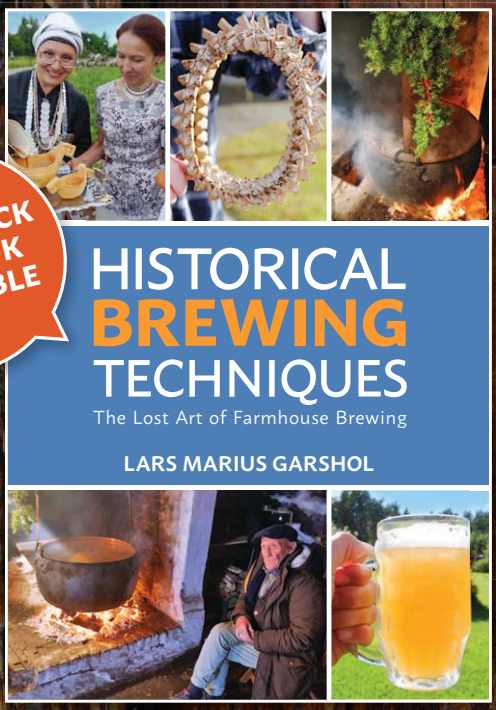

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—RANDY MOSHER, AUTHOR OF *TASTING BEER* AND *RADICAL BREWING*

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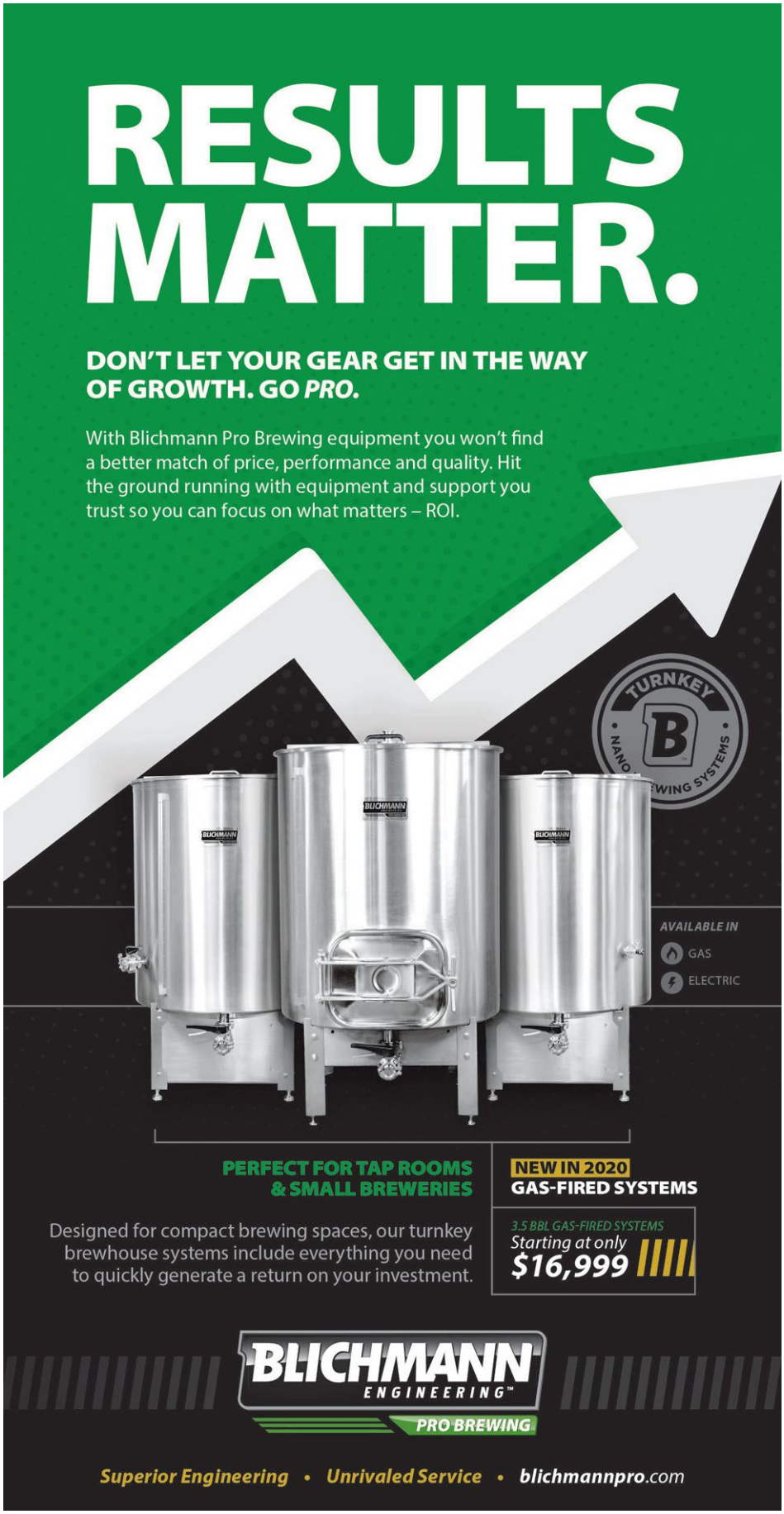

> "Can it be considered a fad if it's been around for more than ten years?

opinion, formed after having tried a highly rated example of the style, which is their prerogative. Once again, it might surprise you to know that I agree to a certain extent that a lot of the NEAs on tap these days are bad. I would say that eight times out of ten, when I try a local NEA where I live on the West Coast, I'm thoroughly disappointed. These tend to fall into one of two categories: too sweet and under-attenuated, or bitter and barely hazy, completely missing the spirit of the style altogether.

I think there are a couple of reasons why there are so many poor representations of NEA out on the market right now. First, there is a lot of demand for these beers, and brewers who otherwise wouldn't make one are making half-hearted attempts to respond to demand. Second, there is the phenomenon I will refer to as Beer Telephone. When I go to Maine every year, there are just as many NEAs on the market and they are generally higher in quality. I would say only 3 out of 10 that I try from New England miss the mark. New England is the epicenter of this style, and it's easy to find a good example in that region.

On the West Coast, your neighborhood brewery might be trying to emulate the →

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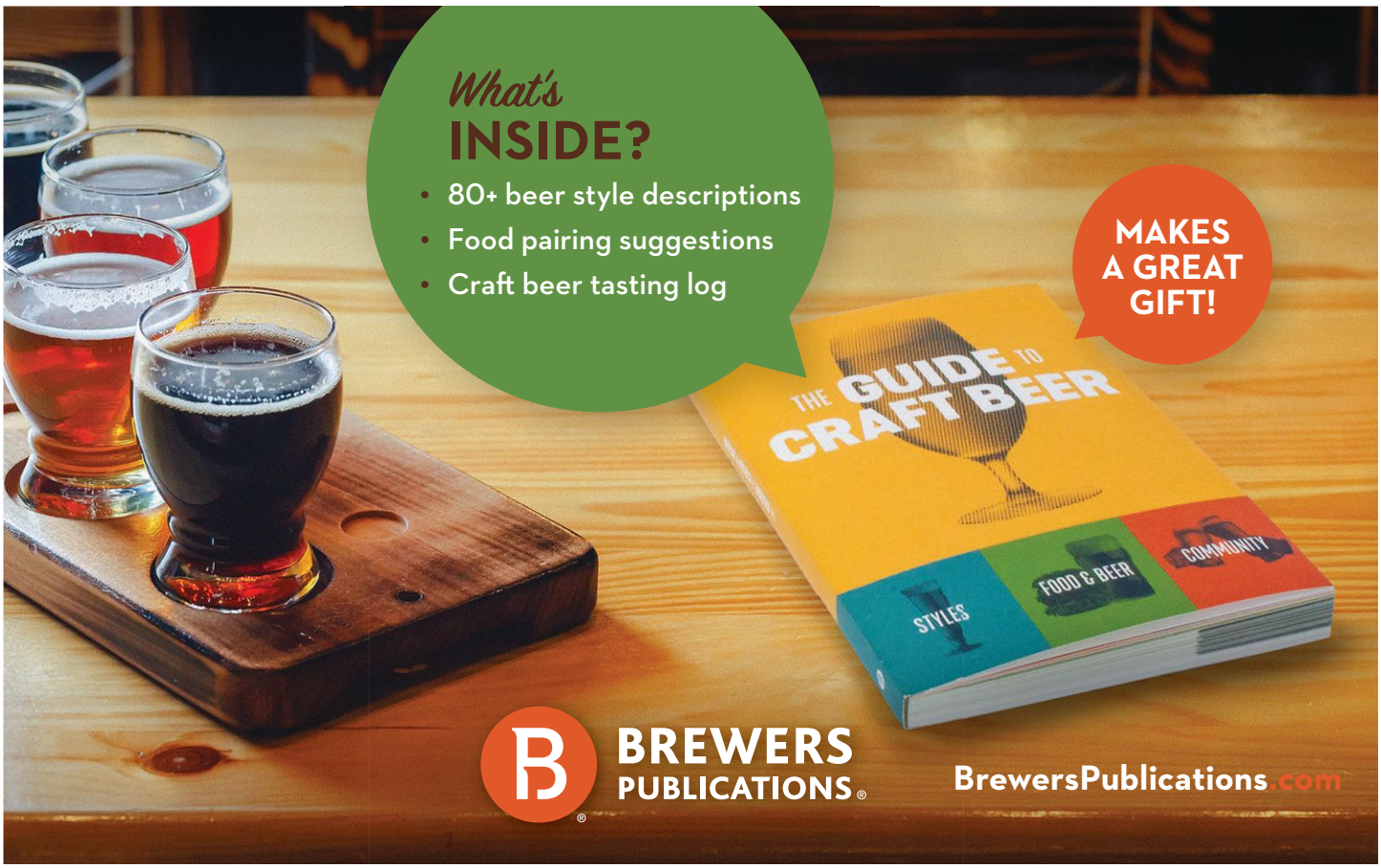

NEA from the guy the down the street, and he's trying to emulate another local brewery, and so on. Some of these brewers may not have tasted one of the best of the best from New England. Much like the classroom game telephone, what began straightforwardly is now a garbled mess nobody understands.

Finally, I would like to address the claim that "hazy is lazy," a phrase I see thrown around on the forums. Brewers who make NEAs know that the struggle against oxidation is even more difficult in these ales than it is for other brews. Making a solid NEA requires hop additions after the boil, hop additions during fermentation (often several), and then an air-free transfer to the keg or other packaging. Good luck bottle conditioning a batch without oxidation or a loss of hop character.

New England Ales are definitely more work. It is also important to note that the haze isn't as much a goal as it is a consequence of the hopping technique and ingredients used. Let's compare to a well-accepted and older style of beer: hefeweizen. When brewing a hefeweizen, the brewer does not set out to make the beer cloudy; haze is simply a byproduct of (1) abundant proteins from the heavy dose of wheat and (2) a low-flocculation yeast. Similarly, NEAs are hazy because of the addition of oat or wheat and suspended polyphenols.[9] The protein haze helps solubilize non-polar hop compounds that would not exist in a typical West Coast IPA and gives them their intense tropical fruit flavor.[9]

You may not like the style. You may not ever want to brew the style, but appreciate the work that goes into it and recognize that it is not an IPA at all. If NEIPAs are called what they should be, New England Ales, the classic American IPA isn't being "ruined" anymore. Simply, tastes have shifted to a different beer style and NEA is the current crowd favorite, for better or worse. Yet, these styles are united in their hop-centered approach, and there is room for both as craft beer continues to grow.

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Christiana Bockisch enjoys the scientific and technical aspects of brewing. In May 2018, she earned her PhD in Chemistry at Arizona State University. When she isn't brewing or under quarantine, Christiana enjoys exploring the great outdoors of the Pacific Northwest.

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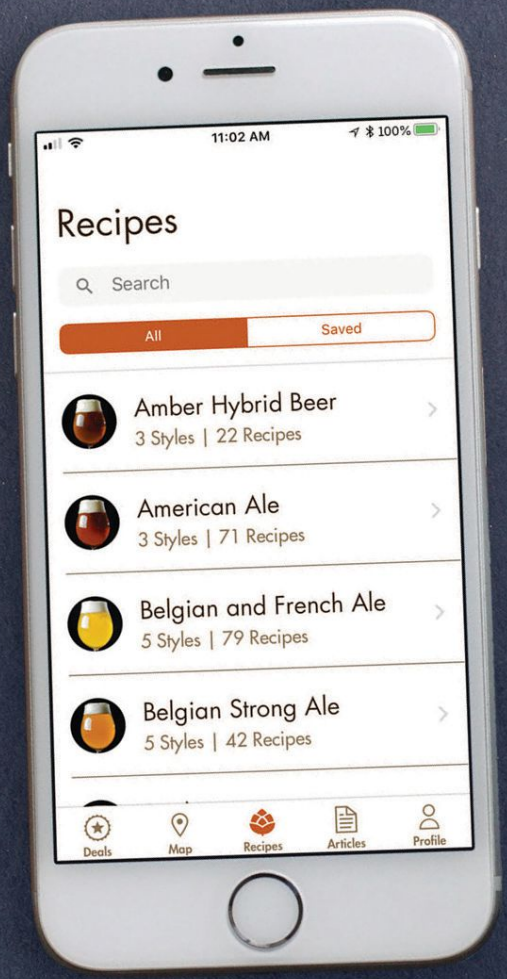

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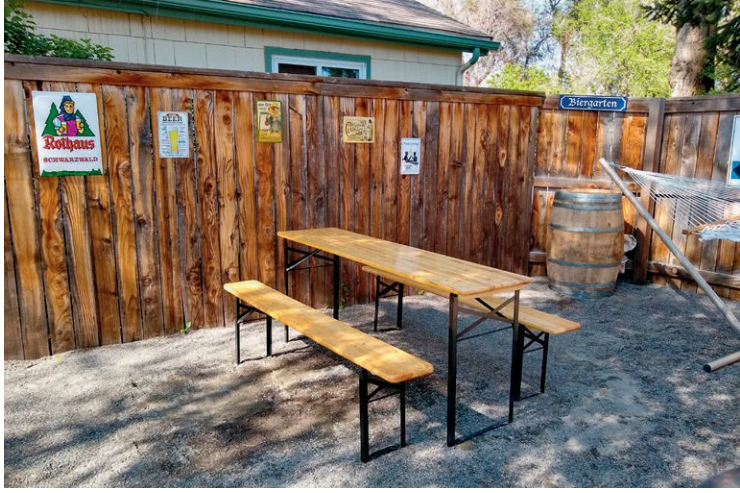


^ Backyard biergarten.

What, Me Worry?

"The point is, you see," said Ford, "that there is no point in driving yourself mad trying to stop yourself going mad. You might just as well give in and save your sanity for later."

—Douglas Adams in *Life, the Universe and Everything*

˅ Caked-on kräusen.

What strange days these have been. My car has been driven beyond the city limits three times in as many months. Once for a solo hike in the foothills west of town. Twice for curbside pickup of crowlers and homebrew supplies. All in service of sanity preservation.

There is time for everything and nothing, time for a hundred indecisions. What shall we do this weekend? The same procedure as last weekend? The same procedure as every weekend. Let us walk simply to walk and not as a means for getting to the pub. It is, after all, still closed.

Myopia sets in a little more acutely with every Zoom call. Time to get new reading glasses. Neglected suitcases acquire a thickening patina of dust as yet another itinerary is canceled (we were all so, so looking forward to Nashville). We find ourselves conversing with the cats more than is perhaps healthy. Gelato joins the ranks of Nutella and Reese's cups on the list of Foods We Simply Can't Keep Around Because We'll Eat a Whole Thing of It in One Sitting.

But we have improved certain critical pieces of infrastructure. Foaming kegerator? Balanced. Homemade Cabernet? Six gallons racked and airlocked. Dodgy gas-post O-ring on keg number two? Replaced and leak-free. Backyard biergarten? Designed, built, and christened. Carboy with caked-on kräusen? Well, there's always tomorrow.

We have bottles. We have cans. Growlers, crowlers, and kegs, oh my. Two mini fridges are now devoted exclusively to beer. Lunching on leftovers opens up a bit of space in the big fridge in the kitchen. I hear another brewery is delivering. There's room! We can make it work!

What to watch? *Derry Girls* would pair well with this dry stout, but Digby's small mead ("In Praise of Small Things," *Zymurgy*, May/June 2020) turns out to be perfect for binge-watching *Vikings* while staying safer at home in our own personal locked-down longhouse. I'll get the drinking horn.

My colleagues and I meet with a number of homebrew clubs through electronic *Brady Bunch*–style video mosaics. We use every available virtual meeting technology, all of them similar enough to inspire familiarity, but different enough to preclude proficiency.

"Is my audio working? No? How about now?"

It was fine in Zoom, but Webex doesn't like it. Maybe this button.

"Still can't hear you, and now your background is a clapping penguin."

I'll have to reboot. That's enough time to hit the bathroom, grab another beer, and—. But what is this I hear? A bump in the night? A knock at the door?

The delivery man cometh, and he bears exotic treasures: shampoo, trousers the next size up, allergy pills, a tube of J-B Weld, and 20 feet of 1/2" I.D. high-temperature silicone tubing. Brew day is saved, as are my luxurious, gray lockdown locks.

"Thanks, FedEx guy!" I yell through one of my 17 masks. "See you again tomorrow."

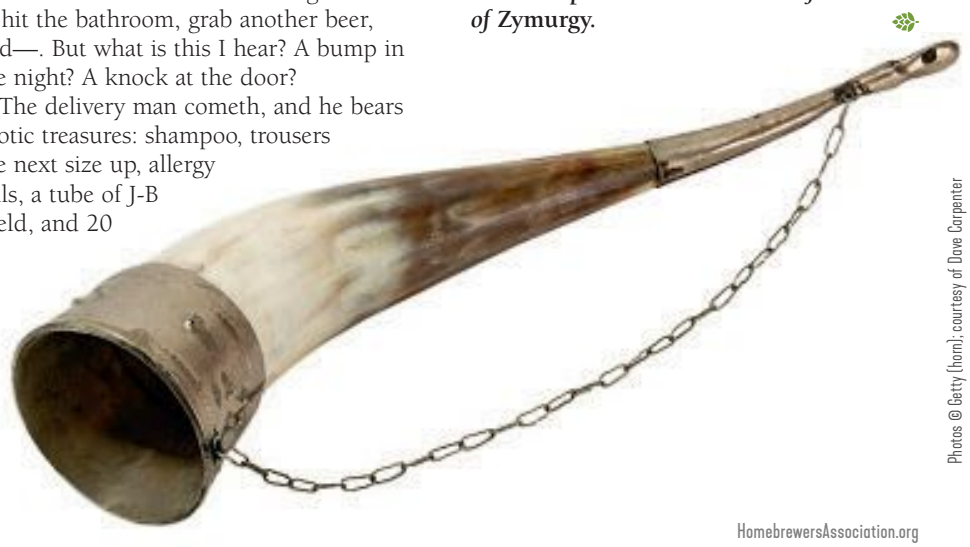
Things are gradually starting to open back up. Is it safe? Maybe it is. Maybe it isn't. Let's stay in a little longer just to be safe. There's nowhere we really *have* to be, and this beer isn't gonna drink itself. Besides, we were just getting to know the neighbors, or at least make note of their habits in a completely non-creepy way.

Do we go mad? We do not.

We are not worried. We are relaxing. We are homebrewing.

But we are still having audio issues. Can we try Slack?

***Dave Carpenter is editor-in-chief of* Zymurgy.**



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MEET ELI TRINKLE

Eli Trinkle of Upland Brewing Co. was immediately drawn to home brewing after being introduced to it by his neighbor. After just one month of owning his own home brew setup, Eli was brewing all-grain with Wyeast smack-packs and kegging his own beer. He admits he was so intrigued by the process, it consumed his life. He spent countless hours researching and experimenting—he even worked as an assistant brewer while finishing his degree in engineering technology. Post-graduation, Eli decided that instead of pursuing more education, he'd turn his passion for brewing into a career.

Today, Eli has crafted a diverse portfolio of award-winning sours for Upland. He attributes his present-day brewing devotion to his colleagues at Upland, to the people of Bloomington, IN and the pride associated with pioneering a quality fermentation product. At Wyeast we share these same values, which is why we're pleased to toast the work of Eli and the rest of the Upland Brewing team.

See **wyeastlab.com** for homebrewing recipes from Eli and other commercial craft brewers.

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