Vol. 35 ✳ No. 6 | November/December 2012

FOR THE HOMEBREWER & BEER LOVER

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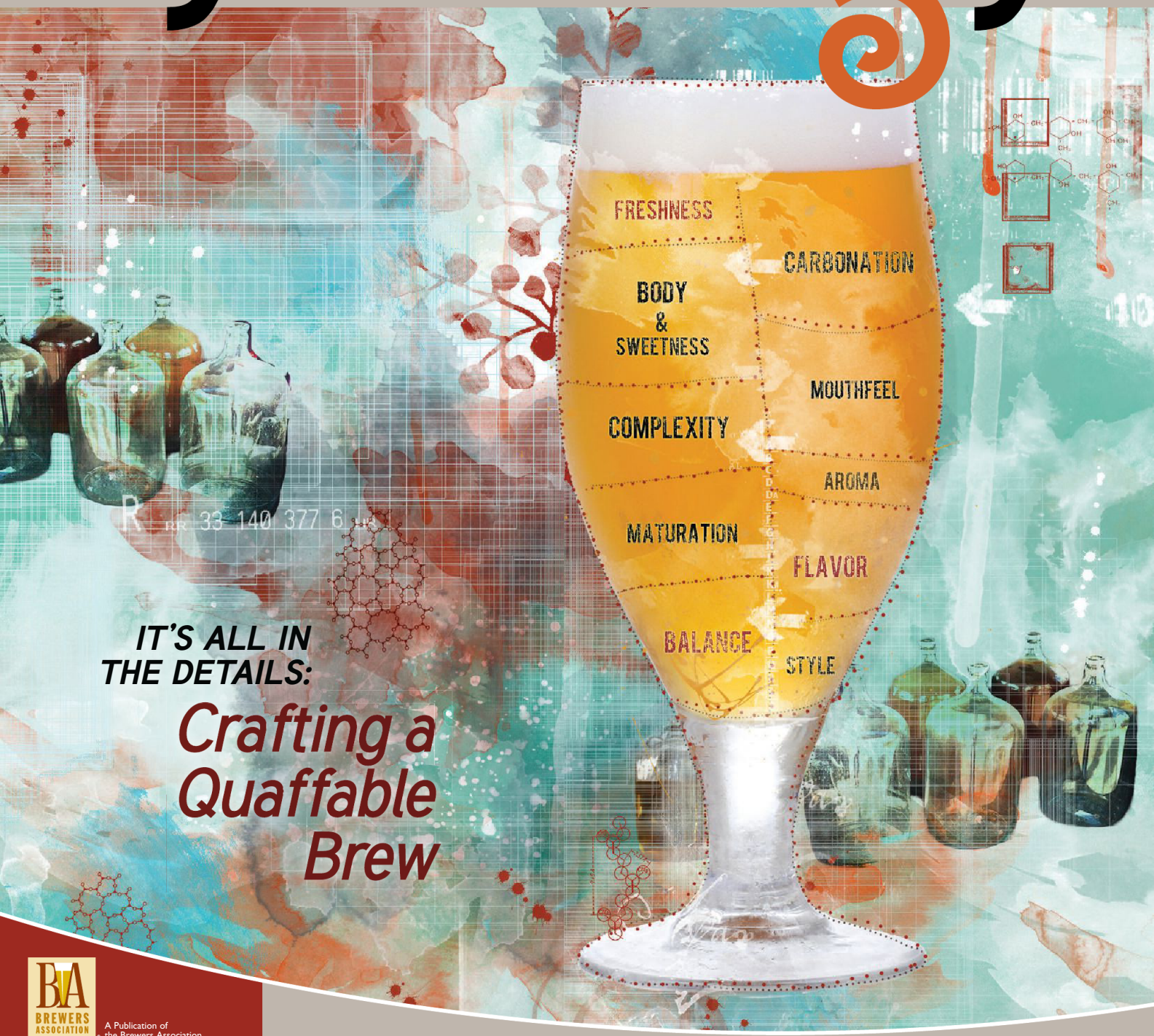
The Journal of the American Homebrewers Association®



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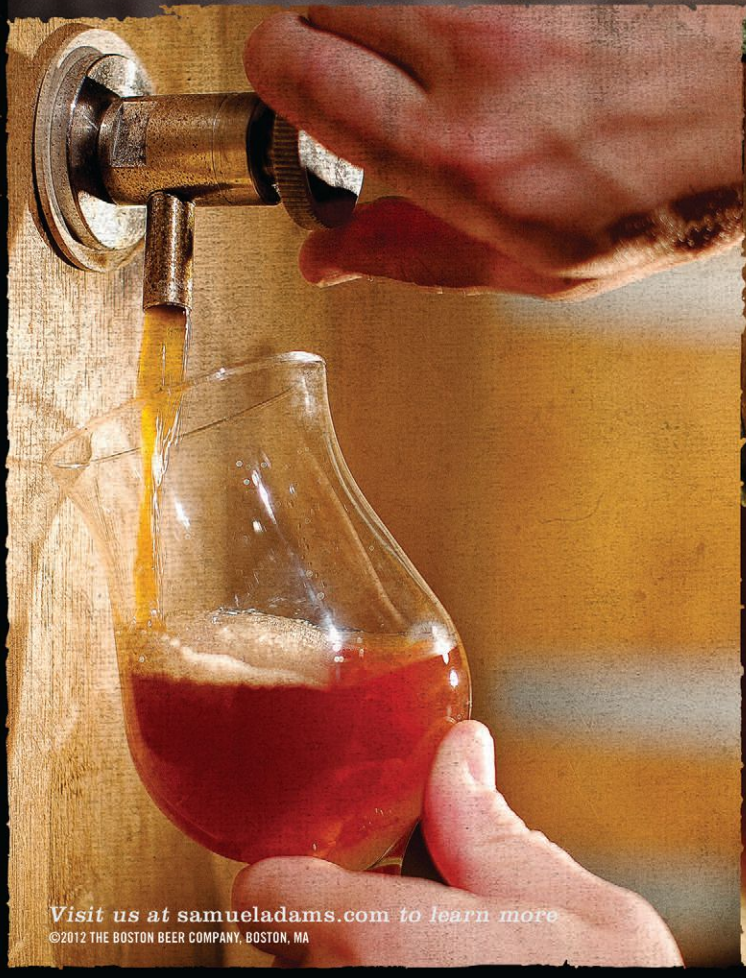

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Beer Meister® The Original

by Jill Redding

Notes from Hop School

I'm fortunate in my role at the Brewers Association to have many opportunities for continuing beer education. From attending Beer Camp at Sierra Nevada to sitting in on seminars at the Craft Brewers Conference each spring, I take my role as a beer scholar seriously.

In mid-September, I attended Hop & Brew School hosted by hop supplier Hopunion LLC in Yakima, Wash. The event, which consisted of two days of seminars followed by a visit to a hop farm, coincided with the hop harvest, which was about 30 percent complete at the time. About 120 homebrewers were in attendance, and approximately 300 had tried to register for the event.

I took copious notes at Hop & Brew School and culled them down to 10 tidbits of "news you can use" and items of interest.

• One hundred percent of Hopunion's hops are contracted out through 2014. Not to worry, though, homebrewers: Brewcraft USA and LD Carlson, Hopunion's two partners that supply hops to homebrew retail shops, also have contracts for hops.

• Hopunion carries 129 varieties of hops. Mosaic, formerly known as experimental hop HBC 369, is the newest hop variety available, imparting notes of blueberry, mango, tangerine, rose, and bubblegum. Mosaic is a daughter of Simcoe®. Those of you who attended Stan Hieronymus' seminar at the 2012 National Homebrewers Conference were able to sample an IPA brewed with Mosaic.

• There are just 63 U.S. hop growers compared to 425 in 1980.

• Cluster is the only hop indigenous to the Yakima Valley.

• Male hop plants are utilized only for hybridization. If hop farmers see a male plant growing in their fields, they will immediately rip it out. Male plants can impart unwanted seeds into hop cones.

• According to Jason Perrault, a fourth-generation hop farmer (he penned the "How Hop Varieties are Developed" article in the May/June 2012 *Zymurgy*), there are currently 22 hops in elite trials in the Hop Breeding Company program. Varieties that have reached the final stages of testing include 366, which Perrault described as "Citra on steroids"; 342, which has elements of watermelon and light citrus; and 291, which is floral and peppery.

• According to third-generation hop farmer Mike Smith of B.T. Loftus Ranches, Inc., Russian River's Vinnie Cilurzo can be largely credited with rescuing a now-popular hop from near-extinction. "Pliny the Elder probably saved Simcoe®," said Smith to a round of applause from the homebrewers.

• Smith said that homebrewers "basically are brewing with the exact same hops as large [craft] brewers" as far as quality is concerned.

• Hopunion sent U.S. hops to the White House after learning that the White House homebrew recipes used hops from the U.K. and Germany.

• Hopunion has a third-party laboratory on-site called Alpha Analytics that will analyze both hops and beer. For example, if you have wild hops growing in your yard and you're not sure of the variety, you can ship samples to Alpha Analytics for analysis. Visit hopunion.com for more details.

Jill Redding is editor-in-chief of *Zymurgy*.

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>> GET THERE!

BEER, WINE, AND MUSHROOM FESTIVAL

For the first time in the 12-year history of the annual Wine & Mushroom Festival in Mendocino County, Calif., local craft beers will be incorporated into the mix, officially making the new title of the festival the Beer, Wine & Mushroom Festival. Anderson Valley Brewing Company and North Coast Brewing Company will be integrally involved in this year's festival, hosting dinners and tours and pouring at the flagship event on November 3. The craft beers and delectable mushrooms of Mendocino County, combined with locally produced wines, will make the 2012 festival, which runs November 2-11, an event that delights foodies, oenophiles, and nature lovers alike.

Mendocino County boasts more than 3,000 types of mushrooms, 500 of which are edible, including chanterelles, porcinis, morels, and hedgehogs, and even the extremely rare candy cap mushroom, with its intense maple-syrup flavor, that grows only along the northern coast of California. The Beer, Wine & Mushroom Festival will celebrate this bounty—along with locally crafted beers and wines—with an array of events, including brewmaster and winemaker dinners, wild mushroom foraging excursions, educational beer and wine-pairing demonstrations, art exhibitions, and more!

To learn more, go to www.visitmendocino.com.

November 2-3
Maine Brewers Festival
Portland, ME
www.learnyourbeer.com

November 2-11
San Diego Beer Week
San Diego, CA
www.sdbw.org

November 10
Fall Beer Festival
Pinellas Park, FL
www.cajuncafeonthebayou.com

November 10-17
Dallas Beer Week
Dallas, TX
www.dallasbeerweek.com

November 10-17
Houston Beer Week
Houston, TX
www.houstonbeerweek.com

November 28-December 2
Holiday Ale Festival
Portland, OR
Holidayale.com

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>> GREAT PRODUCT

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Looking for a great way to transport your homebrew and keep it super cold at the same time? The 64-ounce Hydro Flask Growler is the ideal size for filling up with homebrew or beer from your local brewery (check the laws in your state on growler fills). Or, do some cross training: head up to the mountain with your growler and have some coffee, hot cocoa, or hot soup waiting for you at the end of your day.

The vacuum-insulated, food-grade stainless steel growlers are BPA free and resistant to bacteria and odors. They are designed to keep cold liquids cold for 24 hours and hot liquids hot for 12 hours.

Several craft breweries including Maui Brewing Co. and Deschutes are now using Hydro Flask growlers in place of, or in addition to, standard glass growlers. Unaffiliated growlers are sold directly through the Hydro Flask website (www.hydroflask.com) for $49.99, or check the availability at your local brewery. Hydro Flask also offers a 40-ounce version and several sizes of water bottles.

>> BREW NEWS

SAMUEL ADAMS, JACK MCAULIFFE JOIN FORCES

Jack McAuliffe, a pioneer in craft brewing and founder of the New Albion Brewing Company, and Jim Koch, brewer and founder of Boston Beer Co., announced their plans to brew McAuliffe's original New Albion Ale for the first time in 30 years. This American pale ale will be brewed true to its original recipe using the original yeast, which has been carefully preserved at the University of California since 1977.

McAuliffe, a Navy veteran, acquired a taste for flavorful beer while stationed in Scotland in the 1960s. Shortly thereafter, he developed a passion for homebrewing and eventually started the nation's first craft brewery, the New Albion Brewing Company in 1976. Although the brewery closed its doors in 1982 due to a weak economy and a lack of financing options, McAuliffe's vision for New Albion Ale was ahead of its time, helping pave the way for other American craft breweries, and its impact is still felt today.

"Jack was brewing craft beer when nothing was easy. Nobody made small scale brewing equipment, nobody wanted to invest, retailers and distributors didn't want your beer, drinkers couldn't understand why the beer didn't taste 'normal.' It was so different from today," said Koch. "New Albion is a true legacy. Jack's passion for craft beer has had a widespread influence, and has shaped the craft beer landscape. What Jack started 30 years ago inspired brewers to explore brewing full-flavored craft beers."

McAuliffe traveled to Boston in early July to join Koch and the Samuel Adams brewers as they brewed the first batch. New Albion Ale is a deep, golden beer brewed with American Cascade hops and a two-row malt blend. The Cascade hops, sourced from the Pacific Northwest, create a moderate hop bitterness and lingering notes of citrus and floral, balanced by the upfront cereal character and sweet finish from the malt.

"Jim and I share a common passion for craft brewing, so I was honored when he approached me about bringing the New Albion original recipe back to life," said McAuliffe. "I can't believe I'm brewing New Albion for a new generation of craft beer drinkers—a group that has more great beer choices than I ever had! New Albion will have a place in the growing and diverse craft beer landscape thanks to a fellow craft brewer."

>> YOU'VE GOTTA DRINK THIS

SQUATTERS FULL SUSPENSION PALE ALE

Every craft brew enthusiast has their gateway beer. This is mine. This Northwest style pale ale is clean, crisp, and easy like Sunday morning. The hops are sharp and bitter but reasonable in the nose and on the tongue. The citrusy grapefruit character is balanced by the malt and doesn't linger beyond its welcome. The beer remains capped by a beautiful head of foam that leaves a solid layer of lacing behind with each sip. Many people overlook Utah beers due to the ridiculous alcohol restrictions the state has put in place, but in this case the limitation has become an advantage. Full Suspension's 4.0 percent ABV makes it the perfect session beer and a delight to drink all day long (but if my wife asks, please don't tell her I drink beer all day long).

Reviewed by Matt Haugo, Aliso Viejo, Calif.

>> BEER QUOTE

"My mom taught me to think about recipes instead of just following them."

—Moonlight Meadery founder Michael Fairbrother

If you've had a beer you just have to tell the world about, send your description, in 150 words or fewer, to zymurgy@brewersassociation.org.

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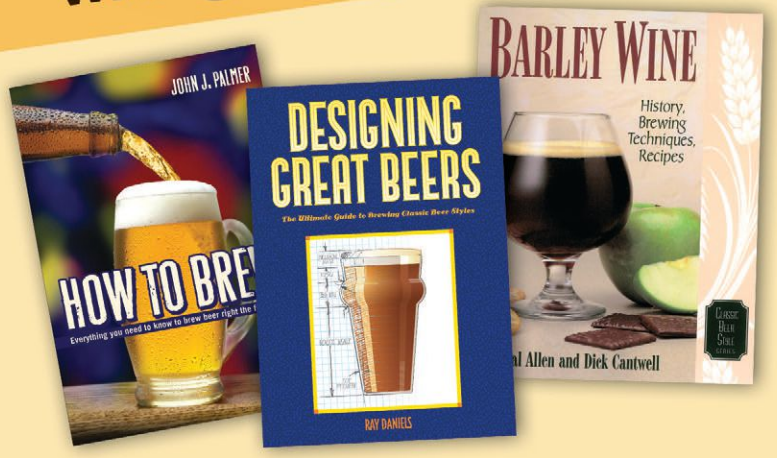

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By Gary Glass

Malt Tips from the Source

I write this column with malt on the brain, having just returned from Briess Malt & Ingredients Company's Malt and Brew Workshop. The event took place over two days in Chilton, Wis., where Briess is located. Malt and Brew Workshop consisted of nine educational seminars and tours of the malthouse, roaster, brewhouse, and extract plant.

Briess is actually a rather small maltster in the grand scheme of things. It ranks around 140th in total production among the world's malting facilities and is the second smallest maltster in the U.S. What it lacks in overall size, it makes up for in the varieties of specialty malts it produces. Briess has more varieties of specialty malts available for brewers than any other maltster in the world.

For me, the highlight of the trip to Chilton was seeing the Briess brewhouse and extract plant. Briess' 500-barrel brewhouse, used to produce wort for brewers extracts and other food industry products, is the third-largest in the country. The brewhouse produces high gravity wort (1.093-1.131 specific gravity or 22-30 °P) for its extracts, which are then chilled and run through a high efficiency, three-stage evaporator. The maximum temperature experienced by the wort in the evaporator is 160° F (71° C), which limits color development for the extracts. According to Briess technical services manager Bob Hansen, darkening of wort in the evaporator is equivalent to less than three minutes in a commercial brewery whirlpool.

For dried malt extract, liquid extract is sprayed in tiny droplets, roughly the equivalent of water droplets found in fog, down a cylinder filled with ultra-dry hot air. Drying of the particles happens so fast that the wort experiences very little darkening in the process.

In addition to the brewhouse and extract plant, Briess operates a 1-barrel steam-fired pilot brewery, where it tests out new extracts as well as runs test brews with its malts. Malt and Brew Workshop students got to try three brews, including a 12-month-old sour beer, from the pilot brewery.

It's not often that homebrewers get to ask questions directly of the people who make malt and malt extract at the source. I took advantage of the opportunity and got some great takeaways for homebrewers.

LME or DME?

That is, liquid or dried malt extract—which is better for brewing? Liquid malt extract is certainly easier to work with. If you are sure the extract you are buying is very fresh and you are going to use it right away, LME is probably the way to go. However, if you are unsure how the extract you are buying has been treated prior to purchasing it, dried malt extract is your best bet. Liquid malt extract will oxidize over time, particularly if it is exposed to warmer temperatures, and will begin to exhibit oxidative qualities and darken over time. Dried malt extract, because it has almost no moisture content, is extremely stable and can be stored for years without ill effect.

What's In Your Extract?

Some manufacturers may include adjuncts in their extracts. Most reputable manufacturers will use all malt. Briess uses two-row malted barley and Carapils® for its Pilsner extract, currently the lightest

colored malt extract on the market, and six-row base malt and Carapils® for its Golden Light malt extract. Its wheat malt extract consists of 65 percent wheat and 35 percent barley malts, and the Munich malt extract is 50 percent Munich and 50 percent base malt. Proportions for other extracts may vary depending on the manufacturer.

Steeping Grains

Best practice for steeping grains for extract beers is at a ratio of half a gallon (1.9 L) of water per pound (0.45 kg) of grain at 160° F (71° C) for 30 minutes prior to sparging. Highly roasted malts such as chocolate and black patent can be cold-steeped in advance, which will reduce harshness that might come from hot steeping (or mashing) roasted malt. Crystal malts that are produced with a roaster, such as Briess caramel malts, should be 100 percent glassy, meaning they are fully converted and all individual grains should have hard dark endosperms when cut in half. Crystal malts that are produced in a kiln rather than a roaster likely won't be 100 percent glassy and thus will have some grains with unconverted starch, which will appear as "mealy" (i.e. crumbles easily) white material in the center of individual grains when cut in half. Steeping crystal malts that are not 100 percent glassy will add unfermentable starch to your wort, which could lead to stability issues in the finished beer.

Boiling Extract

Extracts have already been boiled and are sterile when packaged, and thus don't require boiling by the brewer to sanitize or volatilize off-flavor compounds. Rather than adding all of the extract required by a recipe at the beginning of the boil, some extract brewers have taken to adding half of their extract at the beginning of the boil, with the remainder added at the end of the boil. This is advantageous to brewers conducting partial wort boils for two reasons. First, higher density wort is less efficient at isomerizing alpha acid bitterness from hops than the lower density wort found in full wort boils, so partial wort boils require more hops to get the same bitterness as full wort boils. Second, higher density wort will darken more over the course of a typical boil period than will lower density wort in a full wort boil. Thus, you can more closely match the results from an all-grain full wort boil recipe with a partial wort boil extract brew by adding half of the extract at the end of the boil. You can add the second half of your extract as late as at flame out, but you may want to add that extract during the last 10 minutes of the boil to ensure the extract is fully dissolved and mixed in your wort prior to chilling. No matter when you add it, be sure to remove your pot from the burner before pouring in your extract to avoid scorching.

Malt Sensory Workshop

For one of the seminars, the Briess staff prepared samples of malts, along with plain malt wort made from those malts and beers made with the malts. It was a great experience. Chewing the grains then sampling worts made from those grains was a great way to get to know each malt. One of the samples was for a newly released Vienna malt called GoldPils®. The sample wort and a sample beer made with the malt were excellent. Another

WHAT'S NEW IN HOMEBREW?

THE LATEST FROM C&B 2012

IS IT JUST US...

Or does it feel like the homebrew market needs some kind of kick in the pants?

It's like it's always been the same ol' same ol', and just about everyone seems to be OK with that.

WELL, NOT US. We're gonna be changing things up and looking for new areas to explore. Ideally somewhere no one has ventured before. And, who knows, perhaps steering it in new directions altogether.

If you're the exploring type, stick with us to see what we'll be brewing up in the near future. Rest assured - it's gonna be good.

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interesting revelation from the sensory testing was that the Briess dark chocolate malt (420 °L) is actually smoother than its standard (350 °L) chocolate malt. A similar exercise could be done at home by steeping a quarter pound of grain in a pint of water at 150° F (66° C) for base malts or 160° F (71° C) for specialty malts for half an hour.

Storage of Malt

Malt leaves the maltster with a low moisture content, but will begin to pick up moisture from the air over time. If the moisture content gets too high, it will start to mold. Briess director of malting operations Dave Kuske recommends storing light base malts such as two-row, Pilsner, or wheat malts for six months or less. Higher kilned base malts like pale ale malt can be stored nine months or less; crystal malts 12 months or less; and dark roast malt 18 months or less. For pre-ground malts, cut those times in half. Of course those times are relative and mostly aimed at malt stored in silos or bags. Storage in airtight containers likely will add to malt's shelf life. Local climate will also influence storage time.

There were many other takeaways—too many to fit them all into this column. We'll work on incorporating many of the lessons learned into the Let's Brew section of HomebrewersAssociation.org.

Until next time, happy homebrewing!

Gary Glass is director of the American Homebrewers Association.

Commercial UnCalibration?

Dear *Zymurgy*,
In reading the Commercial Calibration department of the July/August 2012 *Zymurgy*, I was struck by how "uncalibrated" the reviews were for Sixpoint's Resin. Full disclosure here: I have never been a big fan of beer judging in general, mainly because beer appreciation and appraisal is such a subjective art (and pleasure). I have heard several faithful amateur and professional brewing competition entrants

bemoan the conflicting commentary their beers received from judges whose advice was more contradictory and confusing than helpful. Perhaps notes like those provided for Resin are an example of what they were talking about.

When one reads each of the reviews, it almost seems like they are talking about entirely different beers. Here are a few examples for Resin:

- Aroma: "Alcohol not particularly evident" vs. "Alcohol evident."
- Appearance: "Golden colored… with persistent rocky head" vs. "Amber in color with a head that… falls rather quickly."
- Mouthfeel: "Carbonation is a bit low" vs. "High carbonation—mouth-filling bubbles."
- Overall Impression: "Deliciously drinkable" vs. "rough and palate-assaulting… the drinkability suffers in my opinion from heaviness and harshness."

When the comments of the expert judges vary this widely, I can't help but wonder how on earth this feedback is supposed to be helpful to the brewer or to the consumer. I have never tried this beer, and after reading these reviews, I am not sure if I should run out and buy a case or avoid it at all costs. I started to read the same judges' reviews of Isis from Sun King on the opposite page, but stopped when I saw the following two comments side by side: "astringency from the hops is a little high" vs. "there is no to very low hop-derived astringency." Come on, guys—which is it?

Don't get me wrong—I think critical assessment of the myriad flavors, aromas, colors, etc. of beer is a wonderful pastime, and I regularly take "tasting notes" on new beers when I try them for the first time, both to enhance the experience and to help recall my impressions of the beer when I see it on the shelf again years later. And I would encourage anyone who really loves beer (as all *Zymurgy* readers do) to do likewise. But perhaps it is time to stop putting our own tasting notes forward as some sort of authoritative statement as to the quality of the beer brewed by others—especially when our opinions can vary so widely. As the ancient philosopher said, "beauty is in the eye of the beer-holder."

FROM OUR READERS

Homebrew label for a Belgian wit brewed by Alexi Valentín and Eneida Villanueva.

Homebrew label from Mark Lubeski.

Best regards,
Kurt Elia
Maplewood, N.J.

[Editor's Note: Below is a collectively written response from our Commercial Calibration judges.]

Thank you for your note and insights. We judge these beers in different locations, at different times, under different conditions, and with different samples that were likely handled differently. (In this set of beers, one of the judges noted that one of the samples apparently leaked during shipping, which means that there was likely air ingress into the container that may have impacted the quality of the sample.) Some of judging is subjective, and different judges will have different thresholds for various components in beer. Without the judging taking place under identical conditions with the ability to discuss and reconcile differences, some variation in perception and interpretation is to be expected.

The range of opinions in the Commercial Calibration column is not different than what typically occurs in an average competition, except that discussion and reconciliation does not take place among our four judges [who live in California, Pennsylvania, New York, and Ohio.] You are seeing the raw opinions of individual judges; use them as a way of comparing your own perceptions against theirs rather than as an absolute indicator of the quality of the beer—that is not the intent of the column.

More Brew Dogs

Dear *Zymurgy*,
Loved Diana Davis's article! (Brew Dogs, September/October 2012 *Zymurgy*). I have been homebrewing for 15 years, the

last 10 with dogs. In the photo, the three dogs from left are Bru Dog, Micro Bru, and Beamer (a neighbor's dog).

Cheers!
Jim McCaskey
Valley Center, Calif.

Brew Cats

Dear *Zymurgy*,
As an animal lover, I was looking forward to reading the Brew Dogs article. However, I was disappointed by the uncalled-for attack on Brew Cats! Has the author really not yet gotten past the point of the stereotypical "dog vs. cat" arguments and learned to appreciate both as wonderful companions (and brew helpers) in their own right? As evidence, I submit a picture of our beloved Oliver, the faithful assistant brewmaster of our home

brewery. Oliver is with me on every step of beer making, from milling the grains to filling the kegs.

Sincerely,
Barna Mink
San Francisco, Calif.

Photos courtesy of Jim McCaskey and Barna Mink

by Professor Surfeit

Brewing with Fresh Herbs

Photo © 2012 Shutterstock and Brewers Association

Dear Professor,
Would you suggest an herb or herbs that I can use to replace Saaz hops in a Pilsner recipe?

I look forward to brewing your Yarrow Ale again with fresh herbs next spring. Thanks again for taking the time to read emails. It's appreciated.

James "Gruit Guy" Adams
Maynard, Mass.

Dear Jim,
Good question and I'd been pondering how to answer when I noticed an incoming suggestion from Zymurgy reader Joel Gallihue of Anchorage, Alaska. He seems to have some good advice, so I'll just pass his along.

"Brewing spice bitterness can be gauged by making teas of known quantities of hops with known alpha and the other brewing herbs. Add known quantities of sugar to hop tea until it is not bitter and note the ratio of sugar added to known alpha. Now add sugar to tea of the other brewing herb tea until it is not bitter. This ratio has an unknown x value for alpha. Take the two ratios and solve for x. This is the relative bitterness of the particular herb. Keep kettle times short."

The only suggestion I'd add to Joel's procedure is to boil your malt wort for an hour in order to coagulate proteins, etc. Keep your "kettle" boiling time for the herbs to additions during the final five or 10 minutes of the boil.

I can't recommend a particular herb to replace Saaz hop aroma or flavor, but any bitter herb could be considered to replace hop bitterness. Get yourself a good herb book and investigate the safe use of bitter herbs.

To the bitter end,
The Professor, Hb.D.

Malt Details Sought

Dear Professor,

I just purchased BeerSmith and was wondering if there are books providing typical values for DP (diastastic power), CF (course-fine grind) difference, moisture etc. for base malts and specialty grains. I want to add grains (that are not part of the default list) to the BeerSmith inventory list but I don't have lot numbers for grains that I purchased so I can't go back to the vendor for that information. Any suggestions on where to look for typical values?

Thanks,
Dennis

Dear Dennis,

Malt and grain values will vary not only from year to year, but from lot to lot harvests. But for homebrewing purposes, the middle of the range usually indicated online and in other published material will be adequate. The margin of grain value fluctuation for homebrewers is probably much less than the margin of errors encountered during the milling, mashing, lautering, boiling, fermentation, and bottling/kegging process. For example, you could lose a pint or two of brew in any of the above processes and that percent difference in yield would be more than the margin of crop variation values you're entering into your computations.

Where does the most up-to-date information reside? I've found through my own research these very good resources: www.brewingwithbriess.com, www.weyermann.de/eng, www.gambrinusmalting.com, www.rahr.com, www.castlemalting.com, www.crispmalt.info, www.brewerssupplygroup.com, www.greatwesternmalting.com, www.bairds-malt.co.uk, and www.countrymaltgroup.com.

Professing,
The Professor, Hb.D.

Hey homebrewers! If you have a brewing-related question for Professor Surfeit, e-mail professor@brewersassociation.org.

By Jeff Renner

Ant Hayes Memorial Burton (Old) Ale

When South African native and British resident Ant Hayes spoke on "Lesser Known and Misunderstood English Beer Styles" at the 2010 National Homebrewers Conference in Minneapolis, he introduced his mostly American audience to the British euphemism "gone for a Burton." It may have originated when a British pilot didn't return from a mission during the Battle of Britain and was said to have "gone for a Burton," suggesting that he'd just stepped out for a beer and might be back anytime.

Tragically, Ant himself has gone for a Burton, and the Ann Arbor Brewers Guild (AABG), of which he was an honorary member, will honor his memory by hosting a Club Only Competition for Burton ales.

Burton ale is an extinct English beer, at least by name, that originated as an export beer in the famous English brewing town of Burton in the 18th century. It was stronger, darker, and sweeter than India pale ale. It evolved over two centuries, and by the time it faded from the market in the mid-20th century, it was described as "a strong ale of the pale ale type, but with a higher proportion of highly dried or slightly roasted malt; it is consequently darker in colour with a fuller flavour than pale ales. … it is usually given a prolonged cellar treatment, in the course of which those special flavours develop which are associated with maturity in beer."[1]

As such, it more or less fits into the BJCP 19A Old Ale category, although Hayes and English beer historian Martyn Cornell wrote in their January/February 2011 *Zymurgy* article "Burton Ale: A British Comfort Beer" that it could be considerably more bitter than the 30-60 IBUs allowed in the style guidelines. For that reason, for this competition, the AABG is allowing more heavily hopped beers, as long as the bitterness is mellowed by age. As Hayes and Cornell wrote, "Burton Ale is a comforting beer brewed for adults. It is not an extreme beer catering to childish tastes, but a strong, rich beer, playing off plenty of bitterness against a sweet, malty undertone. It has no rough edges."

While no currently brewed beers are called Burton Ale, some modern beers fit the style, including Fuller's 1845, Theakston's Old Peculier, and Marston's Owd Rodger.

"Gone But Not Forgotten" Burton Ale

INGREDIENTS

for 5 U.S. gallons (19 liters)
(assumes 75% mash efficiency)

10.5 lb	(4.75 kg) pale malt (preferably Maris Otter)
1.0 lb	(0.45 kg) flaked maize
5.0 oz	(141 g) British chocolate malt
3 fl. oz	(90 ml) blackstrap molasses
3.0 oz	(85 g) Fuggles hops (4.6% a.a.) 90 min
1.0 oz	(28 g) East Kent Goldings hops (dry)
Wyeast 1968 ESB ale yeast or White Labs WLP002 English Ale Yeast	

Original Gravity: 1.069
Final Gravity: 1.022
IBUs: 68

DIRECTIONS

Adjust water to moderate residual alkalinity and ~200 ppm calcium content with calcium sulfate. Mash at 156° F (69° C) and hold for starch conversion. Boil for 90 minutes, adding molasses near the end. Bulk age as long as you can, up to a year. Dry hop for two weeks before kegging or bottling.

Extract version: Substitute 9 pounds (2 kg) Maris Otter liquid malt extract for the Maris Otter and maize. Steep the chocolate malt in a quart (liter) of water at 158° F (70° C) for 30 minutes, strain, sparge, add to the boiling wort, and proceed with the recipe.

Brewing Burton Ale

To brew a Burton ale, start with good quality British pale malt, preferably Maris Otter, and a bit of dark malt, but avoid any roasted flavor in the beer. Many Burtons were brewed with flaked maize and luscious invert brewing sugars. A light touch of blackstrap molasses can add the flavor of these sugars.

Mash a little higher than usual, say 156° F (69° C), to produce more residual sugars. Use lots of low alpha English hops, and ferment with a fruity, low attenuating English yeast. Age it in bulk as long as you can stand, and then dry hop for two weeks before kegging or bottling. You may get other ideas from the BJCP Style Guidelines and the *Zymurgy* article.

Ultimately, keep in mind what Ant wrote. "When brewing a Burton ale, it is best to remember the things that comforted you most as a child—your teddy bear or blanket, perhaps—and then aim for a beer that will evoke similar emotions. Drinking a Burton Ale should take you back to a safe, comfortable place, not for you to drown your sorrows, but to help you deal with life's little knocks. It is a personal beer, and is best brewed for the brewer. If others benefit, so much the better."

Ant called his Burton Ale "Absent Friends." He is a dearly missed absent friend.

Jeff Renner is a charter member (1986) of the AABG and a past member of the AHA Governing Committee. He got to know Ant Hayes on the Internet's HomeBrew Digest in the late '90s, and met him when the Wort Hog Brewers of Johannesburg flew Renner to South Africa to administer the first BJCP exam outside of North America.

References

1. *The Brewer's Art*, Whitbread & Co. Ltd., 1948.

AMERICAN HOMEBREWERS ASSOCIATION CLUB ONLY COMPETITION

Ant Hayes Memorial Burton (Old) Ale

Entries are due November 10 and judging will be held November 17. Entry fee is $7. Make checks payable to American Homebrewers Association.

Shipping Address
AHA COC
Liberty Street Brewing
149 W. Liberty St.
Plymouth, MI 48170

Hosted by Chris Frey and the Ann Arbor Brewers Guild of Ann Arbor, Mich., this competition covers BJCP category 19A Old Ale, with higher IBUs permitted if well aged. For more information, contact Chris Frey at cfrey@ford.com.

Theakston's Old Peculier Clone (Old Ale)

INGREDIENTS

for 5.25 U.S. gallons (19.9 L) with a 3.5-gallon (13.25 L) boil

2 cans	(6.6 lb or 3 kg) Coopers Light Malt Extract
0.5 lb	(227 g) black treacle (or substitute blackstrap molasses) (100 °L)
0.5 lb	(227 g) dark candi sugar (120 °L)
0.5 lb	(227 g) biscuit malt (35 °L)
0.5 lb	(227 g) crystal malt (75 °L)
3.0 oz	(85 g) chocolate malt (475 °L)
3.0 oz	(85 g) black patent malt (525 °L)
0.5 oz	(14 g) UK Target hop pellets, 11.0% a.a. (60 min)
0.5 oz	(14 g) Challenger hop pellets, 7.5% a.a. (60 min)
0.5 oz	(14 g) Fuggles hop pellets, 5.0% a.a. (15 min)
0.5 oz	(14 g) Fuggles hop pellets, 5.0% a.a. (2 min)
0.75 tsp	(3.6 g) Irish moss (15 min)
3 packages	Wyeast 1028 London Ale yeast or White Labs WLP013 London Ale yeast

For 1.5 to 2.0 volumes of CO_2, use Coopers Drops, or 1.5 to 2.6 oz (43 to 74 g) corn sugar for bottling.

Original Specific Gravity: 1.057
Final Specific Gravity: 1.014 to 1.019
SRM: 23
IBU: 33
ABV: 5.0 to 5.7%

DIRECTIONS

Start with 2.0 gallons (7.6 L) of filtered water. Place the 1.6 lb (0.726 kg) of grains in a grain bag and steep the grains at 158° F (70° C) for 30 minutes. Remove the grains and strain the liquid from them. You can rinse the grains with hot water and bring the volume to 2.5 gallons (9.5 L). Heat the wort to boiling, then turn off the heat, stir in the extract, candi sugar, and black treacle or blackstrap molasses. Top up with water to 3.5 gallons (13.25 L). Bring to a boil and add the two 60-minute hops. Boil for 45 minutes and then add the re-hydrated Irish moss and the first Fuggles hop addition. Boil for 13 minutes and add the last hop addition. Boil for two more minutes and then remove from heat. Cool the wort, then pour into fermenter with enough pre-boiled cool water to make 5.25 gallons (19.9 L). Aerate and pitch yeast when the temperature drops to 65-68° F (18-20° C). Ferment at 67° F (19° C) for a week or two or until fermentation activity has subsided. Rack the beer into a clean, sterilized secondary fermenter to condition for two to three weeks. Use Coopers Carbonation Drops or prime with 1.5 to 2.6 oz (43 to 74 g) corn sugar at bottling, for a carbonation of approximately 1.5-2.0 volumes of CO_2.

Bottle carbonation may take a couple of weeks. After the beer is carbonated, store cellared or refrigerated for up to a year or more. Allow some bottles to mature for 12 to 18 months.

TOP 10 MODERN HOMEBREW FLAWS
(AND HOW TO FIX THEM)

BY GORDON STRONG

Homebrew quality has come a long way since I first started brewing in the mid-1990s. In those days, it was common to sample beers with a "homebrew taste" of stale ingredients and weak fermentation—often infected or mishandled. Thankfully, those days are long gone; today, homebrew is frequently indistinguishable from, and often superior to, commercial craft beer. Better ingredients, equipment, and—most importantly—knowledge, have contributed to this turnaround.

Yet while information about the brewing process has improved dramatically, the current literature on troubleshooting still tends to focus on individual technical faults. This can be helpful for newer brewers, but most faults for advanced brewers don't present themselves like a spiked beer on a Beer Judge Certification Program (BJCP) tasting exam (i.e., a single pure error in an otherwise fine beer). Subtle, hard-to-notice flaws may be involved, and they may often be more stylistic than technical in nature.

TECHNICAL VS. STYLISTIC FAULTS

Technical faults are what most people think of as flaws in beer; they are either single faults or a combination of faults derived from some aspect of the brewing process. These are often the more obvious faults that many people can find; basic tasting skills and quality control can often catch them, although sensory thresholds of the faults can often vary by individual. Classic troubleshooting tends to focus on this group of faults.

Stylistic faults are what often make a beer with no obvious technical flaws seem just not right. These flaws have to do with balance and drinkability of a beer, or how the beer compares subjectively against commercial examples, reference style guidelines, or simply the brewer's own expectations. These faults are often more difficult to identify and isolate, since they are necessarily based on a subjective assessment by a taster and in comparison with a possibly arbitrary standard. Addressing these faults may involve some of the same corrections that would be used to tackle technical faults.

It bears emphasizing that most technical brewing faults can be avoided by using fresh, clean ingredients, following good wort production practices (proper levels of free amino nitrogen, yeast nutrients, and maltose), providing a sufficient quantity of fresh, high-quality yeast with proper aeration, controlling fermentation conditions, keeping oxygen out of the cold side of the brewing process, and following good sanitary practices. One way to control stylistic faults is to formulate a recipe that matches expectations, and then select compatible ingredients and processes to achieve that target.

TOP 10 MODERN HOMEBREW FAULTS

For this article, I decided to try a different approach to troubleshooting. Rather than focusing on the various technical faults that may occur in homebrew (a subject already well-covered), I decided to focus on the most frequent problems observed in homebrew entered in recent competitions. I surveyed a dozen BJCP judges of at least National rank at multiple homebrewing competitions, asking them to identify the most common faults they had seen. I collated the data to compile a top 10 list of modern homebrew faults.

Note that this list is not comprehensive since yeast and fermentation-related problems are discussed in another article in this issue. Those topics were mentioned frequently by judges, so it definitely warrants a separate analysis.

Stylistic faults are what often make a beer with no obvious technical flaws seem just not right.

OXIDATION.

Surprisingly, this fault often goes unrecognized in homebrew in part because of how it is described in troubleshooting texts. Many brewers expect to find papery or wet cardboard flavors, or sherry-like qualities. Yet oxidation frequently presents as simply old, stale, dull, or muted flavors. These beers could have been good once, but are now just "over-the-hill." Drink them younger.

Oxidation affects beer styles differently since beer contains many different compounds, most of which will change significantly when oxidized. Paler beers often will take on a sweeter, caramelly, or honey-like character as they oxidize. The caramel component builds as the color deepens. Fruity esters can become magnified, and often will have a dark-fruit or dried-fruit character. The level of bitterness seems higher because it becomes harsher. In extreme cases, sourness can develop, particularly acetic acid (vinegar), which also tends to make it seem thinner in body. Oxidized beers often have a darker color and can pick up some haze. Darker beers tend to survive better due to natural antioxidants in the darker grains. Malty beers with considerable Maillard-reaction products can actually taste better with a light amount of oxidation, giving that elusive "German malty character" to amber and darker beers. Belgian beers can pick up more esters and richness. But paler and hoppy beers tend to just start tasting dull and lifeless; they do not hold up to aging as well, and thus are best consumed when fresh.

The fix for oxidation is relatively simple. Select fresh ingredients, avoiding staleness at the start. Don't introduce excessive oxygen during the hot side of brewing (splashing hot wort, whipping up the mash, etc.), as this can shorten the shelf life of your beer. And once fermentation is mostly complete, avoid introducing oxygen during maturation, transfers, and packaging. Transfer beer under a blanket of CO_2, blow some CO_2 on top of your beer if you ever open a carboy or keg, and cap on foam when bottling.

In my experience, the hardest part of troubleshooting oxidation is recognizing it in the first place. Keep in mind how oxidation presents itself in your beer, and you will be able to know when to apply these troubleshooting remedies.

MATURATION ISSUES.

Homebrewers can be an impatient bunch. You made it; now you want to drink it. That's a good idea for your hefeweizen, not so much for your barleywine or even your Oktoberfest.

Yeast clean up fermentation by-products during conditioning, which is a big part of removing the young or "green" beer

flavor. Removing beer from the yeast prematurely can give your beer buttery (diacetyl) or green apple (acetaldehyde) flavors. But it can also just make it taste *unfinished*.

Bigger beers need time to allow the alcohol flavors to smooth out. Many brewers rush to drink or enter their big beers, which does not do them justice. If your last bottle or pint from a keg is your best one, then you likely consumed it too soon. Big beers that are too young can have a hot or burning alcohol flavor and mouthfeel, and often taste sweet or the flavors are not well combined.

Lagers often taste sulfury or yeasty (bready or nutty flavors) if not lagered sufficiently. Separating the yeast by fining can help with the yeasty flavors, as can more age. Sulfur can reduce with time, but if you keg and are in a hurry, you can use CO_2 scrubbing to lower it. Chill the keg, overcarbonate it, then warm it and vent the CO_2. Do this repeatedly over a few days, and the action of the CO_2 coming out of solution will take sulfur with it.

Leaving finished beer on the yeast too long can lead to autolysis flavors, which I detect as a glutamate (MSG-like) flavor. It also causes the beer to have a higher pH, which can make it taste duller and fuller. You can bulk condition your beer on the yeast, but don't let it stay there for an extended time, particularly at higher temperatures.

HARSHNESS.

Astringency is often the source of harshness, which affects the flavor, mouthfeel, and aftertaste of beer. I perceive it as an unpleasantly coarse or rough sensation. Many will equate it with bitterness, but it's more than that—it's more of a *quality* of bitterness than anything else. Contrast harsh bitterness with clean bitterness in an IPA, or a rough versus smooth roastiness in a stout.

Typical astringency sources should be investigated (oversparging, too much husk matter present, boiling grain) but I often find harshness in beers with dark malts/grains and high hops. Dark grains exposed to heat too long can pick up harsh or acidic flavors; try adding them at the end of the mash instead. Likewise with hops; try using late hopping to reduce the amount of hops boiled for a long time, or first wort hopping, which produces a quality of bitterness different from what is obtained from an equivalent length in the boil. Avoid using water with a high mineral content, especially carbonates. As mentioned previously, oxidation can also make bitterness seem harsher.

When sparging, avoid raising the mash temperature above 170° F (77° C) and pH 6 at the same time, as this can extract tannins. I acidify my sparge water with phosphoric acid to a pH of 5.5 to avoid this problem entirely.

LACKING COMPLEXITY.

Homebrew can often seem watery or insipid; it won't taste enough like, well, *beer*. This is an easy fault to identify, but harder to fix since it could come from many areas. In general, make sure your raw ingredients (particularly malt) have good flavor, avoiding stale or cheap ingredients. Understand the flavor profile of your ingredients, knowing that flavor can vary between maltsters and batches. For instance, some American versions of Munich malt do not have the same depth of flavor as their German-made counterparts, so be careful when selecting or substituting products.

Some brewers like to make SMaSH (single malt and single hop) beers. This is an interesting way to explore ingredients, but it is particularly important to use high quality ingredients in order to maximize flavor and character in this minimalist approach. Beers that lack medium-weight molecular proteins and dextrins may seem thin and weak; overdoing protein rests or using intensive mash programs on well-modified malt may cause this problem. Finally, a beer with a high finishing pH (above 4.5) may seem dull-tasting. Give it a few drops of phosphoric acid and see if it brightens up.

5 MUDDY FLAVORS.

In a way, this is the opposite of lacking complexity; muddy-tasting beers often have so many ingredients that the flavors clash or become indistinct. This can be a problem in specialty beers, or when someone is purposely trying to make a complex beer with too many hop varieties and grains. If you can't taste the raw ingredients cleanly in the finished product, try making the recipe again but this time removing some of the ingredients.

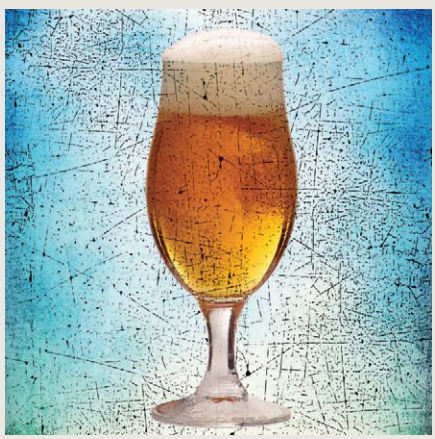
Some flavors naturally clash; for example, I don't like the combination of highly citrusy hops along with strong roasted malt—it reminds me of coffee left on the burner too long. If you can identify the clashing ingredients, maybe you can make substitutions to minimize the clashing elements. For instance, in a black IPA, you might want to use hops with more of a stone fruit character than citrusy, and you might want to use debittered or huskless dark malts rather than the standard versions.

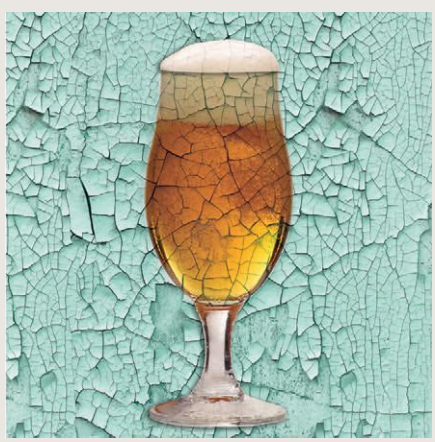
Knowledge of the style expectations, being able to evaluate your own beer, and being able to trace source ingredient flavors to the target beer flavor profile will help you improve your beer.

6 BODY AND SWEETNESS.

The attenuation level of beer, typically under-attenuation, is a common problem. Big beers and Belgians frequently are not dry enough. If beers are under-attenuated, they will have more body and sweetness than expected. Many brewers assume that they need a more attenuative yeast strain, but typically the problem is insufficiently fermentable wort or poor fermentation conditions.

Extract brewers often have little control over fermentability since they don't know how the grain was mashed, and the extract process can produce more caramelization. If fermentability is an issue, try using pale, dry extract as the basis of your recipe. For all-grain brewers, grist formulation, mash temperature, and mash duration all directly affect wort fermentability. Crystal-type malts have more dextrins, as do more highly kilned malts. Try a step mash or a conversion in the 144-146° F range (62-63° C), or add up to 10 percent dextrose to increase fermentability.





Let your big beers and Belgians fully finish fermentation and then condition. The flavor profile will be better, but you often will see a few more points of attenuation if you let the yeast continue to work slowly.

7 PHENOLIC.

There are many expressions of phenols in beer, from the desirable clove in a hefeweizen and smoke in a rauchbier to undesirable medicinal and plastic-like flavors. *Undesirable* doesn't really capture how offensive these flavors are; these two faults are dump-the-batch failures—they really cannot be fixed.

The plastic-like flavors remind me of band-aids or model airplane parts, and generally come from wild yeast infections. If you suspect this problem, look for other clues like gushing, hazy beer (often with floating chunks of yeast), and sometimes sourness. Proper sanitation procedures, selecting fresh, healthy yeast, and avoiding long lag times and extended exposure to air during pitching will help.

Chlorophenols, a combination of phenols and chlorine, can also lead to medicinal flavors and aromas. Remove chlorine from your water supply with charcoal filtering or Campden tablets, or by using reverse osmosis (RO) water (my choice). Also avoid or thoroughly rinse chlorine-based cleaning products before use. Reducing phenols will also help, but not if you are making a style that uses a phenol-producing yeast.

8 IMPROPER CARBONATION.

Surprisingly, there are beers in competition that are flat or otherwise low in carbonation. Low carbonation is pretty easy to detect, although in some cases you may first think the body is too big. A proper carbonation level affects mouthfeel and body impression, and can affect balance since a higher carbonation level adds a zingy bite to a beer. This perceived bite can play a big role in balancing malt sweetness.

Maybe bottling was rushed and the beer did not have time to carbonate. If kegging, you can often lose carbonation when transferring to bottles. I overcarbonate my kegged beers slightly (a few

PSI) before bottling, then bottle near freezing. This helps minimize carbonation losses.

Overcarbonated beers are not often seen, except when an infection is present or when a beer wasn't fully attenuated when it was bottled. Thankfully, "bottle bombs" are mostly a thing of the past.

OUT OF STYLE.
Recognizing whether a beer is out of style is not difficult for brewers with some palate training and judging experience, although many brewers who don't enter beer in competition will not care. Styles can be defined by reference guidelines, but also by consumer expectation. If your tripel is black, it's going to confuse people.

Out of style beers are basically recipe formulation problems, which can include not understanding the target style. For instance, German lagers heavy with crystal malts, Schwarzbiers that taste like roasty porters, and American pale ales that taste like IPAs are common problems. Knowledge of the style expectations, being able to evaluate your own beer, and being able to trace source ingredient flavors to the target beer flavor profile will help you improve your beer.

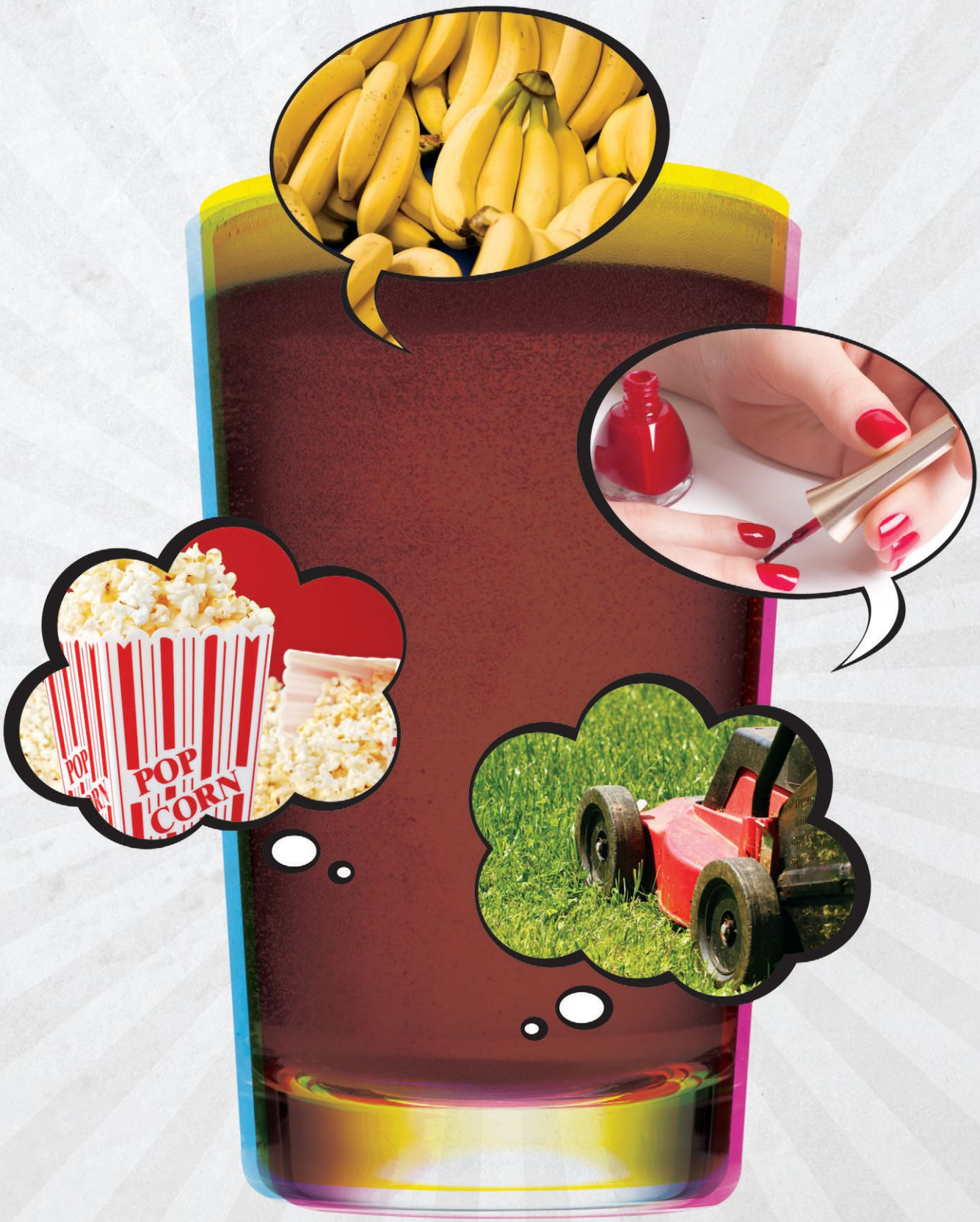
BALANCE ISSUES.
These subtle and style-specific faults can separate the outstanding beers from the merely good. In a way, this is a more nuanced variation of the out-of-style problem. However, a beer can be in style but not great due to minor balance issues.

These faults are hard to generalize since they are often style-specific. For instance, Belgian ales or malty beers that are not bitter enough may seem sweet even if they are well attenuated. Brewers who are told their beers are too sweet will mistakenly try to improve already excellent attenuation levels when the problem could easily be solved by increasing the bitterness level. Judges and consumers may not always be able to properly articulate the problem to solve, so brewers should try to look past the words to the intent of the reviewer.

Balance means the relationship between two or more components in beer. The components can be adjusted to change the ratio. If one of the components can be judged to be at a proper level, focus your efforts on changing the other variable(s). Or if multiple issues exist, try changing the most incorrect variable first. For instance, an undercarbonated American lager may seem heavy in body but can be fixed by increasing the carbonation level. You can probably think of dozens of other examples in beer styles you've made or sampled.

As with many self-improvement programs, recognizing that you have a problem is the first step in fixing your deficiencies. If you can spot these issues in your beers, you will be well on your way to making the changes necessary to brew better beer. Good luck.

Three-time Ninkasi Award winner Gordon Strong is the highest-ranking judge and current president of the Beer Judge Certification Program, and the author of *Brewing Better Beer.*


POP
CORN

UNDERSTANDING YEAST OFF FLAVORS

As far as I am aware, no one in the history of brewing has ever said, "I want my beer to taste like rotten eggs" or "I really want my beer to have the essence of nail polish." If a brewer did consider either of these scenarios desirable, I would question his or her sanity in the realm of good-tasting beer. This is exactly why we call flavors such as these off flavors—because they are off. Off flavors can sometimes mean different things to different brewers; however, most of us can agree that some flavors are definitely considered defects. While these flavor defects can be the result of improper treatment of hops, malt, or water, many can be attributed to yeast.

We all know that the main purpose of yeast is to produce ethanol and carbon dioxide from carbohydrates in wort. However, secondary compounds produced during yeast fermentation are just as important, since they provide complex character to beer including aroma, mouthfeel, and flavor. Yeast produce more than 500 flavor and aroma compounds as secondary metabolites during fermentation. The compounds that make up the spectrum of off flavors can be quite distinct and can overpower the desired beer characteristics. What exactly are these yeast-derived compounds that make us say "ew"? And how can brewers control or prevent these compounds? Let's take a look at some of the most common off flavors.

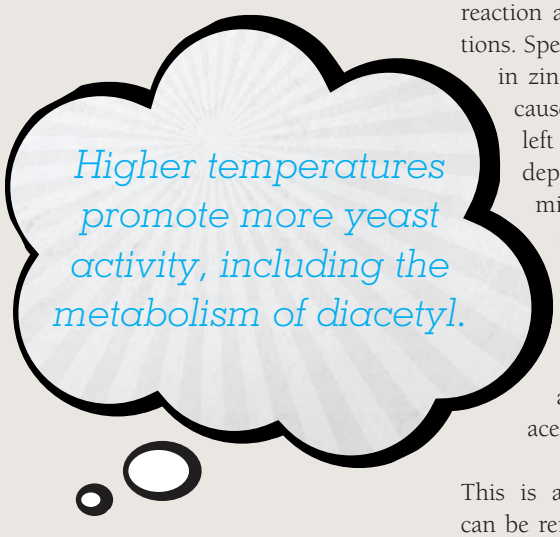
BUTTERED POPCORN

This off flavor is caused by diacetyl compounds. You may also see it referred to as VDKs or vicinal diketones, made up of both diacetyl and 2,3-pentandione. While there are some traditional English-style beers where a small amount of this characteristic is acceptable, it is generally considered undesirable. Not only do these compounds contribute that characteristic buttered popcorn flavor and aroma, they also have an effect on mouthfeel, often causing slickness. It doesn't take much for this compound to be detected in a beer—the threshold level (the level at which a person can smell or taste it) is 100µg/L (micrograms per liter). As a reference, most flavor compounds are detectable in the milligrams per liter range (mg/L) range.

BY NEVA PARKER

In every fermentation, diacetyl is generated by yeast as a byproduct of metabolism. This happens within the first few days, when yeast are most actively growing. As the fermentation progresses, yeast will take the diacetyl back up into the cell and convert it to 2,3-butandiol, which is tasteless and odorless. This seems straightforward, but many fermentation conditions will affect the yeast cell's ability to perform this reduction. Temperature is a primary environmental factor that can affect this process. Higher temperatures promote more yeast activity, including the metabolism of diacetyl. This is why lagers usually require a diacetyl rest, so that the yeast can be given the opportunity to reabsorb diacetyl by increasing the temperature and encouraging yeast activity.

Some strains produce higher levels of diacetyl than others. Yeast strains that are highly flocculent will inevitably leave higher amounts of diacetyl in the beer. Because they tend to drop out so quickly, they do not allow enough contact time for the yeast to reabsorb diacetyl. In this same vein, early removal of yeast from beer or not enough yeast in suspension can result in higher levels of diacetyl. A common practice is for brewers to rack almost finished beer to another vessel to complete a secondary fermentation. This can actually be detrimental, not only because it further exposes beer to the environment and the potential for contaminants and oxidation, but also because it can result in removal of too much yeast from the primary fermentation. In all of these cases, there is not enough time for the yeast to work.



Although some people cannot physically taste diacetyl, it is usually better to try and clean up the beer. Luckily, this is one compound that can be reduced if discovered early enough. The easiest and most effective way of removing diacetyl from beer is to transfer beer to a secondary vessel and krausen it by adding fresh, actively fermenting yeast. The new yeast will work quickly to metabolize any diacetyl left in the beer.

GREEN APPLE, BRUISED APPLE, CUT GRASS, OR SHERRY

These flavors result from excessive levels of acetaldehyde. While some level of this compound is acceptable in beer and even adds to the complexity, too much can be quite off-putting.

Excessive levels of acetaldehyde are usually a sign that there was a problem with the condition of a yeast culture. Similar to diacetyl, acetaldehyde is another compound that is metabolized by yeast after it is produced, which again requires that the yeast have enough contact time with the beer. In a typical fermentation, acetaldehyde is an intermediate compound in the metabolic pathway to ethanol production. Early removal of yeast from the beer can result in insufficient removal of acetaldehyde, leaving the beer tasting "green."

Yeasts that are not at optimal fitness are not able to make this conversion, due to low production of the enzymes necessary to perform the reaction. One particular enzyme, alcohol dehydrogenase, is responsible for catalyzing this reaction and is affected by many conditions. Specifically, worts that are deficient in zinc salts such as zinc sulfate can cause problems with acetaldehyde left in beer, since the enzyme is dependent on zinc. Without the mineral present, acetaldehyde cannot be converted into ethanol. High fermentation temperatures, over-pitching, and over-oxygenation can also work to prevent this reaction and lead to elevated amounts of acetaldehyde in beer.

This is another flavor compound that can be remedied, however. Adding fresh yeast, as with diacetyl, along with a small amount of fresh, cooled wort so that the yeast have some nutrients to feed on can decrease acetaldehyde. Moreover, prolonged conditioning of the beer should reduce acetaldehyde to levels that are below threshold.

SOLVENT OR NAIL POLISH

Ever smell a beer that causes a sharp pain to run through your nose? That is likely from the solvent-like compound called ethyl acetate, in the ester family. Some esters are often considered desirable, but in very low levels. Beyond approximately 30mg/L, these compounds become quite harsh and unpleasant.

What we consider "wild" yeasts produce this compound in excessive levels. Brewer's yeast is also capable of producing ethyl acetate, although normal levels are usually so low (around 10mg/L) that they are not detectable. High fermentation temperature, under-pitching, and excessive oxygenation can contribute to detectable levels. Remember, as yeast go through the growth phase, they are producing various flavor-active byproducts. Since these factors encourage yeast growth, production of ethyl acetate is increased, contrary to formation of other ester compounds. In many ways, yeast growth should be encouraged, but in these cases, excessive growth leads to this characteristic off flavor.

BANANA OR BUBBLEGUM

Another ester compound, isoamyl acetate, is produced by some yeast strains, particularly hefeweizen and Belgian strains, and is detectable at miniscule levels, 1-2mg/L. Again, this characteristic can be appropriate for some styles, but excessive levels can cause the beer to seem cloying.

Unlike with ethyl acetate, factors that promote less yeast growth will actually increase the formation of isoamyl acetate: high pitching rates and low oxygen rates. Here, another enzyme, acetyl CoA, is responsible for catalyzing the reaction to form isoamyl acetate. Acetyl CoA is also the same enzyme that preferentially causes reactions during yeast growth to make new cells. When cell growth is low, or not necessary, the enzyme can be

redirected toward formation of ester compounds, such as isoamyl acetate.

Additionally, high fermentation temperatures will result in increased production of isoamyl acetate. Most esters are enzymatically converted from their fusel alcohol counterparts and in this case, isoamyl alcohol. With higher temperatures, more fusel alcohols are produced so there is more available for conversion. High gravity also contributes to higher ester production, although this mechanism is not entirely established.

ROTTEN EGG

What's that smell? Here's the culprit: hydrogen sulfide or H_2S. H_2S is another compound metabolically produced by yeast during fermentation, and generally lager yeasts produce it in higher quantities. In many lagers, a small amount is actually a desired characteristic.

Hydrogen sulfide is a volatile compound, which means it comes out of solution (fermenting beer) and is driven off into a gas phase very easily. Because of this, using healthy yeast and maintaining a vigorous fermentation is critical, as CO_2 produced by yeast will scrub H_2S out of solution. Yeast cultures that are stressed or sluggish can often leave plenty of H_2S in the beer, because not enough carbon dioxide is produced to encourage removal. Generally, if a high amount of sulfur is detected in the beer at the end of fermentation, rousing yeast or the beer itself along with some conditioning time should volatize the compound.

Yeast are amazing organisms, contributing a wide variety of complex flavor and aroma compounds to beer—including off flavors. It's important for every brewer to understand how to avoid these off flavors from being present in their beers. While some of these flavor-active compounds can be treated post-fermentation, prevention is the best possible approach to making the best possible beer.

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THE ART OF TASTING BEER

BY TED HAUSOTTER

Drinking beer is how most of us first tried beer. It is something we all know how to do. But when you decide you want more out of beer, and you start to *taste* it, a whole new world of beer is revealed.

Tasting beer in various situations including at different serving temperatures, in different glassware, and in comparison with other styles can open up a whole new appreciation for beer and a great opportunity for education. If you've ever watched beer judges in action, you'll notice that they will scrutinize a beer's aroma and appearance before they even taste it. What types of attributes are they looking for? What can the aroma and color tell them about the beer they're about to taste? Let's take a look at the art of tasting beer.

TASTING TOOLS

In beer tasting, glassware is essential. Glassware should allow the nose to be part of the tasting experience, which is why beer tastes better from a glass versus a can or bottle. The shape of the glass also makes a difference. The standard U.S. pint glass is durable and will survive repeated bar fights, but does little to enhance the aroma and flavor of beer. I once tried two different samples of Samuel Adams Boston Lager. The first was served in a U.S. pint glass, and the second was in a Boston Beer glass specially designed for Boston Lager. I was shocked at how different the two samples tasted even though they were the same beer and I had watched them both being poured.

Other tasting tools include tasting partners, a thermometer, and tasting mats. Gather a group of people together to taste beer on a regular basis and talk about what you're tasting. A good experiment to start the ball rolling is to serve the same stout at different temperatures (35° F, 45° F, and 55° F; or 2° C, 7° C, and 13° C) in three separate glasses. Which has a fuller flavor and is more enjoyable? I personally prefer stout to be served at over 45° F (7° C) as it enhances the roast character. Tasting mats with numbers on them can help keep the beers separate and make it easier to talk about them. [Editor's note: a printable tasting mat can be found at www.craftbeer.com/pages/beer-and-food/host-a-tasting/at-home.]

You'll find that with a small group, everyone's ability will improve together as you learn to identify the different characteristics of beer.

THE FLAVORS OF BEER

It is important to know where the various flavors in beer come from. Each component in beer adds a different flavor profile. Malt can contribute flavors of grain, bread, bread crust, toast, caramel, raisin, plum, prune, dark cherry, coffee, roast, chocolate, burnt character, and smoke. This is generally in intensity of color order, although smoke can come from any color of malt. Malt-derived fruits come from darker crystal malts and the use of Munich malt. In addition to the major flavors from different malts, each country of origin can contribute different flavors for the same type of malt. Oats, wheat, and other grains used in malting make further differences in flavor. Brewers have a wide range of options when creating the malt profile of a beer.

Hops are the next major flavor component, providing the bitterness that balances the sweetness in beer, but also flavor and aroma. They can best be broken down into three long-standing families and a collection of new hops. The noble hop family with Hallertau, Tettnang, and Saaz hops tends to be herbal and spicy, and can also impart a light lemon character. They give German beers their typical hop character. English family hops include traditional variet-

ies like Fuggles and East Kent Goldings and some American varieties such as Willamette. These tend to have resin, earth, wood, herbs, and light fruit as their primary characters. The typical American hop family of Columbus, Cascade, Centennial, Amarillo, and Simcoe is less refined and well suited to excessive use common in American pale ales and IPAs. They exhibit resin, citrus, and pine as primary characters. Newer varieties such as Meridian or Calypso impart melon, pineapple, or tropical character. The last two groups also produce, to a lesser extent, berries, apricot, and other fruits.

Yeast creates fruity esters and spice, but most importantly it allows malt and hop flavors to come forward or be muted. Each variety of yeast is unique and allows different flavors to emerge in the final beer—or not. Think of them as gate keepers, where they will open the gate accordingly and dictate how much flavor is imparted into the beer. Yeast has a major influence on how malt, hops, smoke, and spice will be perceived in the beer. Yeast's base flavor is bread and yeast. It also creates fruity esters, with apple, pear, strawberries, berry, bubble gum, and banana. Some yeast will produce a spice character, such as pepper, clove, or vanilla. The same wort on two different yeasts can taste completely different, to the point where you would never think they were related. When you experiment with split batches of beer, use yeast from two different regions to get a wider effect.

Alcohol is the last major flavor contributor, although it is much softer and can easily hide behind other flavors in a beer. Many people cannot taste alcohol, but they will tell you that a nonalcoholic beer is missing a flavor—alcohol. It adds spice to beer and can often be found as alcohol or ethanol, similar to the aroma of rubbing alcohol. It can have spice notes or emerge as paint thinner and solvent. Often times when beer edges to the hot fusel alcohol stage, aftershave and perfume will be noticeable in the aroma. It is easiest to find alcohol in the mouthfeel or as a warming sensation in the back of the throat and in the chest.

By no means is the flavor and aroma profile of beer limited to hops, malt, yeast, and alcohol. Water, adjuncts, and spices often give beer its uniqueness. The different components should blend together to create something greater than the individual parts. The balance can be skewed to one side, such as the malt character in a bock or the hop explosion of an imperial IPA, or it can be evenly distributed among the malt and hops for increased drinkability.

TASTING EXPERIMENTS

When comparing beers, the same size and type of glassware should be used. Samples should be poured to the same level in each glass, as the distance to the nose makes a difference in what is perceived.

The first element to observe is color, which sets the expectations for flavors to be experienced. In black beers, for example, we expect flavors of coffee, chocolate, roast, and perhaps a burnt character. When a beer has ruby highlights, we expect Munich and dark crystal malts, which can create plum, raisin, or prune characters.

Suggested tasting techniques include the following.

- High/Low: Smell the beer on the low side of a tilted glass, then on the high side, holding the glass at the same angle. Different aromatics will come across at each location.
- Triangle Test: Use three glasses. Fill two with the same beer, and the third with a different beer. Shuffle them around or have someone do it for you. Smell and taste all three, and try to pick out the odd beer. This works well in developing skills to indentify flaws in beer where one is doctored with off flavors.
- Beer Panels: Using the below tasting suggestions, pour all beers at the same time and compare.

With beer tastings, look for why an offering is more enjoyable and how the beers differ from each other. Review the BJCP Style Guidelines (www.bjcp.org or download the app on your smart phone) for commercial examples and descriptions of each style.

- Beer Temperature 1: Try the same stout served at three different temperatures (35° F, 45° F, and 55° F; or 2° C, 7° C, and 13° C). Which temperature works best for this beer style?
- Beer Temperature 2: Try the same Pilsner served at three different temperatures (35° F, 45° F, and 55° F; or 2° C, 7° C, and 13° C). Which temperature works best for this beer style?

This printable tasting mat can be found at www.craftbeer.com/pages/beer-and-food/host-a-tasting/at-home.

- Glassware 1: Try the same Pilsner in a Pilsner glass, U.S. pint glass, and brandy snifter. Which glass best enhances the beer's character?
- Glassware 2: Try the same barleywine in a Pilsner glass, U.S. pint glass, and brandy snifter. Which glass best enhances the beer's character?
- Blonde Beer: Try one each from the following styles: Munich helles, U.S. standard lager, blonde ale, Kölsch, cream ale, German Pilsner, and Dortmunder. Compare and contrast.
- Euro Blonde Beer: Sample one each from the following styles: Munich helles, Kölsch, German Pilsner, Belgian blonde, saison, and Dortmunder. Compare and contrast.
- Pilsner Beer: Sample one each from the following styles: German Pilsner, Bohemian Pilsner, Danish Pilsner such as Heineken, and American premium lager such as Full Sail, MGD, or Coors Extra Gold. Serve the beers blind and have the tasters determine which samples have adjuncts in their recipe.
- Amber Beer: Try one each from the following styles: English pale ale, California steam, Vienna lager, Belgian pale ale, and Northern German alt. Compare and contrast.
- Barleywine/Imperial IPA: Try one each from the following styles: imperial IPA, American barleywine, and English barleywine. Compare and contrast.
- High Alcohol: Sample one each from the following styles: imperial IPA, American barleywine, English barleywine, wee heavy, Russian imperial stout, and Belgian dark strong. Compare and contrast.
- Pale Ale: Try one each from the following styles: Belgian pale ale, American pale ale, and English pale ale. Compare and contrast.

Be sure to take detailed notes during your tasting experiments and discuss them with your group. Beer *drinking* can provide instant gratification. Beer *tasting* can bring a lifetime of enjoyment.

Ted Hausotter is an award-winning homebrewer from Baker City, Ore. and the Mountain/Northwest regional representative for the Beer Judge Certification Program.

PROJECT GRODZISKIE:

A Polish Renaissance

By William Shawn Scott

Ask any brewer which style of beer Ireland gave to the world, and dry stout would be the immediate reply. Most brewers could also easily identify a number of different beer styles originating from specific regions in Great Britain, Belgium, and Germany. But if you really want to have some fun, ask the following question: "Name the one beer style that is unique to Poland." Some may shrug, others might guess Baltic porter, but very few would respond with the correct answer: Grodziskie, also called Grätzer beer.

So just what is Grätzer? It's essentially a golden, low-gravity wheat ale with a prominent smoke aroma and flavor, a moderate noble hop bitterness, and a high level of carbonation. It first appeared centuries ago in the Polish city of Grodzisk, which lies in the western province of Wielkopolska. From the late 18th to early 20th century, this region of Poland was ruled by Prussia, which referred to Grodzisk by its German name of Grätz. They called the beer Grätzer, meaning "from Grätz."

During this era, the beer grew rapidly in popularity and was eventually exported to 37 nations. For this reason, it is more commonly known as Grätzer outside of its Polish homeland. Demand dwindled in the last half of the 20th century, and production ceased altogether in the early 1990s when the final brewery producing it was bought out by a larger competitor and closed.

In 2011, the team at Choc Beer Company in Krebs, Okla. took up the challenge of resurrecting interest in this curious style by brewing and bottling an authentic Grätzer. Hopefully our efforts will encourage other brewers to try their hand at replicating this historic beer.

Grain Bill

Grätzer is defined by the exclusive use of malted wheat that has been kilned over an oak fire. Until recently, the commercial unavailability of this key ingredient left brewers with just two options. They could either purchase barley malt that had been kilned with other varieties of wood, or attempt to apply the oak smoke themselves to wheat malt that had already been kilned and cured. Neither of these techniques could fully mimic the flavor profile of a Grätzer.

Fortunately, brewers now have a third and much more authentic option. Responding to a special request, the Weyermann malting company of Bamberg, Germany agreed to produce a traditional oak-smoked wheat malt, Weizenrauchmalz, now available as part of its "heirloom and

terroir" series. This malt comprised 100 percent of the grain bill.

Hops

The traditional hop variety used to produce Grätzer beer was known as Nowotomyski, which took its name from the nearby town of Nowy Tomy [1]. It was one of a number of new varieties developed in the region by famed agronomist and businessman Joseph Jacob Flatau.[1] He imported cuttings of noble Bavarian and Bohemian-Czech varieties as the breeding stock for his early hybridization experiments in the 1840s. Although Nowotomyski is not readily available on the world market, the common ancestry and extended lineage of the Polish Lubliner hop made it the obvious choice for the project. Brewers could also substitute Saaz, Tettnanger, or Hallertau Mittelfrüh.

Water

Grodzisk has long been renowned for the quality of its mineral waters and even its most famous legend concerns the city well. In 1600, a Benedictine monk, Bernard of Wabrzezno, wandered into town and found it in dire shape. The well had run dry and the populace was in great despair. Shortly after his fervent prayers and blessings, water gushed forth from the well. Brewing immediately resumed and the beer tasted even better than it had before. For well over two hundred years, the citizens of Grodzisk would make an annual pilgrimage to Bernard's monastery, some 80 miles away, and leave a keg of Grätzer beer as a token of their gratitude.[2] In the 19th century, two independent wells were dug at the brewery. (See chart.) The team at Choc was able to closely match this water profile with the addition of a few brewing salts.

Grodzisk Water Profile[3]

	Well # 1	Well # 2
Ca +2	122 ppm	121 ppm
Mg +2	34 ppm	31 ppm
Na +	39 ppm	32 ppm
SO4 -2	183 ppm	145 ppm
Cl -	81 ppm	67 ppm
Alkalinity (as CaCO3)	350 ppm	325 ppm

Yeast

Although Grätzer is a wheat beer, traditional Bavarian weizen yeast strains are wholly unsuited for the style. Any relatively neutral top fermenting yeast will suffice, but for added authenticity the team managed to procure one of the actual strains used at the former Grodzisk brewery. Two separate strains of yeast (one flocculent and the other quite powdery) were historically used to produce the beer. The yeasts were propagated separately and pitched in a specific ratio: one part flocculent to two parts non-flocculent.[4] The flocculent yeast strain had been preserved at a university lab in Poland, and had been acquired by local homebrewers, who generously provided two slants in support of this project. Pitchable quantities of this yeast are now available from The Brewing Science Institute of Woodland Park, Colo. Any other neutral ale yeast would work well.

Producing the Wort

The traditional mash consisted of a four-step infusion process. An undated record from the Grodzisk brewery documents the specifics of the mash regimen.[5] The entire grist was mashed in (1.33 lbs. liquid per pound of grain) and subjected to an acid rest at 100° F (38° C) for 30 minutes. Another infusion over a 10-minute period

GRÄTZER

INGREDIENTS
for 5 U.S. gallons (18.93 liters)

5.0 lb	(2.27 kg) Weyermann® Weizenrauchmalz
1.0 lb	(0.45 kg) rice hulls
1.13 oz	(32 g) Lublin hops, 3% a.a. (105 min)
0.28 oz	(8 g) Lublin hops, 3% a.a. (30 min)
ISC-57	Polish Ale yeast, or other neutral ale yeast
16-25 mL	Biofine or 1 g powdered isinglass

Original Gravity: 1.031
Final Gravity: 1.007
ABV: 3.1%
IBU: 20-22
Color: 3° L
Carbonation: 3.6 Vol.
Total boil time: 120 min

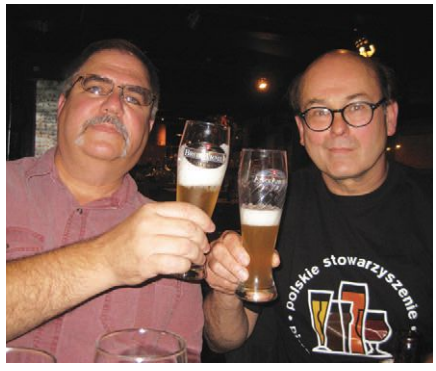
DIRECTIONS
Conduct a multiple-step infusion mash: 30 minutes at 100° F (38° C); 30 minutes at 125° F (52° C); 10 minutes at 150° F (66° C) (optional); 30 minutes at 158° F (70° C); and 15 minutes at 167° F (75° C).

raised the mash temperature to 125° F (52° C) for a protein rest of 30 to 60 minutes, depending on the modification level of the malt. The next infusion took 20 minutes to raise the mash to the relatively high saccharification temperature of 158° F (70° C). The mash was allowed to rest for 30 minutes before receiving the final infusion for a mash-out temperature of 167° F (75° C). Test batches with this malt suggest that a brief rest at 150° F (66° C) may also be beneficial. Since the mash consists entirely of wheat malt, a generous portion of rice hulls should be added to the mash prior to sparging.

Conducting the Boil

The Grodzisk brewery record indicated that the collected wort was boiled for a total of two to two-and-a-half hours to achieve an original gravity of just 7.7° Plato (1.031 SG). It should be noted that although two higher gravity variations (12° P and 14° P) of the beer were briefly introduced in its waning days, these were simply last-ditch efforts to restore the brewery's sinking fortunes. The true Grätzer is light in body and very sessionable.

This same record also cited two whole-hop additions, with 80 percent of the total hop charge added 15 minutes after the start of the boil and the remaining 20 percent added 30 minutes before the end of the boil. Separate laboratory analyses have confirmed that the actual bitterness levels were much lower than generally depicted—normally about 20-22 IBU.[6] A former production manager who worked at the brewery in the 1950s has also corroborated that these values were typical. Keep in mind that this still leaves a decent bitterness, especially when one considers the low starting gravity and the sulfate content of the water.



CLOCKWISE FROM TOP:

Brew day with the author, Dave Darrity, Choc head brewer B.J. Howell, and Choc brewmaster Michael Lalli.

The author with Dr. Andrzej Sadownik, president of the Polish Association of Homebrewers.

Former employees of the Grodzisk Brewery in Poland conduct a blind evaluation of the American prototypes.

Fermentation, Bottling, and Evaluation

Records specified that the wort was initially cooled to 61° F (16° C) and ferment-

GRÄTZER

Editor's note from Zymurgy technical editor and BJCP style guidelines author Gordon Strong: I would consider this a draft style writeup in the style of the BJCP Style Guidelines. The author is coordinating the description with Polish homebrewers working with the committee interested in the revival of the style. A final version will be posted on the BJCP website when completed and accepted. However, homebrewers may wish to enter this beer as a Category 23 Specialty Beer and provide this guideline to aid the judges.

Aroma: Oak wood smoke is the prominent aroma. Smoke intensity is medium to medium-high. A low to very low noble hop aroma is typically present, but is often concealed by the smoke. Hints of grainy wheat may also be detected. The aroma is otherwise clean, although light fruity esters are acceptable. No alcohol or diacetyl.

Appearance: Yellow to deep gold in color with good to excellent clarity. A large, white, tightly knit head with excellent retention is distinctive.

Flavor: Moderate to medium-high oak smoke flavor up front that carries into the finish. Smoke character may be perceived as somewhat acrid to semi-sweet. Moderate noble hop bitterness is readily evident and also lingers into the finish. The perception of hop bitterness is often higher than actual IBU levels would indicate because of the low gravity of the beer and the sulfate waters used. Balance is toward bitterness. Spicy noble hop flavor is low but should be perceptible. Malt flavor is low and consists of a grainy wheat character in the background. Light fruity esters may be present but are often obscured by the smoke. No sourness. No alcohol or diacetyl.

Mouthfeel: Very light in body, crisp, and dry. Carbonation is medium-high to very high, often adding a slight carbonic bite or prickly sensation. No sensation of alcohol.

Overall Impression: A low gravity, well-carbonated, light-bodied wheat beer combining an oak-smoked flavor and aroma with a clean noble hop bitterness. Highly sessionable.

Comments: Known as Piwo Grodziskie in Poland. Historically produced using a multiple-step mash. Wort was quickly fermented and treated with isinglass for clarity prior to bottle conditioning. Traditionally served in tall conical glassware to accommodate the vigorous foamstand.

History: Developed as a unique style centuries ago in the Polish city of Grodzisk (Grätz). Its fame and popularity rapidly extended from Poland and Prussia to other parts of the world in the late 19th and early 20th century. Regular commercial production declined after WWII and ceased altogether in the early 1990s.

Ingredients: Grain bill consists exclusively of malted wheat that has been kilned and cured over an oak fire. Noble hops (Lublin, Saaz, Tettnang, Lomik), moderately hard sulfate water, and a relatively clean top-fermenting ale yeast. German hefeweizen yeast or other yeasts with a phenol or strong ester character are inappropriate.

Vital Statistics: OG: 1.028 - 1.032
IBUs: 18-25
FG: 1.006 – 1.010
SRM: 3-6
ABV: 2.7 – 3.3 %

ed at slightly above this temperature for three days. Because Grätzer is an all-wheat beer, the use of finings such as isinglass was required to achieve traditional levels of clarity. The beer was then bottle conditioned to an almost champagne-like effervescence. One lab measurement placed it at 3.6 volumes of CO_2.[7] Grätzer was even served in a special trumpet-shaped glass to accommodate its vigorous foam stand.

To ensure an added level of historical accuracy, three separate pilot batches of this beer were produced, each with slightly different specifications. Samples from each batch were shipped to Poland and provided to former employees of the Grodzisk brewery in a blind tasting for their evaluation and feedback. This information was then incorporated into adjustments for the production batches.

A Final Word

Whether you call it Grätzer or Grodziskie, this unique beer offers a window into our past, an ethereal link to a world gone by. The Polish Association of Homebrewers (PSPD) has done much to preserve this singular jewel of its national brewing heritage. Now it's time for homebrewers on this side of the Atlantic to pitch in. With all of the information and ingredients currently at our disposal, it would be a shame to lose such a flavorful piece of world beer culture. So fire up your kettles, fill your trumpet-shaped glasses, and raise a toast to the brewers of Grodzisk, both past and present. *Na zdrowie!*

William Shawn Scott is an avid historian, linguist, and world traveler whose excursion into the brewing sciences began in 1987 and continues unabated 25 years later. He is a longtime member of the Fellowship of Oklahoma Ale Makers and currently resides in McAlester, Okla. with his wife, Joyce, and their three dogs: August, Sissi, and Hoover.

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BREWING ON THE ONES

BY DREW BEECHUM

> *"Maybe austere simplicity has an alluring call that we should explore."*

I come to you with a dilemma—the modern homebrew shop. Look around. Gone are the days of sad, pre-crushed grains and room temperature hops. Notice all the choices we have to make. Which variety of base malt? Which crystal? Hops? Adjuncts? Yup, we got 'em! A well-stocked store has a dizzying array to choose from. Northern Brewer, for instance, stocks more than 120 grain choices and 90 hop choices.

I walk into my local shop and the options cause me to swoon. Imagine how it feels if you're new. When I first started designing my own brews, I couldn't resist the temptation. Think a chubby kid at the candy counter stocking up on sugary goodies for a movie.

I remember a sort of mad dash from bin to bin, scooping a little of this and whole lot of that into the mill. The beers I made were OK—unfocused, mostly messy, and filled with the exuberant flourishes of a romantic poet. Let's face it—the beers mostly tasted *brown*.

Over time, my ardor cooled when I realized that many of my best beers came from simple throwaway "starter" beers. My brewing mentors instilled that habit of brewing a simple batch to produce yeast for bigger projects. Given their primary purpose, I'll admit, I paid little heed to them as something other than yeast growth medium.

While I loved the ostentatious "real" beers I made with the yeast, I surprised myself at how fast the throwaway beers were consumed. A great example of this was my Springtime in Amarillo that was originally a starter recipe for a batch of Saison Infernal. (See "A Saison for Every Season" in the May/June 2008 *Zymurgy*.) Maybe austere simplicity has an alluring call that we should explore.

THE SEED IS PLANTED

When I had been brewing for four years, I caught a whiff of a newly emerging style, double IPA. Arguments raged back and forth. Is it a real style? An American barleywine? I had to make one! So I started with a barleywine recipe (that's what the style seemed to be, after all) and went to town! Six different malts! Eleven different hop additions of seven different varieties at eight different times! The end result was a sticky, hoppy treat. ***Recipe: Double Trouble Original***

The first step on the path of brewing righteousness is to strip away all artifice and go straight for the ultra-simplicity of the Single Malt/Single Hop beer called SMaSH. The concept has lurked for ages in various guises, but it all comes back to the same principle: one malt and one hop.

At its heart, SMaSH is an amateur scientist's brew: restrict variables to one ingredient, such as hops, and you have a decent ground for comparison. Of course, it's only a controlled experiment if everything else about your process—mashing, fermenting, conditioning, etc.—is consistent.

With all the recent additions to and deletions from the hop bins, it's no surprise that many brewers take the hop side of the SMaSH equation very seriously. Brew up a basic SMaSH pale ale and you can explore the nuances of a hop. Make a series of 40-50 IBU SMaSH pale ales and you can learn a metric ton about your available hops. If you have more kettles available, you can speed up the process by making a larger mash and boiling several different hops. It's a great club project.

One caveat: I break with the purity of SMaSH thinking in regards to lower alpha aroma hops (think 2.1-percent alpha acid Saaz, still featured at my local shop). I don't think you can learn anything interesting trying to get your bitterness from them. You overload the kettle with vegetable matter and end up with a beer that tastes like yard clippings. Instead, for hops under 7 percent a.a., I use a bittering charge of a neutral hop like Warrior or Magnum.

On the other side of the equation, there's a lot to be said for a blonde ale that explores the nuances of malt. We hear people toss around "grassy," "grainy," and "toasty" descriptors, and the best way to experience them is via a simple malt-focused beer. Step outside of your comfort zone and make an all-Munich malt beer—it is possible! ***Recipe: California Magnum Blonde***

SMaSH also serves as a simple platform for exploring other brewing considerations. Want to prove the effects of water chemistry or mashing temperature? Use the same recipe but with a different chloride-to-sulfate ratio to observe the shift in flavor perception.

Double Trouble Original

Ingredients for 5.5 U.S. gallons (20.82 L)

7.5 lb	(3.4 kg) domestic two row pale malt
7.5 lb	(3.4 kg) Maris Otter pale malt
12.0 oz	(340 g) 55° L crystal malt
12.0 oz	(340 g) Munich malt
8.0 oz	(227 g) wheat malt
4.0 oz	(113 g) biscuit malt
0.5 oz	(14 g) Cascade whole hops, 8.1% a.a. (FWH)
0.5 oz	(14 g) Simcoe pellet hops, 13.7% a.a. (FWH)
0.75 oz	(21 g) Centennial pellet hops, 9.1% a.a. (60 min)
0.25 oz	(7 g) Chinook pellet hops, 10.8% a.a. (45 min)
1.0 oz	(28 g) Crystal pellet hops, 4% a.a. (30 min)
0.5 oz	(14 g) Cascade whole hops, 8.1% a.a. (30 min)
0.5 oz	(14 g) Warrior pellet hops, 15.6% a.a. (15 min)
0.5 oz	(14 g) Amarillo pellet hops, 8.9% a.a. (5 min)
0.5 oz	(14 g) Simcoe pellet hops, 13.7% a.a. (0 min)
1.5 oz	(42 g) Cascade whole pellet hops, 8.1% a.a. (0 min)
1.5 oz	(42 g) Cascade whole pellet hops, 8.1% a.a. (dry hop)

Wyeast 1056/White Labs WLP 001/Safale US-05

Boil time: 90 minutes
Original Gravity: 1.087
IBUs: 99.9
SRM: 10.2
ABV: 9.7%

Directions

Mash at 152° F (67° C) for 60 minutes.

Mini-Mash Version: Substitute 11 lb (4.99 kg) pale malt extract syrup for the pale and Maris Otter malts. Increase biscuit malt to 12 oz (340 g). Conduct a mini-mash with the crystal, Munich, wheat, and biscuit malts at 152° F (67° C) for 45 minutes. Drain and rinse grains, dissolve extract, and commence boil.

Lastly, if you really want to have some fun, do the yeast swap. Same recipe, many different yeasts. I tested all the saison strains available via this method last year. A simple, almost SMaSH recipe provided the test platform.

Classic SMaSH beers exist all over the world. Off the top of my head, styles that can be SMaSHed include Bohemian Pilsner, German Pilsner, Vienna lager, Munich dunkel, wild ales, IPA (the original Burton style), DIPA, and, most surprising given how so many brew it, barleywine. See, SMaSH isn't so strange! ***Recipes: SMaSH the Pils, Isar Dunkel, Bog Standard, The Queen's Diamonds***

BREWING ON THE ONES

Drew's rule: You get one choice per "category." That means one base, one adjunct, one hop, one yeast, and one surprise.

Just like in the SMaSH system, you step away from the modern smorgasbord and focus on a handful of items. It is SMaSH with a little more leeway—now the world of beers you can make is much wider.

Counterintuitively, you may find this to be a more satisfying way of brewing. Studies have shown that people feel more satisfied, more in control, and less anxious when choices are purposefully restricted. If I offer you a steak dinner, you'll generally be very satisfied with the dinner. If I offer you the choice of a steak or lobster dinner, your enjoyment of the exact same dinner is lessened because a part of your brain is fantasizing that the other choice would have made you happier. This paradox of choice effect may explain why so many "simple" things are pleasurable in comparison to their more complex counterparts.

When you start brewing on the ones, you'll be a lot closer to mimicking our favorite production breweries. Think about it—how many craft breweries have you seen with an abundance of space? The ones I know are struggling to keep from bursting at the seams.

Picture the daily life of a brewer, lifting bags of grain to the mill. Do you want to stop and have to fiddle with a few pounds of this, a few pounds of that? Nope—pro brewers, ideally, deal with things in increments of sacks, what Jamil Zainasheff refers to as the "sack rule." At worse, a pro recipe may contain quarter- or half-sacks, but that eats up time, introduces error, and makes life harder, so 55-pound increments are the beloved standard where simplicity reigns supreme.

Just because you've restricted your ingredients, there's no reason to restrict your techniques. I'm historically a lazy brewer—single infusion mash, batch sparge, kettle, fermenter, and call it a day. The restriction on ingredients seems to both free up my mind and make me stretch for new ways to introduce flavors.

SMaSH the Pils, for instance, despite my stance on the effort, should be decocted. Or for the Mo Rye Mild, with no or very limited use of crystal malts, how do I get that caramel taste? By taking a cue from the Scots and boiling the first runnings into a syrup. Use the restriction to break your usual patterns. Toast your grains, or heck, steep them at temp and roast them to make your own crystal malt. ***Recipes: MO Rye Mild, Saison of Zen, Un Tripel, Singular Quad, Boswell's Biography, Bear Gates Ale***

California Magnum Blonde

Ingredients for 5.5 U.S. gallons (20.82 L)

10.25 lb	(4.65 kg) Great Western California Select pale malt
0.75 oz	(21 g) Magnum pellet hops, 11.6% a.a. (60 min)
0.75 oz	(21 g) Magnum pellet hops, 11.6% a.a. (20 min)
0.75 oz	(21 g) Magnum pellet hops, 11.6% a.a. (0 min)

Wyeast 1056/White Labs WLP 001/Safale US-05

Boil Time: 90 minutes
Original Gravity: 1.050
IBUs: 52
SRM: 3.4
ABV: 5%

Directions
Mash at 154° F (68° C) for 60 minutes.

Extract Version: Substitute 7.5 lb (3.4 kg) pale malt extract syrup for the pale malt.

SMaSH the Pils

Ingredients for 5.5 U.S. gallons (20.82 L)

10.25 lb	(4.65 kg) Great Western California Select pale malt
2.25 oz	(64 g) Saaz pellet hops, 4.5% a.a. (60 min)
1.0 oz	(28 g) Saaz pellet hops, 4.5% a.a. (0 min)

Wyeast 2278 Czech Pilsner Lager/WLP 800 Pilsner Lager

Boil Time: 90 minutes
Original Gravity: 1.050
IBUs: 45
SRM: 3.4
ABV: 5%

Directions
Mash in at 124° F (51° C) for 20 minutes. Decoct #1: Pull 1/3 of thick mash and heat to 154° F (68° C) for 20 minutes, then heat to boiling, stirring. Return to main mash to raise temp to 148-150° F (64-66°C). Decoct #2: Pull 1/3 of thin mash and bring to boil, stirring. Return to main mash to raise to 165° F (74° C).

Extract Version: Substitute 7.5 lb (3.4 kg) pale malt extract syrup for the pale malt.

KEEP IT SIMPLE

The idea is not that you'll brew better beer with a restricted palate. If that were the case, we'd all flourish under peasant farmer conditions. The truth lies in changing how you think about constructing your recipes.

> *"You get one choice per 'category.' That means one base, one adjunct, one hop, one yeast, and one surprise."*

Working through this ingredient lens becomes a focusing tool. Building a recipe now is less about what's available and how to use it and more about finding the bare minimum needed to achieve the goal. Do I really need three crystal malts? No, probably not. Is that small dose of Vienna doing me any good in a dubbel? Dubious. Do I really need 20 different varieties of hops in the boil? Definitely not.

(Of course, I believe it is absolutely possible to build a great recipe out of a whirlwind of parts. One of my favorite crazy beers, the Gonzo, takes seven malts, five hops, one sugar, poppy seeds, hemp seeds, mushrooms, tequila, bourbon, and a dash of Coke.)

Now when I create a recipe, I have an informed viewpoint that you'll see again and again. Simple base malt structures—my most complicated arrangement is still my 50/50 blend of two row (pale or Pils) and Maris Otter for pales, IPAs, and DIPAs. Turns out, according to Stone's Mitch Steele, this blend is used in England to replicate the famous Burton white malt for IPA. I do this to get the dryness of the two row and the toasted biscuit and color of the Maris Otter. Usually, I add just enough other stuff to get a target color, without going bonkers on the crystal (under a pound per five gallons).

In the boil, my bittering addition is almost always a neutral hop like Magnum or Warrior with an occasional dose of Chinook to add bite. Otherwise, my goal in the kettle is to keep a low vegetation load to avoid chlorophyll beer.

Playing around with singular yeast experiments over the years has given me insight as to what sort of characters to expect. With that knowledge, I've come to a point where my U.S., British, and German influenced beers are all single pitches. Belgians, of course, yield fantastic results when you pitch a blend of yeast, so consider that a moment of artistic impression.

Isar Dunkel

Sure it's not as dark as the guidelines prescribe, but when combined with the Octoberfest yeast, this will be a very nice lager. Don't forget O'fest strains require a mandated diacetyl rest, so as primary fermentation subsides, raise the temp to the mid-60s before crashing to lager temps.

Ingredients for 5.5 U.S. gallons (20.82 L)
12.0 lb (5.44 kg) German Munich malt
0.75 oz (21 g) Perle pellet hops, 8% a.a. (60 min)
Wyeast 2633 Octoberfest

Boil Time: 90 minutes
Original Gravity: 1.061
IBUs: 25
SRM: 11
ABV: 5.8%

Directions
Mash in at 124° F (51° C) for 20 minutes. Decoct #1: Pull 1/3 of thick mash and heat to 154° F (68° C) for 20 minutes, then heat to boiling, stirring. Return to main mash to raise to 148-150° F (64-66° C). Decoct #2: Pull 1/3 of thin mash and bring to boil, stirring. Return to main mash to raise to 165° F (74° C).

Extract Version: Substitute 9 lb (4.08 kg) Munich malt extract syrup for Munich malt.

Bog Standard (D)IPA

Two beers in one. The West Coast IPA/DIPA defined. In this one, we use Great Western's darker, toastier two row. If you're going to go with a single hop, might as well make it something awesome like Centennial. Columbus would be a nice twist as well.

Ingredients for 5.5 U.S. gallons (20.82 L)
15.0 lb (6.8 kg) Great Western Northwestern pale malt
1.5 oz (42 g) Centennial pellet hops, 10% a.a. (60 min)
1.0 oz (28 g) Centennial pellet hops, 10% a.a. (15 min)
1.0 oz (28 g) Centennial pellet hops, 10% a.a. (0 min)
1.0 oz (28 g) Centennial pellet hops, 10% a.a. (dry hop 2 weeks)
Wyeast 1272 American Ale II

Boil Time: 90 minutes
Original Gravity: 1.074
IBUs: 69
SRM: 7.2
ABV: 7.2%

Directions
Mash at 152° F (67° C) for 60 minutes. To make the DIPA, add 5 lb (2.27 kg) extra malt and an extra ounce of hops to each kettle addition. This will get you a beer of 1.091 original gravity and 113 IBUs.

Extract Version: Substitute 11 lb (4.99 kg) pale malt extract syrup for the pale malt. If brewing the DIPA, substitute 14.5 lb (6.58 kg) pale malt extract syrup for the pale malt.

The Queen's Diamonds

Queen Elizabeth has made it to her diamond jubilee. Huzzah! Here's a beer that will be drinkable even if she makes it to her platinum jubilee in 2022.

Ingredients for 5.5 U.S. gallons (20.82 L)

25.0 lb	(11.3 kg) Great Western Northwestern pale malt
1.5 oz	(42 g) Target pellet hops, 11% a.a. (90 min)
0.5 oz	(14 g) Target pellet hops, 11% a.a. (5 min)

White Labs WLP007 Dry English Ale

Boil Time: 120 minutes
Original Gravity: 1.117
IBUs: 62
SRM: 8.2
ABV: 12.5%

Directions
Mash at 150° F (66° C) for 60 minutes.

Extract Version: Substitute 18.75 lb (8.5 kg) pale malt extract syrup for the pale malt.

MO Rye Mild

This pale mild, served during my talk and at other parts of the National Homebrewers Conference, was a huge hit. It has just enough character to make it interesting while still being sessionable. The first runnings reduction bumps the color and flavor, so don't skip it.

Ingredients for 5.5 U.S. gallons (20.82 L)

8.0 lb	(3.63 kg) Crisp Maris Otter malt
1.0 lb	(0.45 kg) Weyermann rye malt
0.6 oz	(17 g) Progress pellet hops, 8.1% a.a. (60 min)

White Labs WLP001/Wyeast 1056 US-05/ Wyeast 1469 West Yorkshire (for a little something extra)

Boil Time: 90 minutes
Original Gravity: 1.044
IBUs: 18
SRM: 6
ABV: 4.2%

Directions
Mash at 155° F (68° C) for 60 minutes. Reduce the first half-gallon of runnings by boiling them down to a little over an Imperial pint (20 oz or 0.6 L) of syrup. As the syrup begins to stack bubbles, stir continuously and watch the color. Be vigilant—syrups go from clear to golden to amber to burnt in no time. Pull from the heat and let the pan cool before stirring your syrup into the boiling wort.

Mini-mash Version: Substitute 6 lb (2.72 kg) pale malt extract syrup for the pale malt. Mash the 1 lb malted rye at 152° F (67° C) for 60 minutes. (Rye malt has plenty of diastatic power and will convert its own starch easily). Drain and rinse grains, dissolve extract, and commence boil.

"The restriction on ingredients seems to both free up my mind and make me stretch for new ways to introduce flavors."

Saison of Zen

Anyone who's surprised I'd have a saison somewhere in this article needs to turn in their homebrewer's card! The biggest hit from the National Homebrewers Conference talk, this beer disappeared in a hurry. With a yeast-driven style like saison, there's very little need to get fancy.

Ingredients for 5.5 U.S. gallons (20.82 L)

11.5 lb	(5.22 kg) Weyermann Pilsner malt
1.5 lb	(0.68 kg) flaked oats
0.66 oz	(19 g) Magnum pellet hops, 11.6% a.a. (60 min)
Wyeast 3711 French Saison	

Boil Time: 90 minutes
Original Gravity: 1.066
IBUs: 30.4
SRM: 4
ABV: 5.5%

Directions
Mash at 149° F (65° C) for 60 minutes.

Mini-Mash Version: Substitute 6.5 lb (2.95 kg) pale malt extract syrup for 8.5 lb (3.86 kg) of the Pils malt. Conduct a mini mash with the remaining 3 lb (1.36 kg) of Pils malt and the flaked oats. Hold at 152° F (67° C) for 60 minutes. Drain and rinse grains, dissolve extract and commence boil.

Un Tripel

Another style that doesn't need a lot of fuss. The most I would ever add to my tripel is a tiny dose of Aromatic or C8, but that may just be gilding the lily when you taste how great this recipe is. Herkules is a new hop that I'm exploring to replace the mélange of traditional lower alpha hops. I haven't used it in this recipe yet, but I think it would fit perfectly. Substitute Magnum if you'd like.

Ingredients for 5.5 U.S. gallons (20.82 L)

15.5 lb	(7.03 kg) Dingeman Pilsner malt
1.5 lb	(0.68 kg) sugar (cane, beet, turbinado, etc.) (90 min)
0.5 oz	(14 g) Herkules pellet hops, 17% a.a. (60 min)
White Labs WLP 500 Trappist Ale/ Wyeast 1214 Belgian Ale	

Boil Time: 90 minutes
Original Gravity: 1.095
IBUs: 32
SRM: 3.8
ABV: 9.3%

Directions
Mash at 150° F (66° C) for 60 minutes. Just like the MO Rye, I highly recommend reducing part of your first runnings to boost the character.

Extract Version: Omit wort reduction step. Substitute 12.25 lb (5.56 kg) pale malt extract syrup for pils malt.

Singular Quad

For all of the glory lauded on the monks at St. Sixtus Abbey for their Westvleteren 12, the recipe is rumored to be just about this simple. Use this as an opportunity to explore the differences between the D1 and D2 syrups of Dark Candi, Inc and the new syrups of Candi Syrup.

Ingredients for 5.5 U.S. gallons (20.82 L)

16.2 lb	(7.35 kg) Dingeman Pilsner malt
1.5 lb	(0.68 kg) candi syrup (D2 or D-180 preferably)
0.75 oz	(21 g) Magnum pellet hops, 11.6% a.a. (60 min)
White Labs WLP 530 Abbey Ale/Wyeast 3787 Trappist High Gravity	

Boil Time: 90 minutes
Original Gravity: 1.096
IBUs: 32
SRM: 14.4
ABV: 9.3%

Directions
Mash at 151° F (66° C) for 60 minutes. I know, it seems simple, but go with it. Boil the beer and add the sugar for the last 10 minutes.

Extract Version: Substitute 12.4 lb (5.62 kg) pale malt extract syrup for the Pils malt.

Boswell's Biography Oat Beer

Samuel Johnson defined oats as "a grain, which in England is generally given to horses, but in Scotland appears to support the people." His biographer, James Boswell, a Scotsman, supposedly took great umbrage at this in his biography of Johnson. So in memory of the indignant Scot, I present an oat wine.

Ingredients for 5.5 U.S. gallons (20.82 L)

14.0 lb	(6.35 kg) Golden Promise pale malt
2.5 lb	(1.13 kg) Thomas Fawcett oat malt
1.5 oz	(42 g) Target pellet hops, 11% a.a. (60 min)
Wyeast 1275 Thames Valley II/WLP028 Edinburgh Yeast	

Boil Time: 90 minutes
Original Gravity: 1.084
IBUs: 63
SRM: 6.5
ABV: 9.3%

Directions
Mash at 152° F (67° C) for 60 minutes.

Mini-mash Version: Substitute 10.75 lb (4.88 kg) pale malt extract syrup for the pale malt. Mash the malted oats at 152° F (67° C) for 60 minutes. (Oat malt has plenty of diastatic power and will convert its own starch easily.) Drain and rinse grains, dissolve extract, and commence boil.

Bear Gates Ale

The legendary Traquair House Ale, brewed in Scotland since the '60s, supposedly has a "ones" style recipe. The key is the extra-long boil!

Ingredients for 5.5 U.S. gallons (20.82 L)

15.0 lb	(6.8 kg) Maris Otter or Golden Promise pale malt
6.0 oz	(170 g) Crisp roast barley
0.5 oz	(14 g) Target pellet hops, 11% a.a. (60 min)
Wyeast 1728 Scottish Ale/WLP028 Edinburgh Yeast	

Boil Time: 180 minutes
Original Gravity: 1.079
IBUs: 11
SRM: 21
ABV: 7.5%

Directions
Mash at 150° F (66° C) for 60 minutes.

Extract Version: Substitute 11.5 lb (5.22 kg) pale malt extract syrup for the pale malt. Crush and steep roast barley in 160° F (71° C) water for 30 minutes. Rinse well, dissolve extract, and commence boil.

Double Trouble Revisited

Ingredients for 5.5 U.S. gallons (20.82 L)

8.0 lb	(3.62 kg) domestic two row
8.0 lb	(3.62 kg) Maris Otter malt
2.0 lb	(0.9 kg) Munich malt
1.5 oz	(42 g) Warrior pellet hops, 15% a.a. (60 min)
0.5 oz	(14 g) Chinook pellet hops, 13% a.a. (60 min)
0.5 oz	(14 g) Centennial pellet hops, 10% a.a. (0 min)
0.5 oz	(14 g) Simcoe pellet hops, 13% a.a. (0 min)
0.5 oz	(14 g) Centennial pellet hops, 10% a.a. (dry hop)
0.5 oz	(14 g) Simcoe pellet hops, 13% a.a. (dry hop)

Wyeast 1056/WLP 001/US-05

Boil Time: 90 minutes
Original Gravity: 1.088
IBU:109
SRM: 7.2
ABV: 9.2%

Directions
Mash at 152° F (67° C) for 60 minutes.

Mini-Mash Version: Substitute 11.5 lb (5.22 kg) pale malt extract syrup for the pale and Maris Otter malts. Add 10 oz (283 g) biscuit malt to the 2 lb (0.9 kg) Munich malt and mash at 152° F (67° C) for 45 minutes. Drain and rinse grains, dissolve extract, and commence boil.

REVISITING DOUBLE TROUBLE

Keeping our "ones" lessons in mind, I present a revised Double Trouble recipe pared down to three malts, mostly my IPA blend, and six hop additions of four varieties. The hops are structured for clear bitterness from Warrior, a touch of rasp from Chinook, and a grapefruit extravaganza from Centennial and Simcoe. If you can't find Simcoe, sub in more Centennial or some Falconer's Flight, designed to stretch Simcoe supplies. ***Recipe: Double Trouble Revisited***

Here's hoping that you give Brewing on the Ones a shot. I think you'll be pleasantly surprised at the results. Your beers will be cleaner, less muddled, and less *brown*. Ultimately, the restriction proves both freeing and educational and makes you a more focused brewer with a stylistic voice that's easier to hear.

Drew Beechum is a member of the Maltose Falcons and the AHA governing committee. He lives in Pasadena, Calif.

10 Reason to Use LALLEMAND Dry Brewing Yeast

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LALLEMANDBREWING.COM

By Chris Bible

Beer Spoilage Organisms

READER ADVISORY: Warning!

These pages are rated XG (eXtra Geeky) by the Bureau of Magazine Mucktymucks. Items in this section may contain raw data, graphic functions, full statistics and undiluted biochemistry. Keep away from poets, squeamish novices and others who may find the joyously technical nature of this prose to be mindbendingly conceptual or socially offensive. Also, because of the complex nature of brewing science, there is no guarantee that you will live longer, brew better or win any awards in the next homebrew competition based upon the conclusions presented here.

Beer is a rather unfavorable growth medium for most types of beer spoilage organisms. The relatively acidic pH, alcohol content, and presence of various hop-derived compounds all act to inhibit the growth of beer-spoilage organisms[1]. But although beer is reasonably resistant to microbial growth, there are several types of bacteria, wild yeast species, and molds that are capable of growth in beer. These invasive organisms can cause many undesirable changes in beer including the formation of hazes, surface films, scums (pellicles), and negative changes in beer flavor and aroma[2].

Microorganisms exert indirect undesirable effects on beer in several ways. Growth of microorganisms on raw materials (or in wort) can produce undesirable changes such that the raw materials do not behave normally, or the wort does not ferment properly. Additionally, the growth of contaminants on raw materials or in wort can generate microbial metabolites, which may persist into the brewing process and affect the flavor and aroma of the finished beer. Heavily contaminated raw materials or wort may introduce a substantial amount of microbial biomass that persists into green beer.

Although beer that has been infected by microorganisms is often rendered unpleasant or even "nasty," the growth of contaminants does not generally lead to health risks. Pathogenic microorganisms cannot survive in beer[2].

The primary categories of organisms that can cause beer to spoil are bacteria, wild yeasts, and molds.

Bacteria

The ethanol concentration and relatively low pH in beer creates an unfavorable environment for bacterial growth. Furthermore, the dissolved carbon dioxide and very low dissolved oxygen concentration make beer an almost exclusively anaerobic medium. Beer also contains dissolved hop compounds that are toxic to many bacteria. Only a few kinds of bacteria are able to grow under such inhospitable conditions and are able to spoil beer[3]. Bacteria can, however, grow rapidly in

wort. Fresh wort must be pitched as soon as possible with active yeast to inhibit and "out-compete" undesired bacteria.

Under a microscope, bacteria may have many shapes, but beer-spoiling bacteria generally have one of two basic shapes: round (cocci) and rod (bacilli). Bacteria can further be characterized by a staining procedure known as Gram stain. Bacteria will usually be either gram positive (purple) or negative (pink) depending on how they react to this stain. The way bacteria interact with the stain is related to the specific structure of the bacteria cell walls.

Gram Negative Bacteria

Important gram negative contaminants in the context of brewing are acetic acid bacteria, Zymomonas spp., Pectinatus spp., and various Enterobacteriaceae. Several members of this group not only interfere with the fermentation process or produce undesired by-products, but also have been reported to survive the fermentation process and to transfer into the finished product.[5]

Acetic Acid Bacteria

These are gram negative, rod-shaped bacteria that produce acetic acid from ethanol. Acetobacter and Gluconobacter are two important genera of acetic acid bacteria traditionally associated with brewery fermentations. Acetobacter can oxidize

TABLE 1: GRAM NEGATIVE BACTERIA SPOILAGE ORGANISMS

Bacterial Type (Gram Negative)	Description	Effect on Brewing Process or Finished Beer
Acetic acid bacteria: Acetobacter A. aceti A. liquefaciens A. pastorianus A. hansenii	Straight or slightly curved rods up to 4 µm in length. Cells are pleomorphic and occur in pairs or chains. Capable of oxidizing ethanol.	Forms hazes or pellicles in beer containing oxygen. Products of metabolism include acetic acid, acetanal, and acetate.
Acetic acid bacteria: Gluconobacter G. oxydans	Morphology is similar to Acetobacter. Obligate aerobes, catalase positive. Ethanol can be oxidized to acetic acid, but sometimes is not oxidized.	Same as Acetobacter. Forms hazes or pellicles in beer containing oxygen. Products of metabolism include acetic acid, acetanal, and acetate.
Zymomonas Z. mobilis	Fat rods that may occur singly, in pairs, chains, or rosettes. Endospores are not formed. Some species are motile but others are not. They grow anaerobically but are catalase positive. Tolerant of aerobiosis. Glucose and fructose are fermented to form ethanol. Maltose is not fermented. Optimum growth temperature range is 25-30°C (77-86° F).	Exclusive to ale breweries. Causes a "rotten apple" flavor due to the formation of hydrogen sulfide and acetaldehyde.
Obesumbacterium (Hafnia) O. proteus	Short, fat, pleomorphic rods. Catalase positive, ethanol tolerant. Growth in wort produces dimethyl sulphide (DMS), higher alcohols, and diacetyl. Nitrates or nitrites are reduced to form carcinogenic nitrosamines.	Commonly a contaminant in pitching yeast. Grows with yeast during fermentation and causes slow attenuation rates and high pH beer. Produces fruity/parsnip off-flavors.
Citrobacter C. freundii	Slender, straight rods occurring singly or in pairs and usually motile. Cells are catalase positive and are facultative anaerobes. Citrate is metabolized by most species. Glucose is fermented to form mixtures of various organic acids (lactate, pyruvate, isocitrate, and succinate). Relatively ethanol intolerant.	Rare contaminant in fermentations. Causes accelerated attenuation rate and produces increased organic acids and DMS. Killed in late fermentation by the presence of ethanol.
Enterobacter (Rahnella) R. aquatilis E. agglomerans	Short, squat rods, which may be motile. Glucose is fermented to produce acid and gas.	Usually a contaminant of pitching yeast. Acts similar to Obesumbacterium. Relatively intolerant to ethanol. Survives better in top cropping ale fermentations. Produces high diacetyl levels in contaminated worts.
Klebsiella K. terrigena K. oxytoca	Slender, straight capsulated, non-motile rods that occur singly or in short chains. Facultative anaerobes. Ferment glucose to produce acid and gas.	Ferulic acid in wort is decarboxylated to produce 4-vinylguaiacol. Creates phenolic off-flavor in beer. This reaction is also catalyzed by the presence of some wild yeasts.
Pectinatus P. cerevisiiphilus	Very slender, curved rods occurring singly or in pairs. Older cells may be elongated. Motile and obligate anaerobic.	Contaminants of beer where oxygen levels are low. Produces hydrogen sulfide and other sulfur compounds.
Megasphaera M. cerevisiae	Slightly elongated cocci occurring singly or in short chains. Non-motile and non-spore forming. Obligate anaerobic. Relatively ethanol intolerant.	Spoilage happens only in low oxygen environments where the ethanol concentration does not exceed approximately 4% v/v. Putrid aromas and tastes occur due to the formation of hydrogen sulfide and other sulfur containing metabolites.

ethanol to CO_2 and water via the hexose monophosphate pathway and tricarboxylic acid cycle (TCA). For Gluconobacter, the hexose monophosphate shunt is the most important route for sugar metabolism. The entire glycolytic and TCA cycles are not functional in gluconobacter. Beer is not expected to contain oxygen in the final form, and these organisms cannot thrive in beer under highly anaerobic conditions. Contamination with Acetobacter and Gluconobacter can only manifest in beers that have low oxygen tension due to process defects.

Zymomonas

These are gram negative rods that occur as single cells, in pairs, chains, or filaments. The most distinctive characteristic of Zymomonas is the ability to convert glucose or fructose to ethanol and CO_2 via the Entner-Doudoroff pathway. Ethanol only begins to inhibit the growth of Zymomonas at a concentration of around 8 percent. Zymomonas mobilis is known to produce unacceptable levels of acetaldehyde and hydrogen sulfide in lager beer.

Enterobacteriaceae

Possibly the best known home brewery contaminant in the family Enterobacteriaceae is Obesumbacterium proteus. It is a gram negative, nonacid-fast straight rod that is often found as a contaminant in the pitching yeast. It grows in unhopped wort and is able to tolerate pH values ranging from 4.4 to 9.0. Obesumbacterium proteus is known to suppress the fermentation process and produces dimethyl sulfide, dimethyl disulfide, diacetyl, and fusel oils. Beer contaminated with Obesumbacterium proteus may have a fruity or parsnip-like odor.

Gram Positive Bacteria

Gram positive bacteria are generally regarded as the most threatening contaminants in the brewery because of their rapid growth rate and tolerance to high temperatures and low pH conditions.

The most hazardous microorganisms are those belonging to the genera Lactobacillus and Pediococcus and are often referred to as lactic acid bacteria because of their propensity to produce lactic acid from simple sugars[3]. Gram positive bacteria are generally less able to resist the antiseptic effects of hop resins, but this is not true for all varieties and there is significant variability[5].

Lactobacillus

There are several species of lactobacilli that have been isolated from beer, and these are major spoilage organisms within the beer industry. These rod-shaped organisms are resistant to hop bittering compounds. Lactobacillus can spoil beer by causing acidity, off flavors, and turbidity. Some of the lactobacilli produce diacetyl, responsible for a buttery flavor in beer. Although all lactobacilli produce lactic acid, the level of the acid accumulated in beer may not reach a concentration high enough to make a significant flavor impact. Some strains produce a slime that can cause "ropey" strands within beer. This problem is, however, more often associated with pediococci or acetic acid bacteria.

Pediococcus

Pediococcus damnosus is a common spoilage organism found in breweries that

produce lager beer. The organisms are seldom found in the pitching yeast, but are usually found during the late fermentation or in the final beer. The spoilage by pediococci is somewhat similar to that caused by lactobacilli. Pediococci cause high acidity and a buttery aroma due to the production of diacetyl. Pediococci also inhibit yeast growth, which results in decreased fermentation rates. Additionally, pediococcus can produce thixotrophic polysaccharide slimes that cause ropey strands within beer. Pediococcus is often considered to be one of the most difficult types of bacteria to remove from an infected brewery.

Tables 1 and 2 provide a summary description of bacteria likely to be encountered as contaminants within the brewery[2].

Wild Yeasts

Wild yeast can be defined as any yeast that a brewer did not intentionally introduce into a beer[1]. Unintended flavors in finished beer that can be produced by wild yeasts include hydrogen sulfide (rotten egg), estery (fruity), acidic (sour), fatty acid, and phenolic or medicinal. Turbidity can also be produced by poorly flocculating wild yeast strains. Other effects caused by wild yeast include yeast sedimentation difficulties (if infecting yeast is not very flocculent) and higher alcohol content with lower final gravity in the finished beer (if the infecting yeast is highly attenuative). Wild yeast can either be of the Saccharomyces or non-Saccharomyces genus[6].

Saccharomyces Wild Yeast

Saccharomyces wild yeasts are facultative anaerobes. Cross-contamination with another Saccharomyces cerevisiae strain can cause production of off-flavors and unusual fermentation performance. A particularly problematic Saccharomyces wild yeast is the strain Saccharomyces diastaticus, which has the ability to break down the dextrins that are not normally consumed by most brewing yeast strains. This results in overattenuated beers.

Non-Saccharomyces Wild Yeast

There are many different genus and species of non-Saccharomyces yeast that can cause problems in the beer. They tend to be aerobic organisms. Perhaps the most common of these kinds of yeast are Brettanomyces, which produce acid, cidery, and clove/medicinal aromas and flavors. Other non-saccharomyces wild yeast include Pichia, Candida, and Hansenula. Pichia form films, haze, and various unusual esters. Candida and Hansenula grow fast and form films. Additionally, Pichia and Candida will oxidize ethanol if exposed to air and will produce acetic acid.

Non-Saccharomyces yeast are sometimes deliberately used by brewers to create a specific effect within beer[1]. These yeasts can create different flavors and aromas to increase the unique character of a particular beer. Torulaspora delbrueckii is often used for wheat beer production to generate the clove-like flavor typical of these beers. Brettanomyces bruxellensis is used to create the characteristic sour taste expected within Belgian lambic beers.

Molds

Molds are a type of non-chlorophyll-bearing plant. Molds are able to thrive in an environment with a temperature range of between 77-86° F (25-30° C), but can also grow at slightly lower and higher temperatures. Molds are usually aerobic and can tolerate a fairly wide pH range (but most prefer an acidic pH). In breweries (home and professional), mold can thrive anywhere there is a little bit of moisture and some kind of food source in open air. Molds may be encountered on damp walls and floors, inside less-than-clean bottles and kegs, or almost any place where beer residue may be present.

Other Effects of Microorganisms in the Brewery

Microorganisms are capable of not only ruining beer, but some types can actually ruin a brewery. Some microorganisms can produce metabolic by-products that are actually capable of causing corrosion of brewing equipment[7]. In some cases the metabolic by-products react with other chemical species present in solution to produce corrosive compounds. An example of this is the reaction of dissolved chlorine in water with the manganese dioxide by-product from gallionella

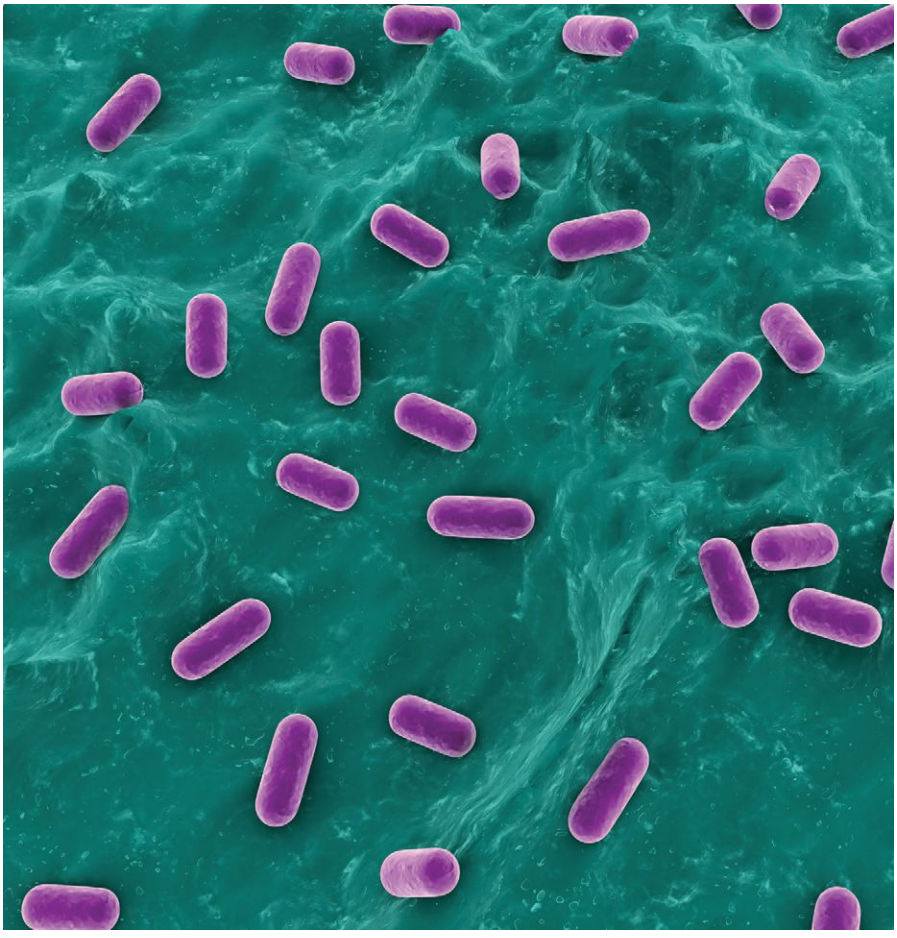


TABLE 2: GRAM POSITIVE BACTERIA SPOILAGE ORGANISMS

Bacterial Type (Gram Positive)	Description	Effect on Brewing Process or Finished Beer
Lactobacillus L. brevis L. casei L. plantarum L. fermentum L. buchneri L. delbruÈckii	Slender, non-motile anaerobic rods that do not form endospores. Lack catalase but can tolerate oxygen and low pH. Some strains are resistant to hop resins. Usually have fastidious nutritional requirements. Fermentative growth produces mainly lactic acid or mixtures of lactic acid, acetic acid, ethanol, and carbon dioxide.	Produce turbidity in infected beers. Some strains produce extracellular, slimy polysaccharides, which appear as visible "ropes" in infected beer. Sour/acidic off-flavors are generated.
Pediococcus P. damnosus (or P. cerevisiae) P. inopinatus	Non-motile cocci occurring singly, in pairs or as tetrads/short chains. Catalase negative but can tolerate some oxygen and grow under microaerophilic conditions. Most strains are homofermentative and many are resistant to hop resins. Ethanol tolerant.	Spoilers of fermenting worts and beers. Produce hazes, acidity, and high concentrations of diacetyl. Can produce polysaccharide slimes that cause ropey strands within the beer.
Bacillus B. coagulans	Large, motile rods that form endospores. Catalase positive and aerobic/facultatively anaerobic. Thermoduric and thermophilic but sensitive to hop resins and cannot grow in media with a pH lower than approximately 5.0.	Endospores allow them to survive wort boiling. They are able to grow in hot (55-70° C/131-138° F) sweet wort where they produce lactic acid. Inhibited by hop acids and low pH. Rarely spoil beer.
Micrococcus M. kristinae	Catalase positive and usually obligate aerobes (M. kristinae is a facultative anaerobe). Sensitive to acidic pH and hop resins.	Common contaminants in breweries but high sensitivity to hop resins and intolerance of acidic pH usually prevent beer spoilage.

bacteria on the surface of stainless steel. This reaction produces hydrochloric acid, which is very corrosive to most common grades of stainless steel.

Another fairly common form of microbiologically induced corrosion involves the metabolic by-products from various sulfur-fixing bacteria to produce sulfurous or sulfuric acids. Sulfurous and sulfuric acids are very corrosive to lower-alloy type stainless steels such as 304L and 316L.

Conclusion

Microorganisms are everywhere. Bacteria, yeast, and mold can find their way into the wort or beer at almost any step in the brewing process. Although no pathogenic microorganisms can survive in beer[2], beer that is infected in a way not intended by the brewer will usually be quite unpleasant or even undrinkable.

A good brewer must understand how to manage cleaning and sanitation practices in order to minimize the potential problems associated with unwanted microorganisms within the brewery. Good cleaning and sanitation practices are fundamental to making great beer.

Chris Bible is a chemical engineer whose love of beer and science intersected when he became a homebrewer over 12 years ago. He resides in Knoxville, Tenn. with his wife and son and especially enjoys brewing porters and stouts.

References

1. Goldammer, Ted. *The Brewers' Handbook*. KVP Publishers, 1999.
2. Briggs, D.E., et al. *Brewing Science and Practice*. Woodhead Publishing Limited and CRC Press LLC, 2004.
3. www.beer-brewing.com/beer brewing/beer_spoilage_organisms/bacteria.htm
4. www.probrewer.com/resources/yeast/contamination.php
5. Reed, G., and T.W. Nagodawithana. *Yeast Technology*. Second edition. 1991. p.124-126.
6. www.probrewer.com/resources/yeast/contamination.php
7. *MBAA Technical Quarterly*. Volume 38, No. 2, 2001, pp. 67-82.

by Amahl Turczyn Scheppach

Southern California Regional Homebrew Competition

Photos courtesy of Inland Empire Brewers

The Southern California Regional Homebrew Competition has been hosted by the Inland Empire Brewers homebrew club for the last 25 years, according to organizer and club vice president Erin Westvig. For 2012, the event was held at the Main Street Brewery in Corona, Calif., and attracted 272 entries from all over California as well as Nevada, Illinois, Pennsylvania, Maryland, and Missouri.

As an added perk, Westvig said, the event's Best of Show winner is given the opportunity to brew a scaled-up version of the winning recipe on Main Street's brew system with owner and brewmaster Bob Kluver. Then, as with the annual Pro-Am competition, the Best of Show beer is put on tap at the brewery for the public to enjoy. "There are even a few beers that have won in the past that Bob will keep around," Westvig explained. "Their flagship IPA, Hop Daddy, is a former BOS winner from our competition."

This year's winner of that honor is Aaron Luelling from Las Vegas, Nev. One of the first and greatest influences on Luelling's brewing career came from one of the greatest beer cultures in the world: in the Army, he was stationed in Germany. There, Luelling was able to visit and experience some of the great breweries in the world. "Learning their culture, particularly as it relates to their beer, was a game changer," he remembers. "When I returned to the States, I had a devil of a time trying to find a good hefeweizen. So I thought, why not just brew one?"

However, even though German brewers make it look easy, that classic Bavarian style can be a challenge for novice homebrewers. "It was not pretty," he joked. As it turned out, this was a positive step in eventually realizing his brewing goals. When asked what it takes to be a good brewer, he cited patience, perseverance, and fearlessness. "You learn by failing," he said. Time passed before he had the opportunity to give it another go, but fortunately that opportunity did eventually arrive. Thirteen years later, after marriage, college, a CPA, and kids, Luelling found he needed a hobby—as he put it, "something to charge my own batteries"—and the time was ripe to dive back into homebrewing.

He brewed his first batch in 1998, but it wasn't until October 2011 when he

Foreign Extra Stout

BEST OF SHOW BEER, 2012 SOUTHERN CALIFORNIA REGIONAL HOMEBREW COMPETITION

Recipe by Aaron Luelling, Las Vegas, Nev.

INGREDIENTS

for 5 U.S. gallons (19 liters)

10.0 lb	(4.54 kg) American two-row pale malt
1.0 lb	(0.45 kg) Weyermann Carafoam® malt
1.0 lb	(0.45 kg) black patent malt
1.0 lb	(0.45 kg) chocolate malt
1.0 lb	(0.45 kg) 80° L crystal malt
6.0 oz	(170 g) roasted barley
1.0 oz	(28 g) Centennial hops (60 min)
1.0 oz	(28 g) Centennial hops (30 min)
1.0 oz	(28 g) Willamette hops (10 min)
1 tablet	Whirfloc

White Labs WLP004 Irish ale yeast

Boil time: 60 minutes
Original Gravity: 1.070
Final Gravity: 1.025
IBU: 63
SRM: 60
ABV: 6.3%

DIRECTIONS

Conduct a step mash with rests for 20 minutes at 122° F (50° C), 45 minutes at 152° F (67° C), and 10 minutes at 168° F (76° C).

EXTRACT RECIPE

Substitute 7.25 lb light malt extract syrup for the pale malt. Steep specialty malts in 160° F (71° C) water for 30 minutes. Drain, rinse, dissolve extract completely, and proceed with boil.

KUDOS—BEST OF SHOW

AHA/BJCP Sanctioned Competition Program

May 2012

2012 Brew Maui Homebrew Off, 56 entries—*Bob Culnan, Hilo, HI.*

California State Fair 2012 Commercial Craft Brewing Competition, 456 entries—*Lightning Brewing Old Ale, Poway, CA.*

June 2012

Barley's 16th Annual Homebrew Competition, 64 entries—*Richard Sheppard, Columbus,* OH.

Inland Empire Brewing Company's Pro Am Competition, 41 entries—*Israel Arrieta, Pasadena, CA.*

California State Fair 2012 Home Brewing Competition, 384 entries—*Virg Redman.*

The Empire Cup, 37 entries—*Ben Maeso, Rochester, NY.*

Maineiac Homebrew Competition, 36 entries—*Brian Hall, Portland, ME.*

Longshot American Homebrew Contest (West), 152 entries—*Kenneth Reister, Olympia, WA.*

McHale's Quarterly Mashout - 2nd Quarter 2012, 25 entries—*Dave Stahl, Fort Wayne, IN.*

Longshot American Homebrew Competition (Northeast), 353 entries—*Rob North, Manchester, NH.*

All Idaho Hausbrau Challenge, 65 entries—*Ryan Collings, Boise, ID.*

July 2012

Keep Austin Beered ProAm, 21 entries—

Dan & Joelle Dewberry, Austin, TX.

2012 WanCup2, 170 entries—

Motoyasu Nakazawa, Shizuoka.

Indiana State Fair Brewers' Cup Competition, 1,124 entries—*Shawn Kaus, Noblesville, IN.*

Bethel Homebrew Festival and Brewers Challenge, 30 entries—*Scott Bales, Merrimac, NH.*

Ohio State Fair Homebrew Competition, 485 entries—*Chris Schaeffer, Lakewood, OH.*

ESB 2012 The Good the Bad and the Ugly, 90 entries—*Matt Cawley, Ballina, NSW, AUS.*

Mile and a Quarter Beer Fest, 28 entries—*John Chase, Flagstaff, AZ.*

2012 Buffalo County Fair Beer/Mead/Wine Competition, 86 entries—

Mark Wethington, Kearney, NE.

Amador County Fair Homebrew Competition, 97 entries—*Ryan Truax & Constance Marshall, Los Angeles, CA.*

Brewster's Cup 2012 July Open, 80 entries—*Darren Link, Dayton, OH.*

El Paso County Fair Homebrew Competition (Limited Styles), 35 entries—*Mike Bordick, Colorado Springs, CO.*

IAMNSOB Homebrewing Competition,

49 entries—*Dale Galligan, Mason City, IA.*

2012 GCHC - Anything Goes, 132 entries—*Brad Clifford, Toronto, CAN.*

2012 Battle of the Brews, 300 entries—*Phil Bayle & Jamie Klarman, Fallston, MD.*

Cowlitz County Fair 2012, 47 entries—*Bill Brawand, Kelso, WA.*

Elevator's Procrastinator Gluten Free Beer Homebrew Competition, 10 entries—*Ryan Bell, Columbus, OH.*

First Coast Cup, 598 entries—*Gary Yetter.*

Summer Beer Dabbler Showcase 2012, 66 entries—*Jeff Swanson, Andover, MN.*

All American Brew Off, 69 entries—*Jed Reinhard, Fort Smith, AR.*

The Bubbly Creek Barrel Brawl, 23 entries—*Nathan Barth, Chicago, IL.*

16th Annual NJ State Fair/SCF&HS Homebrew Competition, 191 entries—*Thomas Eagan, Lambertville, NJ.*

2012 German Fest Stein Challenge, 242 entries—*Randy Simmons, Springboro, OH.*

Iowa State Fair, 306 entries—*Tim Mason, Pleasant Hill, IA.*

Best of the Bay, 178 entries—*Jeremy Allison, Oak Harbor, WA.*

Dancing Bear Pub's Homebrew Competition, 9 entries—*Mark Laack, Harker Heights, TX.*

Brisbane Amateur Beer Brewers (BABBs) Annual Club Competition 2012, 67 entries—*Kristian Domagala, Brisbane, AUS.*

Gnarley Barley Brewfest, 427 entries—*William Beeson, Castle Rock, CO.*

Nevada County Fair, 50 entries—*Mystery Lofgren, Nevada City, CA.*

Ventura County Fair Amateur Beer Contest, 106 entries—*Jeff Ham, Ventura, CA.*

ASH Homebrewer of the Year Round 6, 4 entries—*Sam Patterson.*

August 2012

25th Annual Southern California Homebrew Championship, 272 entries—*Aaron Luelling, Las Vegas, NV.*

17th Annual Montgomery County Agricultural Fair Homebrew Competition, 175 entries—*Walter McGrath & Penny Peanut, Silver Spring, MD.*

Lunar Rendezbrew XIX, 603 entries—*David Rogers, Cypress, TX.*

Brew Haven, 97 entries—*Paul Till, Fort Wayne, IN.*

Los Angeles County Fair Homebrew Competition, 280 entries—*Ward Walkup IV, Pasadena, CA.*

Tillamook County Fair Homebrew Competition 2012, 13 entries—*David Swisher, Jefferson, OR.*

Denver County Fair - Craft Brew, 124 entries—*Kyle Campbell, Westminster, CO.*

National Capital Homebrewing Competition, 225 entries—*Joey Kilbride, Ottawa, ON.*

Mystery Brewing Style Competition, 36 entries—*Matthew Mathias, Durham, NC.*

Stapleton Beer Festival Homebrew Competition, 34 entries—

Scott Kendall, Aurora, CO.

Deer River Bar-b-que and Brew Fest, 31 entries—*Bud Cone, Grand Rapids, MN.*

19th Annual Dominion Cup, 518 entries—*Brian Berquist, Scott Berquist, & Rod Berquist, Mineral, VA.*

Josephine Co. Homebrew Competition, 27 entries—*David Hunt, Grants Pass, OR.*

Blues and Brews Homebrew Competition, 227 entries—*Michael Switzer, Newburyport, MA.*

Evergreen State Fair 2012, 185 entries—Nate *McLaughlin, Everett, WA.*

Kentucky State Fair Homebrew Competition, 467 entries—*Nathan Vogelpohl, Louisville, KY.*

Western Idaho Fair, 57 entries—*Ryan Collings, Boise, ID.*

Nebraska State Fair Beer & Wine Competitions, 112 entries—*Leo Vitt, Sidney, NE.*

Bristol IPA Showdown, 64 entries—*Mark Grundy.*

Benton Franklin Fair Homebrew Competition, 31 entries—*Darin Curtis, Pasco, WA.*

Beer & Sweat, 261 entries—*Brian Jackson, Cincinnati, OH.*

AHA Club-Only Competition, Porter, 92 entries—*Rob Bernard, Keene, NH.*

5th Festival Internacional de la Cerveza Artesanal Buenos Aires 2012, 136 entries—*Paez Emiliano, Buenos Aires, ARG.*

Timbers Army Homebrew Competition, 30 entries—*Jeremie Landers & Jenn McPoland, Portland, OR.*

The Anchor Town Invitational, 51 entries—*Tim & Jen Bisson, Anchorage, AK.*

4th Annual Beehive Brew-Off, 595 entries—*Brad Cooley, Salt Lake City, UT.*

Grant County Fair Homebrew Championship, 6 entries—*Jeremy Adair, John Day, OR.*

Kitsap County Fair Homebrew Competition, 78 entries—*Ron Gresley, Bremerton, WA.*

Colorado State Fair Homebrew Competition, 675 entries—*Scott Jackson, Brighton, CO.*

2012 ACO Brewfest, 30 entries—*Todd Esslinger, Longmont, CO.*

Crystal Coast Brew Off, 61 entries—*Terry Laurie, Newport, NC.*

2012 RBT American Ales Brewing Competition, 42 entries—*Scott Eckford, Townsville, AUS.*

Malt Madness VI, 585 entries—*John Wible, Philadelphia, PA.*

KC Irish Fest Scottish or Irish Ale Brewing Contest, 32 entries—*Michael Fagan, Edwards, MO.*

St. Mary of the Rockies Harvest Festival, 35 entries—*Mark Vakos, Evergreen, CO.*

September 2012

Heart River Home Brewers Members Only, 7 entries—*Ryan Jilek, Dickinson, ND.*

Consumer's Beverages 1st Annual Homebrew Competition, 52 entries—*Terry Ostrander, Orchard Park, NY.*

The Great Frederick Fair, 125 entries—*Calvin Perilloux, Middletown, MD.*

started brewing regularly. Since then, it's become a weekly ritual. "My short-term goal is to brew every Saturday, five gallons at a time," he said. And professional aspirations are definitely on his mind: "Longer-term goals are in the works."

Luelling brews on a single tier, three-burner system. "I designed it, and my father-in-law and I built it. It's almost all stainless." He also built a cold storage walk-in, which he uses for cold storage and lager fermentation. Lagers, particularly dunkels, are his favorite beers to brew, but he also has a passion for stouts, so it comes as no surprise that his Best of Show at the Southern California Regional Homebrew Competition was a Foreign Extra Stout.

Amahl Turczyn Scheppach is the associate editor for *Zymurgy*. He lives and brews in Lafayette, Colo.

AHA SPECIAL EVENTS

Visit the Events section of HomebrewersAssociation.org for more information.

November 3
AHA Learn To Homebrew Day

February 2013
AHA National Homebrewers Conference: Attendee Registration Opens

February 2013
AHA National Homebrew Competition: Entry Registration Opens

May 4, 2013
AHA Big Brew: A Celebration of National Homebrew Day

AHA/BJCP SANCTIONED COMPETITION PROGRAM CALENDAR

For complete calendar, competition and judging information go to www.HomebrewersAssociation.org/pages/competitions

November 10
Knickerbocker Battle of the Brews
Albany, NY. Entry Deadline: 11/10/2012.
thoroughbrews.com

November 10
Land of the Muddy Waters
Rock Island, IL. Entry Deadline: 11/2/2012.
mugzhomebrew.org

November 10
SCH*ABC V
Collegeville, PA. Entry Deadline: 11/1/2012.
schomebrewers.com

November 10
Butler Brewfest/Homebrewers Competition
Butler, PA. Entry Deadline: 11/9/2012.
p.bricker.3bsbrew@zoominternet.net

November 10
Beer for Boobs
Zanesville, OH. Entry Deadline: 10/26/2012.
beerforboobs.sodz.org

November 10
Monster Mash
Brandon, MS. Entry Deadline: 10/26/2012.
hbamm.org/brewcomp

November 11
London and South East Craft Brewing Competition
London, Merton, UK. Entry Deadline: 11/5/2012.
londonandsoutheast.brewcompetition.com

November 16
II Concurso Estadual Acerva Gaúcha
Porto Alegre, RS, Brazil. acervagaucha.com.br

November 17
Sunshine Challenge
Winter Springs, FL. Entry Deadline: 11/4/2012.
cfhb.org/sunshine-challenge

November 17
AHA Club-Only Competition, Ant Hayes Memorial Burton (Old) Ale
Plymouth, MI. Entry Deadline: 11/10/2012.
homebrewersassociation.org/pages/competitions/club-only-competitions

November 17
FOAM Cup
Tulsa, OK. Entry Deadline: 11/10/2012.
FOAMCup.us

November 18
Malt's Annual Turkey Shoot
Baltimore, MD. Entry Deadline: 11/11/2012.
maltclub.org/MALT/Home.html

December 1
6th Annual Virginia Beer Blitz
Hampton, VA. Entry Deadline: 11/20/2012.
colonialalesmiths.org/BeerBlitz

December 1
Monk Melee II
Hulmeville, PA. Entry Deadline: 11/29/2012.
aleiens.com/page/monk-melee-ii

December 8
Biere de Rock
Parker, CO. Entry Deadline: 11/24/2012.
bierederock.rockhoppersbrewclub.com

December 8
Fugetaboutit 2012
Chattanooga, TN. Entry Deadline: 11/24/2012.
fugetaboutit.org

December 8
1o. Concurso Estadual de Cervejas Caseiras da ACervA Catarinense
Blumenau, Santa Catarina, Brazil.
Entry Deadline: 11/3/2012. acervacatarinense.com.br/i-concurso-estadual

January 11
Big Beers, Belgians & Barleywines Homebrew Competition
Vail, CO. Entry Deadline: 12/15/2012.
bigbeersfestival.com

COMMERCIAL CALIBRATION

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 widely available commercial beers (or meads or ciders) using the BJCP scoresheet. We invite you to download your own scoresheets at www.bjcp.org, pick up a bottle of each of the beverages and judge along with them in our Commercial Calibration.

OUR EXPERT PANEL includes **David Houseman**, a Grand Master IV judge and competition director for the BJCP from Chester Springs, Pa.; **Beth Zangari**, a Grand Master level judge from Placerville, Calif. and founding member of Hangtown Association of Zymurgy Enthusiasts (H.A.Z.E.); **Scott Bickham**, a Grand Master III 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 VII judge, principal author of the 2004 BJCP Style Guidelines and president of the BJCP board who lives in Beavercreek, Ohio.

Two best-selling meads that incorporate apples were presented to our judges for this issue.

First up was Kurt's Apple Pie from Moonlight Meadery in Londonderry, N.H. It's the second-best selling mead for Moonlight and checks in at 16.8 percent ABV.

Moonlight Meadery founder Michael Fairbrother said the mead is named after his lifelong friend Kurt Demmer, who taught him how to bag grocery items and was a fellow homebrewer. Demmer made a mead and dropped off a bottle for Fairbrother, who didn't get around to drinking it until several months later. "When I opened the bottle, it was amazing," Fairbrother remembers. "The mead smelled just like apple pie. When I tasted it, I was completely floored. It was the best mead I had ever tasted."

Fairbrother called Demmer to get some more and learned that it was his last bottle. Unfortunately, Demmer never made any more of it, but he was kind enough to share the recipe with his friend. Fairbrother bottled Batch #1, using early season apples, on October 16, 2010—Demmer's birthday. "I tweaked the spices just a bit, using Vietnamese cinnamon and Madagascar bourbon vanilla beans with fresh pressed cider. We made 40,000 bottles last year."

Fairbrother shared the basic recipe for Kurt's Apple Pie: 25 percent Wildflower honey; 75 percent late season apples (for sweeter version) or early season apples (for drier version); no preservatives; three vanilla beans (whole—don't split, scrape, etc.); and 3-5 teaspoons of cinnamon. Add spices in the secondary, not the primary.

Next up was Zombie Killer, a lightly carbonated, tart cherry cyser from B. Nektar in Ferndale, Mich. It checks in at 5.5 percent ABV.

Zombie Killer is made with fresh pressed apple cider, star thistle honey, and tart Montmorency cherry juice, said B. Nektar's Brad Dahlhofer. "From apple pressing to bottling takes about six weeks. We ferment cool (around 60° F). It's lightly filtered so as to remove larger solids, but not enough to make it clear. We like cloudy cider here in Michigan," said Dahlhofer.

Zombie Killer started as an experiment when B. Nektar was asked by an account to create something on draft with cherries. "One of our mead makers was reading the *Walking Dead* graphic novel and suggested we name it Aaarrgghh," said Dahlhofer. "We all looked at him inquisitively. He started laughing and said, 'That's what zombies say!' We settled on Zombie Killer. It's now our most popular mead ever."

ON THE WEB

B. Nektar
www.bnektar.com

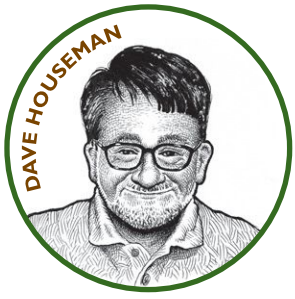
Moonlight Meadery
www.moonlightmeadery.com

BJCP Style Guidelines
www.bjcp.org

Commercial Calibration
www.HomebrewersAssociation.org/pages/zymurgy/commercial-calibration
(Note: This is a Members Only area of the website)

Kurt's Apple Pie—Moonlight Meadery, Londonderry, N.H.
BJCP Category: 26C Open Category Mead

THE JUDGES' SCORES FOR KURT'S APPLE PIE



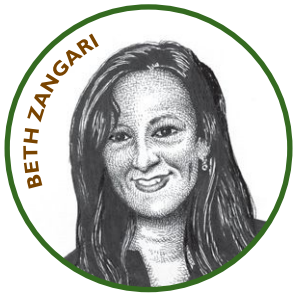
Bouquet/Aroma: Spicy, peppery aroma with light notes of cinnamon and vanilla. The apple esters are very cider-like with notes of sulfur and geraniums. Honey expression is there as a sweet component of aroma, but low honey aroma. (7/10)

Appearance: Brilliant clarity. Golden yellow color. Delicate legs and very thin meniscus. (6/6)

Flavor: Sweet honey expression. Fruity apple cider esters. Cinnamon is quite evident but vanilla is only adding to overall complexity. Sweetness is a bit cloying; there is some acidity to offset sweetness but additional tartness would better balance the lingering sweetness. There are substantial tannins to balance the mead and lend more body to mouthfeel. Subtle but substantial alcohol present. (19/24)

Overall Impression: A nice, sweet, sipping mead. Greater drinkability would benefit from additional acidity. The impression of apple pie might also include nutmeg in addition to cinnamon for pie aficionados. The geranium notes in flavor and aroma are distracting to me; this is a fault in the processing of cider. Still, this is a mead worth sipping as a digestive or served with a cheese course. I enjoyed mine with some aged cheddar, but then apple pie is often served with a slice of cheddar cheese. (7/10)

Total Score: (39/50)



Bouquet/Aroma: Strong, clear, clean honey with a spicy herbal note. Crispy apple plays in the background, reminiscent of Honeycrisp. A grassy, green note emerges, which is a bit distracting, but gives way to a bit of vanilla and hint of cinnamon. (8/10)

Appearance: Straw colored with brilliant clarity. No legs. A few bubbles occasionally rise. (6/6)

Flavor: Initial lightly tart apple gives way to full, sweet honey flavor with hints of cinnamon, nutmeg, and vanilla. The vanilla adds a character suggestive of buttery pastry crust. Alcohol is not hot, in fact barely evident. Body is medium light, with petillant carbonation. A light astringency of apple peels adds a crisp character to the finish. Subtle warmth and flavor of cinnamon lingers at the finish, with a bit of alcohol warmth as well, then honey makes a comeback with a floral note. (20/24)

Overall Impression: The honey notes are clear and all ingredients well expressed. No one flavor dominates. The overall effect is of warm apple pie, even when served lightly chilled. Lovely to sip with friends around the table! Very well done. (8/10)

Total Score: (42/50)

Bouquet/Aroma: Woody, earthy notes of cinnamon are at the forefront, with sweet apple and honey notes following. The alcohol is noticeable, but clean without any harshness. I pick up light acidity when the mead is swirled, but it's understated relative to the spicy sweetness. (7/10)

Appearance: Light golden in color with alcohol legs that trail down the sides of my tasting glass. The clarity is pristine, and there is no carbonation. (6/6)

Flavor: The apple pie description fits the flavor more than the aroma. The sweet character is high, but not cloying, with assertive honey and apple components. I cannot identify the varieties of either, but the apples lend some acidity and tannins in addition to providing sugars. The vanilla is subtle and is likely the origin of the bourbon character. I get cinnamon near the end, but it is less prevalent than in the aroma, lending a light spiciness without any harshness. Alcohol is apparent, but more as a pleasant warming sensation on the palate than a distinct flavor. (22/24)

Overall Impression: An elegant and tasty mead that certainly earned the high score. The aroma was perhaps a little more understated than I expected, but the flavor more than compensated by bombarding my taste buds with a complex blend of sweetness, spice, and alcohol. I appreciate the recommendation to serve with ice cream, but I think I'll savor this sample straight-up. (9/10)

Total Score: (44/50)

Bouquet/Aroma: Spicy and sweet. Significant apple complexity with a strong honey sweetness. Dusty, warming cinnamon character is obvious. Warm spice quality, like mulling spices. Vanilla is subtle—more would be welcome. Spice complexity suggests more spices are present, like cardamom. Very intriguing. Cleanly fermented. Apple acidity noted, as is light alcohol. (9/10)

Appearance: Crystal clear. Still. Pale yellow color. Very attractive. (6/6)

Flavor: Sweet and strong, but oh so smooth. Balanced acidity. Full body. Strong cinnamon character complements apples nicely. Vanilla is still in the background, just adding some rounded notes. Warmth noticeable but not hot. Mostly apples and cinnamon. Honey body and sweetness noted, as well as supporting flavor. Acidity of apples deftly balanced by honey sweetness. Tannins provide structure. Nuanced—a difficult feat for a mead this big. Vanilla comes out more in the aftertaste as it warms. Well fermented; strong and sweet but not cloying at all. (21/24)

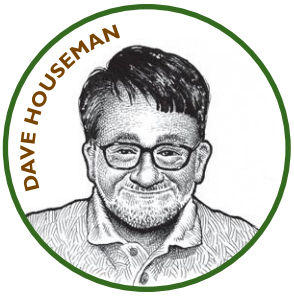
Overall Impression: Wow. Big but smooth and well-balanced. Honey is supportive and plays its role well. Vanilla is elusive, providing a subtle rounded character; a little more vanilla would add more interest. Like a great baked apple dessert. Seems more complex than simply cinnamon—the apples are likely giving it some extra spice character. Delicious. Finally, a commercial mead that can go head-to-head with the best homemade meads. Bravo. (9/10)

Total Score: (45/50)

Illustrations by Terry McNerney

Zombie Killer Cherry Cyser—B. Nektar, Ferndale, Mich.
BJCP Category: 25C Other Fruit Melomel

THE JUDGES' SCORES FOR ZOMBIE KILLER CHERRY CYSER



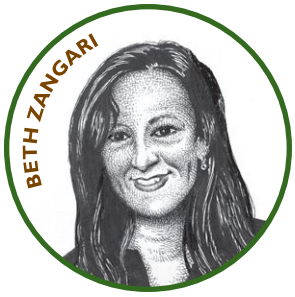
Bouquet/Aroma: Low, balanced honey and cherry aroma take a back seat to the alcohol. Apple esters are not as readily recognizable. Overall, a light aroma that is proper for a hydromel. Clean fermentation. (8/10)

Appearance: Lightly carbonated (petillant). Bright clarity with a pink color. Long-lived legs with noticeable meniscus. Looks very much like a big, white zinfandel. (6/6)

Flavor: Big tart cherry flavor up front adds the acidity that keeps the sweetness balanced. Apple esters are evident. Fresh, bright flavors. Finishes fairly dry but not austere, with some lingering sweetness that embraces the cherry and apple esters. Very well balanced. Honey expression, however, is quite light with a touch of tannins to help with overall balance, flavor, and mouthfeel. There's a bit of almond nuttiness. Alcohol is there but subtle. (21/24)

Overall Impression: A very drinkable mead full of flavor and balanced sweetness, alcohol, acidity, and tannins. The alcohol is there but subtle; it goes down deceptively easy. The aroma is not nearly as bold as the flavor and I'd like to see more honey notes, but that would be nitpicking. Anyone who likes mead or white zinfandel wine would enjoy this mead. Great accompaniment to a brie en croute appetizer. (9/10)

Total Score: (44/50)



Bouquet/Aroma: Subdued honey aromas, with some apple present. Cherry is present, but in wisps—very subtle at first, but more pronounced, as black cherry, on rousing. Apple character is spicy, dominates the aroma, with honey as a background note. (6/10)

Appearance: Delicate salmon pink color, with brilliant clarity. No head formation. No legs on sides of the glass. Tiny bubbles continually rise to the surface. (6/6)

Flavor: Honey expression is overpowered by a crisp, spicy apple flavor that dominates initially, but gives way mid-palate to cherry flavor like cherry soda (Shasta is the brand—not sure if that was ever available nationally, and not sure it's still made at all). Sweet and moderately tart, like a Granny Smith apple. Honey plays in the background, with a light spiciness. Very clean fermentation. Balance is in components rather than a blend of characteristics. Carbonation is present, but soft. Finish is crisp, dry, and clean with a moderate cherry note. (19/24)

Overall Impression: Easy drinking, but more like a cherry cider than a mead/cyser. The fruit character, both apple and cherry, is more pronounced than the honey character. At 6 percent ABV, the alcohol was not really evident in the flavor, and is therefore rather sneaky. It is quite refreshing on a very warm evening, but too easy drinking to be a session beverage for this judge. Quite yummy, with notes of cherry pie. I would score this higher if it were presented as a cider, since the honey is so far in the background. (7/10)

Total Score: (38/50)

Bouquet/Aroma: Sour cherry pie as the mead is poured. In the glass, the honey is a little more prominent than the apple, but I do pick up the earthy, corky notes common in many traditional ciders. Light alcohol notes but otherwise has a neutral fermentation character. Light sulfite notes emerge as it warms. (7/10)

Appearance: Similar to a rosé wine, but with a sheen from suspended yeast or proteins. The modest carbonation leaves a crown of bubbles around the rim. This sample should have had time to settle after shipping, but perhaps I should have been more patient. (4/6)

Flavor: Lots of complexity from start to finish. It starts softly, with sweet honey notes, then the sourness from both apples and cherries crescendos toward a somewhat tart, dry finish. I pick up some tannins and almond notes, along with some woody notes. Low alcohol warmth, with some tingle from carbonation. The light-medium body makes this a refreshing beverage. While perhaps not a classic mead, it should appeal to fans of Belgian sour ales. (20/24)

Overall Impression: This is a pleasant creation, especially for quenching one's thirst on a hot summer afternoon or after a zombie hunting expedition. The honey provides a good supporting structure for the apples and sour cherries, but a little more honey character and sweetness would help balance the acidity, add complexity, and emphasize the mead character. I will seek out a second sample and see if a clear pour enhances the flavor as well as the appearance. (8/10)

Total Score: (39/50)

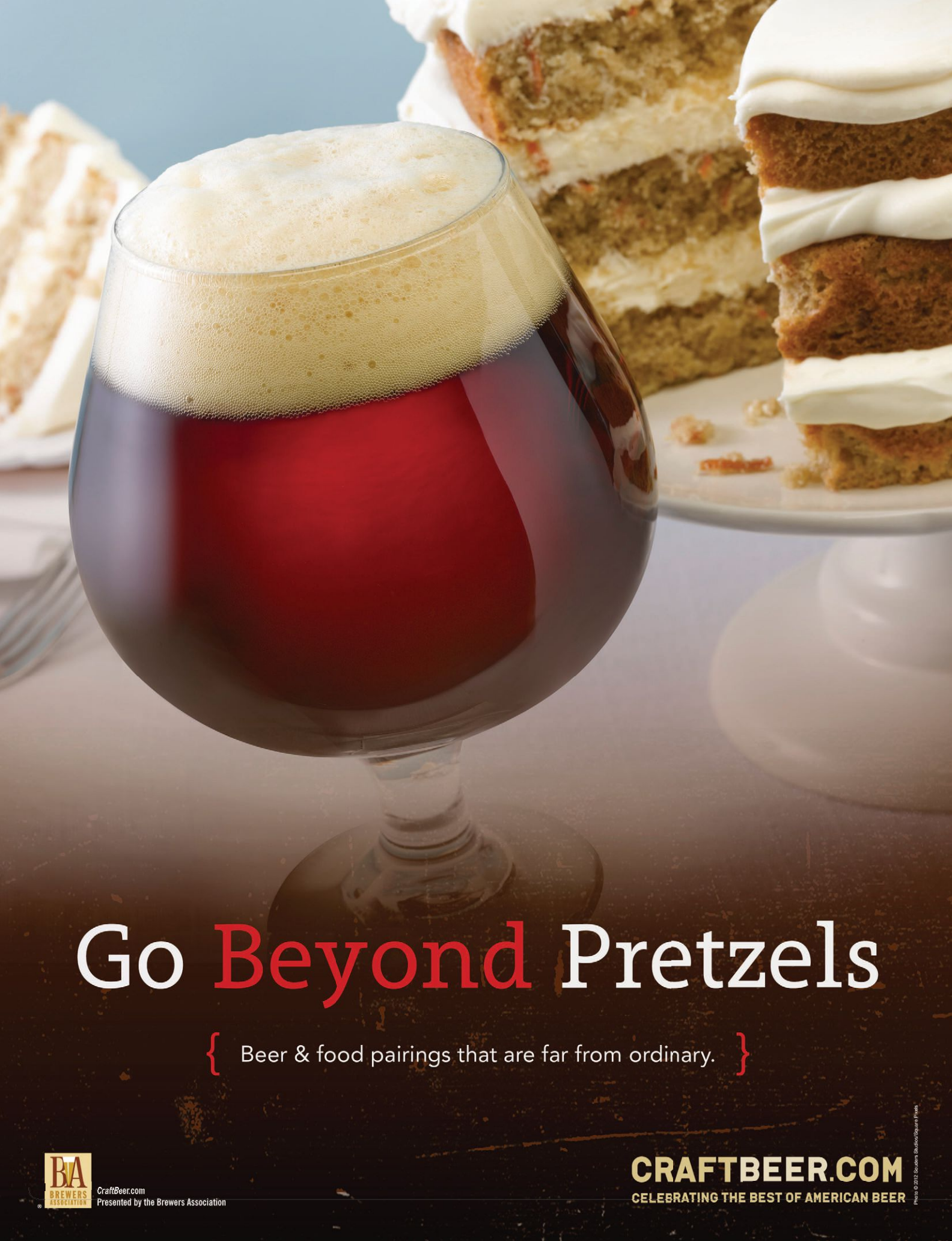
Bouquet/Aroma: Smells like a cider. Sweet-tart aroma, mostly of apples. Yeasty, nutty quality with a hint of sulfur—almost like champagne. Malic acid notes. More apple than honey or cherry. Cherry does add some complexity, but not a big "pop." Apple is strong and clean, and has quite a bit of complexity. Not really getting honey at all. Nothing is off; it just lacks in cherry and honey in relation to the apple character. (7/10)

Appearance: Crystal clear. Pinkish blush color, strawberry-like. A few tiny bubbles in a ring. (6/6)

Flavor: Sweet and tart, with apple in the palate and cherry emerging toward the finish. Petillant. Full bodied, full finish, somewhat heavy but not syrupy. Clean flavors, well-blended. Honey mostly gives body and support—not getting much flavor character from it. Cider/apple qualities dominate. Lightly spicy, as from some cherry varieties. Fruit seems fresh. Apples are fairly complex and interesting and provide considerable acidity and some tannin. (18/24)

Overall Impression: Reads a bit more like a cider to me than a mead. The honey qualities are subtle and the apple flavors dominate. Likewise, the cherry is in the background. It adds a nice accent but it doesn't seem to be an equal partner. Very drinkable, but has more of a "wine cooler" taste than I'd expect in a mead. But as a 6 percent ABV beverage, that's somewhat understandable—that's a very small mead. Clean and well-made, just small and unbalanced. (7/10)

Total Score: (38/50)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by Charlie Papazian

Ode to Hops: Beer's Most Emotional Ingredient

Any way you enjoy them, hops have to be the most emotional ingredient in beer. This is especially so during the late summer and autumnal harvest as hop crops around the northern hemisphere are ripening to perfection on a day-by-day and even hourly basis.

It wasn't always such a heralded and celebrated ingredient. Sure, hop farmers have celebrated the harvest, and mass migrations of hop pickers initiated familial gatherings in past eras, but now the beer drinker reigns as the celebrator.

We grow hops, harvest hops, talk about hops, and seek fresh hop ales and lagers from local breweries. Brewers take extended journeys to find organic, local, fresh hops. There are brewers, hop growers, beer drinkers, and journalists who thrive on being hop experts.

We celebrate the lingo: oils, bitterness, lupulin. We mourn the short supply of Citra, Simcoe, and Amarillo. We journey to distant lands and see what farmers have that others may not know about.

We react with joy at floral and fruity India pale ales. We grimace and grin at palate-shredding, hop assertive IPAs and double IPAs and royal IPAs and imperial IPAs and "barleywine ales" that should be "kingdom come" IPAs. We relish the soothing deliciousness of a Czech Saaz-hopped Pilsener. We refresh with the crispness of noble hop varieties and their hybrids in German Pils. We gently balance light ales, German Kölsch, and wheat beers with a touch of balanced bitterness and sometimes artfully introduce those mysteriously satisfying touches of hop aroma and flavors.

Brewers single-, double-, triple-, late-, dry-, mash-, first wort-, second-, and back-hop their beer. They age their hops or maximize their fresh-picked character, with both methods introducing unique character celebrated and discussed by beer drinkers.

Beer drinkers fashion crowns of hops for headgear, and decorate shirts, pants, skirts, blouses, ties, socks, and underwear with hop motifs. We collect hop pins, cufflinks, and necktie clips. We think about hop cologne, hop shampoo, and hop salve, and infuse our butter with hops instead of chives. We sleep with hop pillows. We take our French coffee presses and turn them into a hop-infusing beer press at our tables. We take hops into our hands and joyfully rub them together, crushing the fragrant lupulin gland—*pow, zap, wham*. Aromatics engulf our noses as we cover our faces in ecstasy. We sprinkle crushed hops into salads, soups, and gravy. "What variety is your favorite?" we ask each other. If there is a pile of hops to be seen, the first reaction is to dive head-first and emerge covered with happiness. Or hoppiness?

We seek solace if we are fortunate to be able to walk among the vines as they twirl themselves clockwise on. It makes us smile.

Malt is the quiet soul and foundation of beer. Water is the supporting cast. Yeast, we propagate and herd, but I've never seen a yeast cufflink, nor an embroidered brewing water motif on a hat. I have seen amber waves of barley, but never any emotion attached. Hops are emotional—hands down.

Sometimes we sip hoppy beers for the first time and admit, "I don't like bitterness, but I like this beer and I don't know why." Welcome to lupulin mania.

The harvest is celebrated, but the future is uncertain. Hops are a specialty crop. There are shortages and risks taken to grow them. Most hops that are grown are used for brewing. Craft beer from small and independent brewers use 30 to 40 percent of all the hops used in American beer. Craft beer from craft

Mango Mud
ALL GRAIN RECIPE

INGREDIENTS
for 5.5 U.S. gallons (21 liters):
final yield 5 U.S. gallons (19 liters)

7.0 lb	(3.2 kg) Maris Otter pale malt
1.0 lb	(454 g)10° L crystal malt
12.0 oz	(340 g) roasted barley
8.0 oz	(225 g) Belgian aromatic malt
8.0 oz	(225 g) black malt
8.0 oz	(225 g) chocolate malt
2.5 oz	(70 g) Belgian Special-B malt
0.75 oz	(21 g) UK Wye Challenger hops 6% a.a. (4.5 HBU/126 MBU) 60 min
1.0 oz	(28 g) UK Kent Golding hops 6% a.a. (6 HBU/168 MBU) 15 min
1.0 oz	(28 g) Cascade hops, 1 min
0.5 oz	(14 g) Australian Galaxy hops, 1 min
0.5 oz	(14 g) Australian Galaxy hop pellets, dry hop
0.25 tsp	(1 g) powdered Irish moss

Irish Ale type yeast

0.75 cup	(175 ml) corn sugar (priming bottles) or 0.33 cup (80 ml) corn sugar for kegging

Target Original Gravity: 1.053 (13.3 B)
Target Extraction Efficiency: 80%
Approximate Final Gravity: 1.016 (3.5 B)
IBUs: about 30
Approximate color: 48 SRM (96 EBC)
ABV: 5%

Directions
A step infusion mash is employed to mash the grains. Add 10.5 quarts (10 l) of 140° F (60° C) water to the crushed grain, stir, stabilize, and hold the temperature at 132° F (53° C) for 30 minutes. Add 5.25 quarts (5 l) of boiling water and add heat to bring temperature up to 155° F (68° C) and hold for about 30 minutes. Raise temperature to 167° F (75° C), lauter and sparge with 3.5 gallons (13.5 l) of 170° F (77° C) water. Collect about 5.5 gallons (21 l) of runoff. Add 60-minute hops and bring to a full and vigorous boil.

The total boil time will be 60 minutes. When 15 minutes remain, add the 15-minute hops. When 10 minutes remain, add the Irish moss. When 1 minute remains, add the 1-minute hops. After a total wort boil of 60 minutes, turn off the heat and place the pot (with cover on) in a running cold-water bath for 30 minutes. Continue to chill in the immersion or use other methods to chill your wort. Strain and sparge the wort into a sanitized fermenter. Bring the total volume to 5.5 gallons (21 l) with additional cold water if necessary. Aerate the wort very well.

Pitch the yeast when temperature of wort is about 70° F (21° C). Ferment at about 70° F (21° C) for about one week or when fermentation shows signs of calm and stopping. Rack from your primary to a secondary and add the hop pellets for dry hopping. If you have the capability "cellar" the beer at about 55° F (12.5° C) for about one week. Prime with sugar and bottle or keg when complete.

Mango Mud
MALT EXTRACT RECIPE

INGREDIENTS

Ingredients for 5.5 gallons (21 liters):
final yield 5 gallons (19 liters)

5.0 lb	(2.3 kg) light malt extract syrup or 4 lb (1.8 kg) light DRIED malt extract
1.0 lb	(454 g)10° L crystal malt
12.0 oz	(340 g) roasted barley
8.0 oz	(225 g) Belgian aromatic malt
8.0 oz	(225 g) black malt
8.0 oz	(225 g) chocolate malt
2.5 oz	(70 g) Belgian Special-B malt
1.0 oz	(28 g) UK Wye Challenger hops 6% a.a. (6 HBU/168 MBU) 60 min
1.0 oz	(28 g) UK Kent Golding hops 6% a.a. (6 HBU/168 MBU) 15 min
1.0 oz	(28 g) Cascade hops, 1 min
0.5 oz	(14 g) Australian Galaxy hops, 1 min
0.5 oz	(14 g) Australian Galaxy hop pellets, dry hop
0.25 tsp	(1 g) powdered Irish moss

Irish Ale type yeast

0.75 cup	(175 ml) corn sugar (priming bottles) or 0.33 cup (80 ml) corn sugar for kegging

Target Original Gravity: 1.053 (13.3 B)
Target Extraction Efficiency: 80%
Approximate Final Gravity: 1.016 (3.5 B)
IBUs: about 30
Approximate color: 48 SRM (96 EBC)
ABV: 5%

Directions

Place crushed grains in 2 gallons (7.6 l) of 150° F (68° C) water and let steep for 30 minutes. Strain out (and rinse with 3 quarts [3 l] hot water) and discard the crushed grains reserving the approximately 2.5 gallons (9.5 l) of liquid to which you will now add malt extract and 60 minute hops. Bring to a boil.

The total boil time will be 60 minutes. When 15 minutes remain, add the 15-minute hops. When 10 minutes remain, add Irish moss. When 1 minute remains, add the 1-minute hops. After a total wort boil of 60 minutes, turn off the heat.

Immerse the covered pot of wort in a cold water bath and let sit for 15-30 minutes or the time it takes to have a couple of homebrews. Strain out and sparge hops and direct the hot wort into a sanitized fermenter to which 2.5 gallons (9.5 l) of cold water has been added. If necessary, add cold water to achieve a 5.5 gallon (21 l) batch size. Aerate the wort very well.

Pitch the yeast when temperature of wort is about 70° F (21° C). Ferment at about 70° F (21° C) for about one week or when fermentation shows signs of calm and stopping. Rack from your primary to a secondary and add the hop pellets for dry hopping. If you have the capability "cellar" the beer at about 55° F (12.5° C) for about one week. Prime with sugar and bottle or keg when complete.

brewers accounts for only 6 percent of all the beer in the U.S. Forty percent of the hops in 6 percent of the beer. Now that's hop love.

But the threat of shortages is real. There is far more enticement to grow other crops on the land being used for hops. A decade of low prices has left farmers anxious about the future of hop farming. Will attitudes and demand change? Will beer drinkers' thirst and love affair with hops, hop farms, hop farmers, and hop magic change the paradigm? I went to Hop and Brew School in Paonia, Colo. for two days of hop learning, fun, and camaraderie in July. See what I discovered at ow.ly/cXECa .

For now, let's cut the shuck and jive and get on with the recipe.

Mango Mud is both a celebration of a classic dry Irish stout with the excitement of fruity and floral hops reminiscent of the character of mangos. That combined with the roast and toast character of caramelized and roasted malts and barley creates a vortex that transcends and takes you on a journey few have taken. In essence, Mango Mud is a synergy of chocolate and mango flavors and aromas without the bitterness of an IPA.

Charlie Papazian is founder of the American Homebrewers Association and author of *The Complete Joy of Homebrewing.*

ADVERTISERS INDEX

By Dave Carpenter

I Love You Beer, Worts and All

A year after I started all-grain brewing, as I was diagnosing a string of curiously hazy homebrews, I found that my thermometer had developed a bit of a negative bias. Advantageous, perhaps, for a future in politics, but of little use to the serious brewer. I discovered modest, yet tolerable, inaccuracy at water's boiling and freezing points, and splendid, glorious unreliability in the range of temperatures critical to mashing. Bother. An optimistic scale I might indulge (more hops!), but a dishonest thermometer I would not tolerate. So I went out and purchased an obscenely accurate and marvelously expensive model.

My beer cleared up straight away. But I began thinking: friends, family, and I had enjoyed with absolute sincerity every one of my murky, mis-mashed beers. Had our naïve appreciation been wrong? Did a new thermometer and bright beer suddenly invalidate our earlier experiences?

Of course not. Taking pleasure in a handcrafted, artisan product is the essence of our obsession, and infectious enthusiasm for our own little *objets d'art* can compensate for many a technical flaw. We enjoy myriad approaches to our hobby but share a common desire to create and savor. Sure, we'll endlessly debate how to get there, but I think we're all ultimately in it to quench a primal thirst for something satisfying, distinctive, and uniquely ours.

When I brewed my very first Belgian dubbel, I broke every rule of fermentation (I didn't know there *were* rules) and turned out something so lavishly fruity that I promptly christened it Carmen Miranda's Hat. But, you know, my girlfriend, my buddies, and I downed every last bit of it. It was neither what I'd set out to brew, nor a remotely faithful representation of the style, but it was beer, and something to be proud of. I delighted in those initial batches of stovetop extract beer every bit as much as I do the triple-decocted, first-wort-hopped exercises in madness that I create today with the help of assorted Rube Goldberg contraptions.

I don't suggest that we stop improving *how* we brew, but rather that we always honor *why* we brew. And there are as many reasons as there are brewers. For some, it's a way to relax on the weekend, a few hours spent not worrying and savoring several of one's past efforts. For others, it's an endless pursuit to nail the perfect example of a BJCP description. It's even rumored that some save money by crafting their own beer, though I firmly believe Sasquatch will be positively identified well before these individuals. But we all brew to create something unique, and regardless of our particular approaches, we share a most satisfying goal.

So enjoy the journey. When next you lie awake, obsessing over yeast or hot side aeration, try visualizing and counting airlock bubbles. You're a homebrewer, and a little uncertainty is OK.

Unless it's a Bavarian lager. The Reinheitsgebot allows a handful of ingredients, and imprecision isn't one of them.

Dave Carpenter is a writer and recovering engineer from Fort Collins, Colo. In addition to homebrewing, he enjoys hiking, skiing, traveling, and other gerunds. Follow him online at www.quaffablequips.com.

Photo courtesy of Dave Carpenter

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