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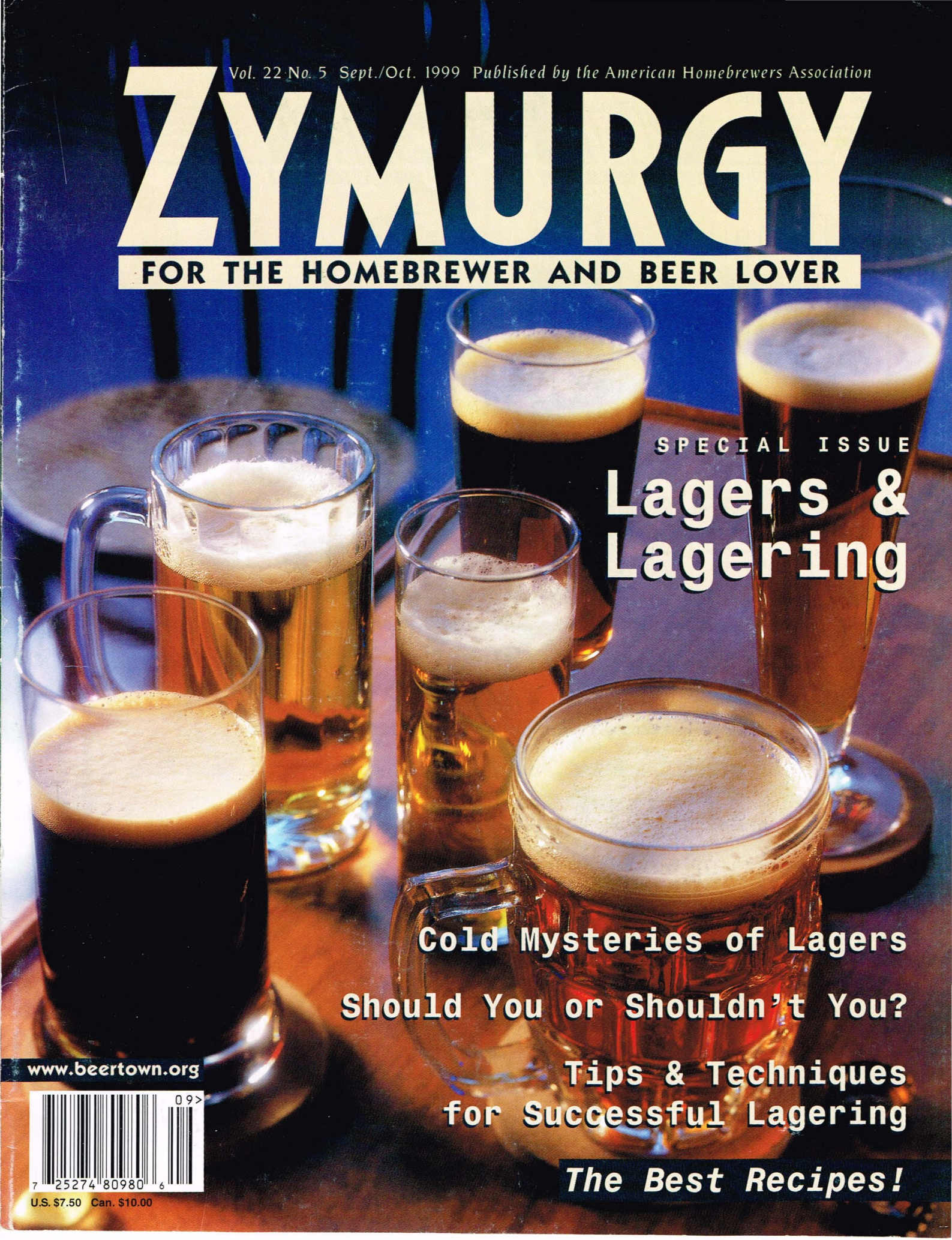
ZYMURGY

FOR THE HOMEBREWER AND BEER LOVER



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ZYMURGY®

FOR THE HOMEBREWER AND BEER LOVER

Journal of the American Homebrewers Association®

THE AMERICAN HOMEBREWERS ASSOCIATION® MISSION STATEMENT

To promote public awareness and appreciation of the quality and variety of beer through education, research and the collection and dissemination of information; to serve as a forum for the technological and cross-cultural aspects of the art of brewing; and to encourage responsible use of beer as an alcohol-containing beverage.

The American Homebrewers Association is a division of the Association of Brewers, 736 Pearl Street, Boulder, CO 80302-5006 USA. Membership is open to everyone. ***Zymurgy*** (ISSN 0196-5921) is the bi-monthly journal of the American Homebrewers Association and is published six times a year. Application of mail at Periodicals Postage Rate is Pending at Boulder, CO and additional mailing offices. Annual memberships are $33 U.S., $38 Canadian and $51 international and include a $24 subscription to ***Zymurgy***. **Changing your address? Let us know in writing or e-mail your address changes to service@aob.org.**

Zymurgy welcomes letters, opinions, ideas, article queries and information in general from its readers. Correspondence and advertising inquiries should be directed to ***Zymurgy***, PO Box 1679, Boulder, CO 80306-1679, (303) 447-0816, FAX (303) 447-2825, www.beertown.org. Via e-mail contact ***Zymurgy*** Editor Michael Bane at michael@aob.org.

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ZYMURGY®

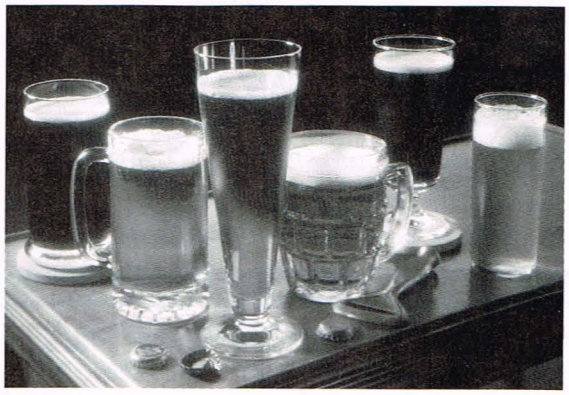
Zymurgy \ zī'mər jē \ *n: the art and science of fermentation, as in brewing.*

COLUMNS

DEPARTMENTS

COVER PHOTO BY RICHARD HARRIS PHOTOGRAPHY

FEATURES



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ASSOCIATION OF BREWERS INC.

The Association of Brewers Inc. is a Colorado nonprofit corporation for literary and educational purposes to benefit brewers of beer and all those interested in the art of brewing. The Association of Brewers is a not-for-profit trade Association under Section 501(c)(6) of the Internal Revenue Code.

The Association of Brewers has three divisions — American Homebrewers Association®, Institute for Brewing Studies, Brewers Publications — and one affiliate, Brewing Matters, dba the Great American Beer Festival®.

PAUL GATZA

I brew on the opposite schedule of most homebrewers. Many brewers take the summer off from brewing due to temperature and outdoor activity considerations. In the mountains of Colorado, however, summer temperatures are perfect for fermenting ales, and brewing on an all-grain tiered set up is an outdoor activity. My biggest challenge of brewing in the hills is not the yeast, malt, hops, temperature or equipment. The biggest challenge to my summer brewing is keeping the bears away.

"Fluffy the Bear" is the name Jean and I have given our frequent visitor(s), which somehow makes him less scary and more like part of the family. My first experience with Fluffy (a black bear) was when I attempted to compost my spent grain in 1994. I walked out one morning to find my six foot compost cage reduced to two feet, with grain spread all around. The following year I brewed outside in the morning and went to a party in the evening. My first thought when I returned was that an earthquake had hit. The earthquake was so selective that my next thought turned to Fluffy in the house. The entire contents of the refrigerator were emptied on the floor or carried out the window (now lying on the deck). Fluffy's favorite items were tea, maple syrup and butter, as evidenced by the toothmark in the butter dish. He headed to the basement of the dome and crushed a table that had malt extract on it. The sound must have scared him off, as he left fifteen gallons of boysenberry mead untouched only five feet away.

We now live near the bottom of a canyon that seems to trap the brewing smells and bring Fluffy the evening of each summer brewing day. The pattern last summer was a broken record. We brew, Fluffy comes by and rips the mud room door off its hinges, we fix door. We brew, Fluffy comes by and rips the mud room door off its hinges, we fix door. We brew—you get the picture.

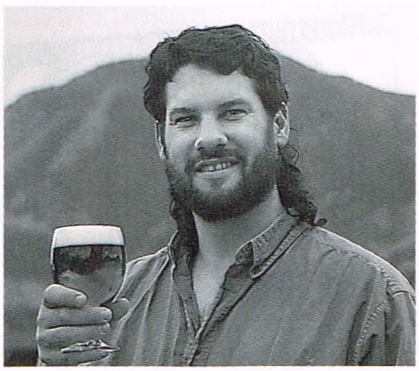


PHOTO BY BOB GOLDMAN

We may be rid of Fluffy. He has a habit of nosing open car doors and searching for food inside cars. Most people who don't lock their car doors in the hills that Fluffy roamed have scratched their heads wondering why their car door is open again. Fluffy got in a local car, the weight shifted, and the door locked behind him. The owner, awakened by his own horn at one in the morning, found Fluffy in his car. The division of wildlife tranquilized and relocated Fluffy. I expect Fluffy to be back soon.

Now that summer is winding down, it is time to gear up for the fall brewing season. In my homebrew supply shop days, many of the local homebrewers would take the summer off from brewing to return in September to replace tubing and other equipment and get batches going for the fall and the holiday season.

Brewers are at their most enthusiastic in September and October. This fall we are hoping to channel that energy into developing as many new brewers as possible.

Teach A Friend to Brew Day

The American Homebrewers Association has teamed with the Home Wine and Beer Trade Association in a joint project to create as many new brewers as possible with Teach a Friend to Brew Day on Saturday, September 18. We are calling on each homebrewer to find an interested friend who has not brewed before, take him or her to your favorite homebrew supply shop, select ingredients and any needed equipment and brew a batch on the eighteenth.

The success of the AHA Big Brew on National Homebrew Day the past two years will be the model for this event. HWBTA will promote the event to their retailer and wholesaler members. AHA will make a section of our www.beertown.org website available for brewers to sign in their friends as new brewers. We will also work with our registered clubs to get as much participation as we can. We will have a section for contacting the local media to generate press for homebrewing. More brewers brewing means more business for supply shops and wholesalers, which in turn means better access to better ingredients and equipment back at the local level. The relationship functions like a circle, or the rings after each sip on a glass of homebrew.

Teaching others to brew directly addresses our mission to promote the hobby of homebrewing as AHA members. I hope I can count on you to participate in this event.

AHA Board of Advisers Election Results

Rob Moline is the newest member of the AHA Board of Advisers, as selected by participating AHA members. Rob was an instrumental part of the first AHA Big Brew, served as a commercial brewer, has founded homebrew clubs, has been a regular participant in the technical online homebrewing community and works in the yeast business. His wealth of experience will be an asset to the board. Rob was sworn in at the AHA National Homebrewers Conference in Olathe, KS. Congratulations, Rob! The Board of Advisers is integral in the functioning of the AHA, providing experience and wisdom on the direction, programs and budgetary aspects of the AHA.

(continued on page 59)

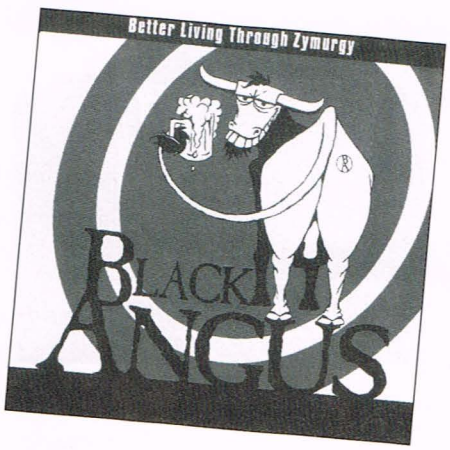
All Fermenting is Good Fermenting

Dear ***Zymurgy***,

I read Paul Gatza's editorial (May/June Vol. 22, No. 3) about the possible scenarios for the future of ***Zymurgy***, and I am writing to give you my input.

I have been a member of the AHA for about six years now, although I first bought Charlie Papazian's *Joy of Home Brewing* somewhere around 1984. But I looked through the book a few times and was scared to death. The whole process looked way too complicated at the time. It wasn't until 1993 when I picked up a copy of ***Zymurgy*** that I really got a sense of the fun and the limitless possibilities that homebrewing offered. I've been hooked ever since. But let me respond to some of the points brought up in the article. What about wine? The occasional story or moderate coverage of winemaking would not be objectionable to me. But I have no more interest in making wine than I do in making mead or cider, which I feel are covered in ***Zymurgy*** in just the right proportion. So I could see some coverage of grape growing and winemaking thrown in without "losing the integrity" of a beer magazine. You could say the same for stories about whiskey and distillers. But please, nothing about cigars. A fad that doesn't need any more attention than it is getting already.

Let me digress a bit here to say that when I first started homebrewing, I began subscribing to just about every beer publication that there is out there. Today, I only get ***Zymurgy*** and *All About Beer*. I like reading *All About Beer* to know what is out there, to learn about trends, what brewery is buying what brewery and so forth. I enjoy reading about the diverse world of commercial beer, though I don't necessarily buy much of it. First off because I live in Utah where anything over 3.2% has to be sold through



the state-owned liquor stores, where it is stored warm and could sit on the shelf for months at a time. Besides that, their idea of diversity is to offer beers from 20 different countries, but they are all light lagers, plus they charge a ridiculously high price for them.

So to finally make my point, I have enjoyed your cult beer articles, but I would definitely like to see more. I like the fact that you include a recipe for the style as well. So in my opinion, a lot more commercial beer coverage, and advertising, would be a big plus. I also used to subscribe to *Brewing Techniques* magazine. I enjoyed their technical articles, but eventually lost interest in the magazine because of their mixed homebrewer-microbrewer coverage. I very much enjoy your technical articles and would hate to see them relegated to the Internet.

I have saved every issue of ***Zymurgy*** I have ever received, and I refer to them often. If not always for information, then for inspiration. I would not like to have to start a notebook for articles that I had to print out, or even worse, boot up the computer to look at articles I had to save to disk. Part of the reasoning for on-line articles was to save on mailing costs. That makes me ask why ***Zymurgy*** switched from an uncoated stock to a glossy coated stock? The uncoated is lighter, cheaper, and ages much better. I also liked it better when they were perfect bound. Much easier to find a particular issue on the shelf. I enjoy ***Zymurgy*** very much, sometimes one issue more than others. The recent issue was of exceptional interest to me. Though I don't do the club thing, and competition holds no interest for me, I am sure it does for many. I always enjoy the World of Worts. A recipe all by itself is of little interest, but when accompanied by some background and some reasoning for the ingredients, it can be very interesting.

So keep up the great work.

Thanks,
Alex Gonzales
Salt Lake City, Utah
Home of Big Brew '99 site #9, the Black Sheep Brewers

Alex...Thank you for your comments. We appreciate them more than you know. Interestingly enough, we're looking at the uncoated paper stock option (although, sadly, perfect binding has gotten prohibitively expensive for a magazine of Zymurgy's *size). We will be doing another wine story, and keeping our fingers crossed. Maybe we should call the article Wine—The Phantom Menace. Ed.*

Wineless and Proud

Dear ***Zymurgy***;

In Paul Gatza's editorial in the May/June issue (Vol. 22, No. 3) he raised the question of devoting some advertising and content space in the magazine to winemaking. Though winemaking may in fact be a natural progression from homebrewing, I'd still rather that ***Zymurgy*** be "pure beer". I don't care if it makes the number of pages of ***Zymurgy*** less if it doesn't include winemaking. And I also don't really care much

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for reading about wine making. Keep it all-brew please.

Thanks for listening, and keep up the good work.

Dean Mitchell <dmitchel@prb.net>
Hollywood, MD

Ah, the other side of the question heard from! Here's a question for all of you—how about sake? Ed.

Another Fermenting Fan

Dear ***Zymurgy***,

Regarding Paul Gatza's request for input on the direction ***Zymurgy*** should take at this current fork in the road, permit me a brief (?) personal observation.

The very first thing I fermented was wine when I was about nine years old. I picked some wild grapes, smashed them in a bowl and poured the contents into a bottle and corked it. It blew up several weeks later. My next fermentation attempt was about 15 years later, again it was wine, using a primitive kit with dubious ingredients and the result was a hideous, undrinkable syrup. Then, five years after that, I finally tried making beer using a British Bitter kit that called for LOTS of sugar and a warm ferment and the final product was a fizzy, powerful, horrible beverage.

Several kit brews later I got brave and entered a few bottles in a local competition. The judging sheet had nearly straight zeros across the page with devastating critiques. The final judge's comment was "Don't give up/get help!"

I kept that judging sheet to remind me of my humble beginnings and I DID get help.

I joined AHA, started reading ***Zymurgy*** cover to cover, bought reputable brewing books, started buying ingredients from my local homebrew shop exclusively and started asking questions.

That was all 15 years ago. Now I have a homebrewer's "state-of-the-art" (my state, anyway) brewing system including a 15 gallon cut down boiling keg, propane jet burner, stainless-steel insulated mash tun, sparge vessel with rotating sparge arm and immersion wort chiller, and a fleet of 10 glass carboys including 6 1/2-, 6- & 5-gallon sizes, etc.

I've also got a wall full of award ribbons from competitions. My point here is that brewing and fermenting are an evolving process that can take you in a variety of directions. The skills and techniques that I've learned over the years to finally successfully brew beer have served me well to ferment other things as well. Currently I have three carboys of doppelbock lagering in the basement, one IPA in secondary upstairs as well as one in primary, two carboys of two-year-old mead, two carboys of hard cider and one carboy of three-year-old red wine from my own homegrown grapes. My airlocks are just as happy (sometimes as much as 6-8% more happy!) blowing CO_2 from cider and mead as they are from a pale ale.

I feel like I put as much creative process into my selection of honey types and herbs and spices for my meads and also my blending of apple varieties for my ciders, as I do in designing a grain bill and a hopping schedule for any of my beers. I spend just as much time considering my yeast strain choices and certainly the same care and attention sanitizing and handling (and cleaning) for them all. So, to me, the different kinds of fermentation are complementary, not exclusive. I encourage ***Zymurgy*** to continue to include, encompass and embrace ciders, meads and wines along with beer brewing. I think it will make a stronger, more informed and diverse group in the end.

Sincerely,
Brad Hunter
AHA # 25267

Thanks, Brad...Sounds like you're ready to start writing for **Zymurgy***! Ed.*

Wants More Anchor

Dear ***Zymurgy***,

The Cult Classics article in the May/June issue (Vol. 22, No. 3), featuring Anchor Steam was interesting and enjoyable. After finishing it, however, I felt like it wasn't complete. Looking back on it, I realized the following:

There was no tasting information. No comparison with other examples of the style. No serving recommendations. No discussion (speculation?) about the yeast used. No mention of commercially available yeasts that will give similar flavor profiles under similar fermentation conditions (other than those specified in the three recipes). No comparison to AHA style description. No discussion of relationship to cream ale. Is the beer filtered? How warm is warm conditioning? What is the carbonation level in volumes of CO_2?

History is nice, but the product resulting from the historical process is what it's all about, especially in the context of related styles and competing brands.

Stanley E. Prevost
Huntsville, Alabama
sprevost@ro.com

We'll include your ideas in the next Cult Classics article. Ed.

Hey guys! We're suffering from a LABEL SHORTAGE! Send us your homebrew labels, and we'll be happy to show your great art to the world. Send your labels to the Great Label Art Collection, *Zymurgy*, c/o Stephanie Johnson, PO Box 1679, Boulder, CO 80306.

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Will Smith—Louisville, CO
Dan Turczyn—Eastpointe, MI
Charles A Watson—Hillsboro, OR

For Information about AHA Sponsorship, call (303) 447-0816.

PAUL GATZA

Here is another in the series of what homebrew clubs are up to. The intention of this column is to gather good club ideas and put them out on the air for other clubs to review and try the ideas that club members may think would improve their home clubs.

We would like to take submissions by AHA club members. If you would like to submit an article, please do so in a Word format to paul@aob.org. I find a homebrew by my side helps me write, so give it a try. We may not be able to print all of the articles about each club, but encourage you to send in your club articles, experiences, ideas and projects.

Homebrew Clubs of the Year

Congratulations to the 1999 AHA Homebrew Clubs of the Year, the Oregon Brew Crew and the Urban Knaves of Grain. Both clubs scored 77 points on a 6-3-1 basis in the six AHA club-only competitions from August through May and the first and second rounds of the National Homebrew Competition. This information just came in at press time, we'll have full results in the next ***Zymurgy***. Thanks to Coopers Brew Products for sponsoring the AHA Homebrew Club of the Year.

Teach a Friend to Brew Day

Word of mouth about the hobby of homebrewing has traditionally brought the most new brewers into the hobby. It certainly is how I learned about the hobby. I was shooting pool at the New Wave Café in South Philadelphia with a Greenpeace buddy who told me he had started brewing beer. I scratched the felt on the pool table as he gave me all of the info in detail. Ten hours later I was waiting outside the door of

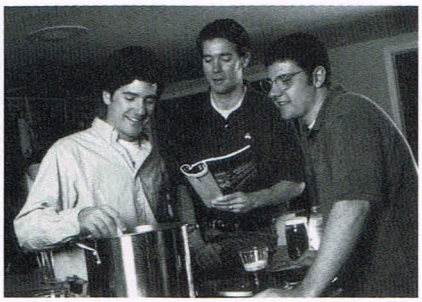


PHOTO BY BOB GOLDMAN

September 18, 1999 is Teach a Friend to Brew Day.

Home Sweet Homebrew as George Hummel opened his doors for the day.

Each of us knows someone who loves beer or cooking who may be interested in learning how to make beer. My neighbor Rose and I had a bet on the Stanley Cup Finals. If the Sabres won, I would teach her how to make beer; if the Stars won I would teach her how to make mead. Think of how happy your local homebrew supply shop owner would be if every customer brought in one more customer this fall. Your retailer would have a bigger customer base and better buying power and the ability to stock fresher ingredients and more equipment choices. The hobby (and many retailers) could use a vigorous boost like this right now.

I am asking each club officer or club newsletter editor to push September 18th as "Teach a Friend to Brew Day." Please talk about it at your homebrew club meetings and write about it in your club newsletter. Make a list of the new brewers and put it on our www.beertown.org website. We will have a packet on the website about how to generate media attention for the event. More brewers in your area mean more potential club members and potential AHA members, which make for a better club and a stronger AHA, able to run better programs for the membership.

This program is a joint project with the Home Wine and Beer Trade Association. The HWBTA is a trade organization that represents manufacturers wholesalers and retailers in our hobby. The AHA represents homebrewers. This project will benefit everyone involved in homebrewing in any way. Please visit www.beertown.org for more information. Thanks for your help.

Club-Only Competition News

As I mentioned last issue, we are reducing the number of bottles needed for club-only competitions from three to two.

The AHA would like to thank Bob Kauffman and Hop Barley and the Alers for hosting the Bockanalia AHA Club-Only Competition in May. This competition was the final one in the August to May cycle with points going toward the Homebrew Club of the Year trophy. Thanks to everyone who entered. There were 33 entries.

Congratulations to the following winners:

First Place

Jay Kash, Downers Grove, IL, representing Urban Knaves of Grain with his German-style Helles Bock/Maibock called "Helles Bock."

Second Place

Leo Vitt, Rochester, MN, representing Minnesota Timberworts with his German-style Doppelbock called "Rochester Doppelbock."

Third Place

Bruce Brode and Brian Vessa, Los Angeles, CA, representing Maltose Falcons Home Brewing Society with their German-style Doppelbock called "Instigator."

Homebrewer Paul Gatza is the softball coach for Hop Barley and the Alers, a Boulder, CO homebrew club.

AHA STAFF

It's That Time Again!

Yep, time to schedule the pilgrimage to the Mile High City for the 1999 Great American Beer Festival (GABF), October 7–10.

This year expect to see a much greater AHA presence at the preeminent beer festival. In addition to our customary Members Only tasting and homebrew demonstration, our own Charlie Papazian will be on hand, using his hands to hand out custom "I HAD A HOMEBREW WITH CHARLIE" glasses for new members who sign up at the GABF. They'll also be able to inscribe their names on Charlie's glass. Charlie has also promises to bring a selection of his own legendary homebrews.

The Members Only Tasting is Saturday afternoon October 9 at Currigan Hall in Denver. The evening sessions of the GABF often have 10,000 attendees. The Members Only Tasting has only about 1,500 attendees, all of whom are AHA or IBS members or their guests. That means lots of elbow room and no lines for the best beers in the country.

The AHA also announce the medal winners during this session of the festival. AHA members can purchase a pair of Members Only Tasting tickets for only $30, $30 less than the public session. The AHA has arranged travel packages for AHA members through Travel by Dana at (800) 348-4743. AHA staff and volunteer members will staff the brewing demonstration, AHA booth and GABF education areas of the festival.

Also as usual, we'll have plenty of homebrew for you to try. If you recall last year, those of you who were fast were lucky enough to sample the Smoked Coconut Porter, all the way from Japan. While the porter will be missing this year, we've got a couple of surprises up our sleeves, so be sure to stop by.

See you there!

Join the crowds in Denver! This year's GABF is scheduled for Oct. 7-10.

PHOTOS BY TOM DALLDORF

PROFESSOR SURFEIT

EDITOR'S NOTE: Well, we put on our heavy galashes and waded into the Byzantine ***Zymurgy*** *files to recover some of the Professor's previous words of wisdom on lagers and lagering. We won't tell you what all we discovered in those files, but it was a tossup on whether to call the bomb squad or a good exterminator! Here's the Prof on lagers ... MB*

Real Cold Bottling?

Dear Professor Surfeit,

My questions concern priming after bulk lagering. Perhaps I am complicating this matter unnecessarily, as all my references are rather vague about this. Should I bottle at lagering temperature or raise the beer to the yeasts' primary fermentation temperature range? If I raise the temperature, will that not cause precipitated chill haze to dissolve back into solution?

Should temperature shock be taken into consideration, or is the effect of yeast mutants on the taste negligible at this time? Finally, if I bottle at 35 degrees F (1.5 degrees C), I'm assuming the carbon dioxide content to be about 1.7 volumes and that I would lose about 0.5 volumes during bottling. Does this sound about right to you?

Concerned, but not worried,
John Krueger
Oshawa, ON

Dear John,

Hey, man, keep it cool. I'm assuming you are bulk lagering with a fermentation lock and not pressure lagering your brew. Let me address at random several of your concerns.

If you've cold lagered long enough, most of the chill haze may have settled out to the bottom of your vessel. Keep the beer calm when transferring and do not disturb.

Why would you assume that your carbon dioxide would be 1.7 volumes? If your fermenter is not pressurized, then there would be very little carbon dioxide in solution.

What if you were to bottle a beer with a known volume of dissolved carbon dioxide then cut your kraeusen or priming sugar down. How much? Hmmmmm, don't forget I'm a homebrewer.

No mutants,
The Professor, Hb.D.

Frozen Beer

Dear Professor Surfeit,

I am not familiar with the term "zymurgy." Can you explain?

Normally, I keep my homebrewed beers (and those I buy) stored in a shed. I think the temperature indoors is too high (about 70 degrees F/21 degrees C). Our summer temperature is mostly moderate and we usually have mild winters. Here is my question:

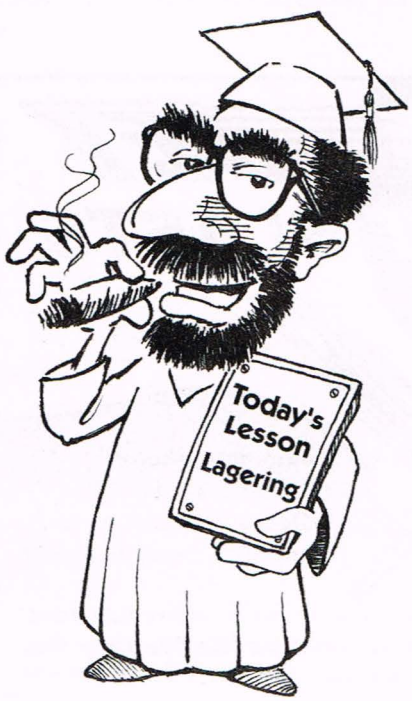


ILLUSTRATION BY JOHN MARTIN

last winter was severe (14 degrees F/-10 degrees C) so I decided to keep the temperature at 33.8 degrees F (1 degree C) with electric heating, which costs me a lot. Did I make the right decision? What is the freezing point of a beer with say 5, 7.5, or 10 percent alcohol by volume? I thought I figured out by myself (29, 27, 25.5 degrees F respectively), but it did seem unreal to me.

Make haste slowly in answering since springtime has arrived!

Sincerely,
Hans Aikema
Hoorn, Holland

Dear Hans,

Zymurgy is the last word in my dictionary and refers to the science and art of yeast fermentation as in brewing.

At what temperature will beer freeze? Well, it depends mostly on the alcohol content. The stronger the beer the lower the temperature required to freeze. I've also noticed that freezing is pressure sensitive. A supercooled beer that is liquid will quickly ice up when the cap is popped off. Agitation also will enhance the freezing of brews.

For your information, many lager breweries will routinely lager their beer at 30 degrees F (-1 degree C) without freezing. Perhaps some of our colleagues out there in beer land know a bit more about beer freezing temperatures. In the meantime keep it above 30 degrees F.

Downhill brewski,
The Professor, Hb.D.

In Search of Real Pils

Dear Professor Surfeit,

I have been a homebrewer and an AHA member for six years during which time I have made some excellent beer. ***Zymurgy*** has been an immense help.

As a member of the U.S. Army, I have had the good fortune to spend six years in Germany where I developed a strong preference for the average German Pils found on draft in most local gasthauses. My original interest in homebrewing was to as nearly as possible duplicate that style of beer. However, somewhere along the way I lost my focus among the stouts, ales, etc. Also, I must admit that my early attempts at light lager were drinkable, but nothing like what I was trying to produce.

Now that I have been introduced to liquid yeast, partial mashes, a full boil and the Cornelius keg, I am again pursuing the German Pils. Recently, I have been using light dry malt (5 to 6 pounds) and liquid yeast in recipes such as Charlie's Tempestuous Pilsener (***Zymurgy***, Winter 1989 Vol. 12, No. 5). The beers are clear, clean, with good color and head retention. However, they are still not what I am looking for. The problem is a residual sweetness and a sharp, spicy hop flavor. The German Pils I remember has a bitter aftertaste and a mellow hop flavor. I am not sure I can do much about the hop flavor because most homebrewers and microbrewers have it (i.e., Samuel Adams). These beers are great but not really close to what I'm trying to duplicate.

The second problem, residual sweetness, I believe is caused by high terminal gravity. I seem to always finish up near 1.019 since I started using the liquid yeast and all DME. My sanitation is meticulous and I ferment single stage in either a seven-gallon or five-gallon carboy with blowoff.

I have a refrigerator that I use to ferment my lagers at about 45 to 50 degrees (7 to 10 degrees C). Still, I finish at high gravity. For instance, the Tempestuous Pilsener was made exactly according to the recipe using Wyeast 2007 (St. Johns) and lagering for 1 1/2 months. It finished at 1.080 SG. It was good, but too sweet and spicy to be a German Pils. Sure looked like one when pumped out of the keg at 18 pounds. I have an ale in the fermenter with Chico Ale Wyeast stopped at 1.019. Can you advise me on a way to get a fuller ferment? Do I need more than a 24 ounce starter? I use about .75 cup DME boiled and cooled. My starter never really goes crazy, but my beers seem to start in about 12 hours. Any suggestions on working with these liquid yeasts and starters would be helpful to those of us just beginning to use them. I have the ***Zymurgy*** yeast special issue (Vol. 12, No. 4). I am after a fuller ferment from these liquid yeasts. So far, I really believe I got lower terminal gravities from dry yeast but the beers were not nearly as clean tasting.

I recently had a friend bring me a couple of Pils back from Germany (the ones you get here don't compare) and I verified the taste I'm looking for. Can I make them or must I just go back to live in Germany? I intend to try the "What the Helles" recipe next (***Zymurgy***, Winter 1990 Vol. 13, No. 5). Maybe the partial mash will give me a better ferment than with all DME.

Thanks for your great publication and all the interesting things AHA organizes.

Sincerely,
Charlie Riordan
Hanover, MD

Dear Charlie,

Nice name.

If you are trying to duplicate that German Pils taste, give your water some attention. The mineral content of the brewing water will greatly affect the hop flavor and bitterness perception for a German Pils. You want a relatively soft water. Keep your sodium and calcium less than 30 ppm, your magnesium less than 110 ppm, your sulfates less than 200 ppm and your chloride less than 200 ppm. This would fit a typical German Pils profile.

If you've been following the latest information on how to calculate International Bittering Units, then you know to keep the IBUs at or around 30 to 40. Your original gravity should be about 1.044 to 1.050 and final alcohol 4-5% percent by volume. Use a "noble-type" hop such as Hallertauer, Perle, Tettnanger, or Spalt grown in Germany for that hop flavor and bitterness you're looking for. German Pils has some degree of sweetness. You want that. I suspect your water and your hop quality are a bit askew. Try fooling around with those two things first.

How to get better attenuation, or a fuller ferment, as you say? You've got to take care to really aerate that wort before pitching. And use a good starter. Why not try using the sediment from your last batch of similar brew. The correct amount of yeast really helps a lot; use about a cup of the pasty sediment. That amount is pretty hard to culture up from a starter. You'd need a sediment from a couple of gallons of starter for that amount.

Doing a partial mash rather than using all malt extract will help you in your quest; as a matter of fact, you will get there with a partial mash.

Let me know how it all works out,
The Professor, Hb.D.

Lager Problems

Dear Professor Surfeit,

Hello. I am an all-grain brewer who, for the most part, has learned a great deal from your publication and its contributors. I do not do anything without first thinking out what it is I am going to do, so I can use as much information as possible in making my decision. I hope becoming a member will open new avenues of success in my brewing. My tastes in beer styles are not limited, but I do lean toward Pilseners and European lagers. I do not care much about porters, stouts, wits, krieks or even wheat beers. I would characterize my favorite style as either a low or extremely high-gravity style of lager such as doppelbock or Czech Pilsener. Because of my preference for lager styles I have run into many problems in trying to brew them.

My question is this: what options exist for the homebrewer who must work in limited space (small apartment) to maintain a proper fermentation temperature? Currently I brew primarily in the winter and pull up the carpet in one of my closets and set my carboy on the cold cement. This maintains a temperature of about 60-70 degrees F (16-21 degrees C). Although I have been successful in reducing off-flavors (buttery, medicinal), once my fermentation is complete and fining agents are added I often cannot get my beer to condition properly. How do I maintain a constant fermentation temperature?

Sincerely yours,
Miguel Mayo
Denver, CO

Dear Miguel,

I'm assuming that when you say you can't get your beer to condition properly you mean no carbonation. If this is the case I'd suggest that when you add your priming sugar, you also add some fresh yeast. That should help.

How to maintain constant temperature? Well, for the type of beers you want to brew, lagering at cold temperatures is your best bet. If you do have room for an extra refrigerator, that would be the ticket. Otherwise I'd suggest that after vigorous (and heat producing) primary fermentation is done in your cool, dark closet, insulate your beer with a sleeping bag or other such material. This will not keep your beer any cooler, but it will inhibit temperature fluctuations.

Adios for now,
The Professor, Hb.D.

Helles Water Problems

Dear Professor Surfeit,

I live in Huntsville, AL, and want to brew a Münchner helles like the one served at the Hofbräuhaus in Munich. I have a question about brewing water treatment.

According to the chart on page 273 in *The New Complete Joy of Home Brewing* by you-know-who, my water supply is similar to the Munich water. Here is the comparison in ppm:

	Munich	Huntsville
Calcium	70-80	72
Sulfates	5-10	10
Magnesium	18-19	10
Sodium	10	6.2
Chloride	1-2	9
pH	Not given	7.5

I understand that the Munich water did not need treatment for brewing the dark beers of the 19th century and perhaps earlier. David Miller's *Continental Pilsener* states that "It was in the 1920s when applied chemistry had advanced to the point where brewers could make both light and dark-colored beers from the same water."

My question is what do the Munich brewers do to treat their water for brewing the helles? I would like to try the treatment.

Tiki Tiki Tiki Hoi Hoi Hoi
Del Bradford
Huntsville, AL

Dear Del,

Some Munich area brewers with carbonate hardness problems and higher pHs will acidify their mash in order to get their pH down. They do this by essentially culturing up a lactic-acid-producing sour mash and adding it proportionally to their main mash to get the pH down. But your pH is pretty good. I wouldn't mess around with it. You should be able to make a pretty good helles with the water you have.

Go for helles,
The Professor, Hb.D.

Secondary Foamers

Hey Prof:

My dry-hoppin' habit has got my bottles a-poppin.' What am I doing wrong?

My latest example is a nice Continental Pils. After three weeks in a glass primary at 45-55 degrees F (7-13 degrees C), I racked to another carboy *(continued on page 59)*

CHARLIE PAPAZIAN

A Castle Golden Pilsener, Please

I was on a train journey...comfortable ...relaxed...cold beer in hand. The landscape slithered by highlighted by the glow of the setting sun. The steam engine chugged ahead, leading us around another horseshoe bend. Two minutes earlier I had watched the sun balance on the horizon. Now, a full moon rose on its own horizon. I opened the window wider, took a deep breath and another long draw of beer. A baboon (thirstfully, I swear) watched me from the dry grasses along the railroad sidings. Sucking the foam off my mustache, I tried to recount the experiences of the past few days, but I continued to be distracted by the frequent stops during this overnight journey northwards.

In the middle of nowhere, shadows and silhouettes got off and on, their chatter muffled by the mysteriousness of these places. No vehicles were waiting at any of these stations; only people, donkeys, two-wheeled carts and the glowing embers of small fires, comforting in the stillness along the sidings. The full moon rising added a sense of mystery. Like standing black paper cutouts, silhouetted trees dotted the landscape. I knew there were small villages beyond the shadows the moon cast. In these villages I was sure people brewed beer–of that, I was certain.

As the train silently pulled away, I could hear people chatter, Shonna and Ndeble among bits of English. Sure there was beer out there. But there were people, too. I felt a very strong urge to just get off at one of the next stops. Wouldn't it be interesting, I fantasized, to simply get off with the one small bag of belongings I had and go encounter the unknown of this African night. I took another sip of Castle and promised myself I'd be back someday and do just that.

Siding the Rails

I was on the Zimbabwe National Railway journeying from Bulawayo to Victoria Falls to catch my long flight back home to Colorado. At the same time I was enjoying the local beer—the one in my hand and the ones of the past few days. I had learned to appreciate the commercially produced beers because I had had the privilege of attending an international convention of southern and central African brewers. The variety of cultures and beer styles and quality of life were far better than what I had—incorrectly—anticipated.

The all-malt Reinheitsgebot Windhoek lagers of Namibia, the aromatic and hoppy Zambezi Lager of Zimbabwe, the stouts and fruit beers of South Africa all provided thirst-quenching relief from the late summer sun of southern Africa. Castle Lager and Castle Pilsener provided welcome rehydration as I canoed the Zambezi River for days earlier in the week. The elephants 20 feet away along the river banks, hippos sloshing their way only yards from our evening campsites, the distant roar of lions, the ominous crocs lining the riverbanks and the nighttime hyenas skulking through the campgrounds were not beer hallucinations. The beer helped, believe me, though one was wise not to drink too much in the evening. Late night trips to the potty were discouraged as a sure invitation to nighttime encounters best left to the stupid. The morning sun was always a welcoming light to my bladder.

But as a brewer and enthusiast of indigenous beers, the real treat of this journey was the discovery of native and commercially brewed opaque sorghum beer. I feel quite certain these beers were among the first beers brewed, perhaps paralleling the beers of ancient Mesopotamia and Egypt. Unfortunately for historians, we haven't yet discovered the beer records (if they exist at all) of the peoples of southern and central Africa. But unlike the ancient Mesopotamian and Egyptian brews, these sorghum beers were now a living tradition. It made all the sense in the world that these people have been making these beers for millenniums. Why?

Sorghum is a grain that grows well in semiarid regions of Africa. It can easily be made into malt and has adequate enzymes to convert itself into the essential sugars and fermentables that become beer. People are known to roast all or a portion of these grain malts to produce a variety of flavors and colors in their beer.

Beer Milkshakes

Did I say beer? Well, yes I did, but to most of the Western world opaque sorghum beer would hardly be recognized or considered as such. In reality, it has far more tradition and importance as a nutritional food than any Pils, bock, pale ale or stout.

I visited the small Chibuku Brewery in the municipality of Dete. The brewery was one of dozens of Chibuku Breweries in southern Africa commercially producing opaque sorghum beer. It was at the Institute of Brewing's convention and during my visit to the brewery where I began my sorghum beer education. More than half of all the beer consumed in South Africa, Botswana, Zimbabwe and neighboring nations is not light lager, but Chibuku-type sorghum beer. Here at the tiny brewery in Dete they were churning out 10,000 to 12,000 hectoliters per month (that's about 8,500 to 10,000 U.S. barrels; one barrel equals 31 gallons).

How is it made? Malted sorghum is ground to a medium-fine flour; maize (corn) is also added in some formulations. The flour is "mashed" into hot water and converted into soluble starches and fermentable sugars. From the mashing vessel the sweet liquid is passed through a simple screen, removing only the coarsest pieces of grain. The fine flour and sweet liquid enter a stainless-steel tank where it is cooled. Yeast is added, and so are a couple shovels full of freshly milled sorghum malt. On the same day, the mixture is packaged and shipped to retail outlets and beer halls. What a concept! Brewed and packaged in one day. And get this, folks: the beer is not alcoholic when it leaves the brewery. What are you gonna do now, taxman?

The beverage is designed to ferment in the package or the holding tanks serving draft beer. After one day, the beer is one percent alcohol. It has a creamy texture much like a thick milkshake. The yeast has begun to ferment the sugars into alcohol, but that shovelfull of malt at the end of the process wasn't for cheap thrills. No, at that point the loads of *lactobacillus* bacteria inoculate the sweet liquid and, at the warm African temperatures, a lactic souring slowly evolves over the ensuing days. After 24 hours the beer is slightly acidic in taste and the aromatic character strongly reminiscent of yogurt. (But remember there is no milk in this beverage.) The tannins from the sorghum husk contribute an evident astringency.

Sweet and Sour

The taste is a pleasant blend of sweet and sour. Carbonation is beginning to develop naturally. The bready aroma of yeast begins to emerge. I liked it quite a bit, though I could imagine something like this would be even more delicious with fruit or chocolate flavor served at cold temperatures.

And it's healthy. As a matter of fact, sorghum beer is an important part of the nutritional intake of many Africans. It is a fact that fermented grain is more nutritious than nonfermented grain.

Day two and the alcohol develops to three percent. Day three, three percent. On the fourth day, the worm will emerge. This is when you know it has reached its prime. Alcohol, acidity and flavor balance to achieve the preference most enjoyed by Chibuku enthusiasts. Oh yes, the worm? No, not the wiggly kind, but rather the foaming fermentation that emerges from the pinhole atop the milk cartonlike container.

Enthusiasts may likely be found wearing a Chibuku Brewery T-shirt with the slogan, "Hari Yemadzisahwira." It is the Chibuku version of "Relax. Don't worry. Have a Homebrew." More accurately it is a phrase that relates that with good beer, there are friends to be made.

Commercially made Chibuku is quite popular, but the homebrewed stuff is even more so. Instant 24-hour homebrew kits are readily available in South Africa, as well as "all-grain" traditional homebrew kits. But most sorghum beer is made to village or family recipes handed down through generations, using 100% home-malted sorghum. I've tried my hand with the 24-hour mix-and-wait homebrew and must admit it is quite reminiscent of some versions of the real thing. Unfortunately, while very popular and accessible in parts of southern Africa, you won't find many homebrew shops carrying inventory this year.

HOMEBREW BITTERING UNITS (HBUs) are a measure of the total amount of bitterness in a given volume of beer. Homebrew Bittering Units can easily be calculated by multiplying the percent of alpha acid in the hops by the number of ounces. For example, if 2 ounces of Northern Brewer hops (9 percent alpha acid) and 3 ounces of Cascade hops (5 percent alpha acid) were used in a 10-gallon batch, the total amount of bittering units would be 33: (2 x 9) + (3 x 5) = 18 + 15. Bittering units per gallon would be 3.3 in a 10-gallon batch or 6.6 in a five-gallon batch, so it is important to note volumes whenever expressing bittering units.

INTERNATIONAL BITTERNESS UNITS (IBUs) are a measure of the bitterness of a beer in parts per million (ppm), or milligrams per liter (mg/L) of alpha acids. You can estimate the IBUs in your beer by using the following formula:

$$\text{IBU} = \frac{(\text{ounces of hops} \times \% \text{ alpha acid of hop} \times \% \text{ utilization})}{\text{gallons of wort} \times 1.34}$$

Percent utilization varies because of wort gravity, boiling time, wort volume and other factors. Homebrewers get about 25 percent utilization for a full one-hour boil, about 15 percent for a 30-minute boil and about 5 percent for a 15-minute boil. As an example, 1 ounce of 6 percent alpha acid hops in five gallons of wort boiled for one hour would produce a beer with 22 IBUs:

$$\text{IBU} = \frac{1 \times 6 \times 25}{5 \times 1.34} = 22 \text{ IBUs.}$$

METRIC BITTERNESS UNITS (MBUs) are equal to the number of grams of hops multiplied by the percent alpha acid.

The soothing clickety-clack of the train and my third Castle Pilsener helped me recall my visit to the beer gardens of Bulawayo the day before. I had remembered an article in the 1984 issue of ***Zymurgy*** about "The Beer Gardens of Bulawayo." Now, 13 years later, the little worm of intrigue materializes, and I'll-be-damned-if-I-wasn't-going-to-find-a-fabled-beer-garden.

Disappearing Beer Gardens

I had discovered early on there weren't any beer gardens in Bulawayo town. Outside my hotel I told a parked cab driver of my intentions.

"You wanna do what?"

"Yeah man, I wanna go to one of those sorghum beer gardens. Can you take me there and will I be able to find a cab ride back?"

Richard, the cab driver, looked a bit perplexed, but finally shrugged his shoulders and abandoned himself to my crazy fantasy.

"Sure man, but you aren't gonna find a cab out there to get you back. I'll tell you what, I'll stick with you for as long as you want to stay. Buy me a beer and let me know when you want to come back."

Off we went to the western suburbs of Bulawayo and out to the Mashumba Beer Garden in Makakoba Township. The streets were dimly lit, but there was no shortage of people walking to everyday destinations. We pulled over and stopped in a well-lit area. Women sat on the gravel selling vegetables and snack food. There was a continuous bustle of activity—the place was alive.

We entered through a grand gate in the brick and cinder block garden wall. My first impression was one of lots and lots of people in quiet, happy conversation. Benches haphazardly lined the grounds, which extend beyond the maze of half-high walls. To get a "draw" of brew we stood in line and picked up a rather intimidatingly large five-liter white plastic bucket. "Where are the glasses?" I wondered. I didn't wonder too long.

"Two liters or four?"

"Two," I blurted. One can't be too cautious with these kinds of experiences, you know.

Slooooosh, the brew gushed out of its dispenser and within 0.84 seconds my bucket contained two liters of fermenting, sour smelling, yeasty, thick, beery, alcoholic and wonderful Chibuku.

Richard and I found a bench occupied by several other men and women. We passed around our suddenly communal bucket and shared its glories. Every time it was my turn, I grabbed the sides of the bucket with my thumbs and fingers, swirled the contents (to get the good stuff into suspension), inhaled the pungently sour lactic aroma (repeating in my mind a mantra, "Charles, there are no known pathogens that can survive in beer. Charles, there are no known pathogens that can survive in beer. Charles, there are ...."), took a good healthy swig and began to feel the camaraderie, the glow, the conversation, the culture and the urge for another. The conversation became more animated and Isaac, a stringer of tennis racquets, found questioning me easier and easier:

"How far is America from here?"

"Where is your family?"

"Why are you here?"

"Who are you?"

A Cultural Faux Pas

After my sixth swirl and swig, I noticed Regina's smile begin to fade into a frown directed at me. She was a rather large, robust, healthy woman who had taken a liking to Richard, my cab driver. Her mood has changed each time I swirled my bucket of brew. By the sixth go 'round, swirl and swig, she was watching me with a bothered look. I wondered what I did.

Finally, her patience reached an end and she let out a sigh. Our small group had became silent. I offended? What? What have I done but sip this brew that hath no pathogens?

Seated with hands on her wide hips and a slight friendly tilt of her head, she eased the muscles on her face and pleaded, "Sir, will you *puleeeeeeeeaase* keep your thumbs out of the bucket."

Red faced and totally embarrassed I thought to myself, "And I was concerned about pathogens!" This issue of thumbs out of the bucket was clearly a much more important consideration while drinking in the beer gardens of Bulawayo. A consideration one could never learn in any book about Bulawayo beer garden etiquette. I learned a very important cultural lesson.

I can still recall the clean aftertaste and the desire to have just one more swig. It grew on me. I must admit, it grew rather slowly, but one does develop a taste for the unique. It doesn't come easy. But when you've acquired it–well, perhaps you will find out for yourself someday.

Richard and I polished off our two liters and some of theirs as well. As I climbed into the cab to leave I couldn't help notice a sign high on the building next door to the beer garden:

"Mushumbo Surgery, M-W-F, 1 - 4 p.m."

Hmmmmmmmm, I wonder if the beer garden is open before noon?

"Let's go, Richard, I need a Castle now."

The train pulled into Victoria Falls Station at 7 a.m. I'd had a reasonable nights' rest and a pleasant recollection of my two and a half weeks of experiences. My plane was scheduled to leave the next day. I know I'll be back someday. Gemuchlichkeit, Prost, Cheers, To your health...Hari Yemadzisahwira. Or like I said, "Relax. Don't worry. Have a homebrew."

World traveler Charlie Papazian is the founding president of the Association of Brewers and the author of numerous best-selling books on homebrewing. His most recent books are *Home Brewers Gold* (Avon, 1997), a collection of prize-winning recipes from the 1996 World Beer Cup Competition, and *The Best of Zymurgy* (Avon, 1998) a collection of the best articles and advice from 20 years of *Zymurgy*.

Zimbabwe Zephyr Sorghum Beer

If I could find the ingredients here's how I'd proceed:

Ingredients for one U.S. gallon

1.5 lbs finely crushed sorghum malt
ale yeast
water

Mash the malt flour with three quarts of water at about 156 degrees F (69 degrees C). Hold this temperature for 30 to 60 minutes. Complete conversion is not critically important. Quickly pour the mash through a wire mesh strainer. Rinse with 165 degree F (74 degrees C) water until a volume of one gallon is reached. Cool to about 75 degrees F (24 degrees C). Add yeast and about .25 cup of freshly milled sorghum malt flour (this contributes *lactobacillus* bacteria). Keep temperature above 75 degrees F (24 degrees C).

Begin to drink and experience after 12 to 24 hours. Keep your thumbs out of the bucket–and remember, it's an acquired taste.

AUGUST

20-22 1999 New Mexico State Fair PRO-AM, **AHA SCP**, Albuquerque, NM. Entries due 8/1/99 through 8/7/99 with $6/1st entry and $4/additional entries. Awards ceremony is on 9/4/99. Contact Bill Aimonetti at (505)286-2746 (h) or (505)822-7103 (w), email: Bill.Aimonetti@abq.sc.philips.com, http://www.angelfire.com/nm/DukesofAle.

28 Michigan State Fair Homebrew Competition, **AHA SCP**., Detroit,MI. Entries due 7/19/99 thru 8/1/99 with $12 entry fee. Judging is 8/8 thru 8/21/99. Contact Bill Holmes at (734)761-5315 (h) or (734)647-0459 (w), email: bholmes@umich.edu, http://hbd.org/michigan/.

28 Mt. Brewer Open '99, **AHA SCP**, Huntington, WV. Entries due 8/1/99 through 8/13/99 with $5/1st entry and $3/each additional entry. Contact Jeff Boggess at (304)757-0337 (h) or (304)744-7535 (w), email: Brudr@aol.com.

29 Western Washington Amateur Beer Competition, **AHA SCP**, Puyallup, WA. Sponsored by the Western Washington Fair. Entries due by 8/21 with $4 entry fee. Contact Grace Nilsson at (253) 845-9791, www.thefair.com.

SEPTEMBER

6 Majestic Brewing Cup Series 1999 - English Strong/Old Ale, **AHA SCP**, Louisville, CO. Sponsored by Majestic Brewing Company who will brew and serve the BOS at their brewery. AHA Category 10a only. Entries due 8/30/99 thru 9/3/99 with $5 entry fee. Contact Chris Munzer, Brewmaster at (303) 666-5914.

1-18 Fort Lauderdale American Brewoff, **AHA SCP**, Fort Lauderdale,FL. Entries due by 9/11/99 with $6 entry fee. Contact David M. Fisher at (954)570-8737 (h) or (954)698-0828 (w), email: davef@mediaone.net, http://www.pompano.net/~davef/flab/competition.htm.

25 2nd Annual Cactus Challenge, **AHA SCP**, Lubbock, TX. Entries due 9/13/99 with $7 entry fee. Contact Mike Sawyer or Lubbock Homebrew Supply at (806) 797-5163 or (800) 742-BREW, email: msawyer@door.net or lubbockhomebrew@door.net.

25 4th Annual Music City Brew-Off, **AHA SCP**, Nashville, TN. Entries due 9/6/99 through 9/18/99 with $5/1st entry and $4/each additional entry. Contact Steve Johnson at (615)327-4100, email: MusicCityBrewers@yahoo.com, http://www.ThePorch.com/~homebrew.

25 Northern New England Regional Homebrew Competition, **AHA SCP**, Rockport, ME. Entries due by 9/22/99 with $5 each or $4 each for 5 or more entries. Contact Thomas J. O'Connor, III, M.D. at (207)236-3527 (h) or (207)596-8900 (w), email: toconnor@nehealth.org.

25 Pacific Brewers Cup 99, **AHA SCP**, Los Angeles, CA. Entries are due 9/1/99 through 9/17/99 with $6 entry fee. Awards Ceremony will take place on 10/2/99. Contact Craig Corley at (310) 397-3453 or (310) 452-0310 (h), email: brewmaster@pacificgravity.com, http://www.pacificgravity.com/pacbrewcup99.

OCTOBER

2 Arizona State Fair, **AHA SCP**, Phoenix, AZ. Open only to Arizona residents. Entries due by Sep 10, 99 with $3 entry fee. Contact Joan Di Pasquale at (602)252-6771 (h) or (602)867-8071 (w), email: smdl@home.com.

4-16 The Derby Brew Club 6th Annual Homebrew Competition, **AHA SCP**, Derby, KS. Entries due 9/20/99 through 10/1/99 with $6 per entry. Judging takes place 10/4 through 10/16. Awards Ceremony is on 10/16/99. Contact Kip Innes at (316)788-4787 (h) or (316)523-6894 (w), email: kbinnes@aol.com, http://clubs.yahoo.com/clubs/derbyksderbybrewclub.

15-16 Bidal Society of Kenosha Homebrew Competition, **AHA SCP**, Kenosha, WI. Entries due by 10/2/99 with $6 entry fee. Contact Arthur Steinhoff at (414)539-2004.

16 Oktobersbest, Zinzinnati, **AHA SCP**, Cincinnati, OH. Entries due 9/24/99 through 10/8/99 with $5/1st entry and $3/additional entries. Contact Jeff Seeley at (513)231-6062, email: Infuser@aol.com, http://home.fuse.net/cincinnatimaltinfusers.

30 Hoppy Halloween Challenge, **AHA SCP**, Fargo, ND. Entries due 9/27/99 thru 10/15/99. Entry fee is $7ea/1st 4 entries, $5ea/over 4. Contact Susan Ruud at (701)282-8830 (h) or (701)231-8445 (w), email: sruud@badlands.nodak.edu, http://www.linkup.net/users/dtrautmann/phc1.html.

NOVEMBER

19 The Great Brews of America Classic Beer Festival, **AHA SCP**, Lake Harmony, PA. Entry fee is $5 per entry. Contact Shelly Kalins at (570)722-9111, ext. 800, email: srinfo@splitrockresort.com, http://www.splitrockresort.com/beer.html.

FEBRUARY 2000

5 War Of The Worts V, **AHA SCP**, Lahaska, PA. Sponsored by Keystone Homebrew Supply & the Keystone Hops. Entries due 1/15/00 thru 1/29/00 with $6/1st entry, $5/each subsequent entry. Contact Alan Folsom at (215)343-6851 or (215)628-0353, email: folsom@ix.netcom.com.

ILLUSTRATION BY JOHN MARTIN

AHA SCP = American Homebrewers Association Sanctioned Competition Program

The Calendar of Events is updated weekly and is available from the Association of Brewers: info@aob.org or www.beertown.org on the web.

To list events, send information to ***Zymurgy*** Calendar of Events. To be listed in the November/December Issue (Vol. 22, No. 6), information must be received by September 1, 1999. Competition organizers wishing to apply for AHA Sanctioning must do so at least two months prior to the event. Contact Brian Rezac at brian@aob.org; (303) 447-0816 ext. 121; FAX (303) 447-2825; PO Box 1679, Boulder, CO 80306-1679.

• KUDOS •

AHA SANCTIONED COMPETITION PROGRAM

• MARCH 1999 •

Hudson Valley Homebrewers 9th Annual Competition
Hyde Park, New York, 223 entries - Ray Sykes of High Falls, New York won best of show.

• APRIL 1999 •

1st Annual Palmetto State Brewers Open
Columbia, South Carolina, 88 entries - Ron Thomas of Silverton, Oregon won best of show.

Spring Thing 99
Albuquerque, New Mexico, 103 entries - George Fix of Arlington, Texas won best of show.

Bluff City Brewers 11th Annual Homebrew Extravaganza
Memphis, Tennessee, 186 entries - Doran & John Moranville of Memphis, Tennessee won best of show.

Snow Goose/Sleeping Lady 1999 Breakup Homebrew Competition
Anchorage, Alaska, 20 entries - Roger Blouch of Anchorage, Alaska won best of show.

3rd Annual B.E.E.R. Competition
Long Island, New York, 120 entries - Thomas Towly & Frank Columbo won best of show.

High Desert Brewers Spring Thing
Idaho Falls, Idaho, 62 entries - Tom Borshel of Idaho Falls, Idaho won best of show.

• MAY 1999 •

3rd Annual Western New York Homebrew Competition
Buffalo, New York, 181 entries - Keith Curtachio of Buffalo, New York won best of show.

Green Mountain Homebrew Competition
Burlington, Vermont, 139 entries - John Watson of Southbury, Connecticut won best of show.

Japanese Homebrewers Association 1999 National Homebrew Competition
Tokyo, Japan, 30 entires - Kazuo Ogawa of Meito-ku, Nagaya-shi, Japan won best of show.

Upstate New York Homebrewers Association's 21st Annual Competition/10th Empire State Open
Rochester, New York, 129 entries - Karl Schwesinger of West Amherst, New York, a member of the Niagara Association of Homebrewers, won best of show.

7th Annual Great Alaskan Homebrew & Craftbeer Festival
Haines, Alaska, 130 entries - Rose Risley of Juneau, Alaska won best of show.

Elizabethan Home Brew Competition
San Bernardino, California, 90 entires - Aaron Weston & David Sullivan of Little Lake, California won best of show.

3rd Annual Celtic Brews
Arlington, Texas, 75 entries - Charlie Feder of Dallas, Texas and J.B. Flowers of Arlington, Texas tied for best of show.

• JUNE 1999 •

2nd Annual Firkin Homerackers' Competition
Williamston, Michigan, 45 entires - Rick Georgette of West Bloomfield, Michigan won best of show.

5th Annual BUZZ Boneyard Brew-Off
Urbana, Illinois, 208 entries - Tom Wolf of Valencia, California won best of show.

1999 NATIONAL HOMEBREW COMPETITION WINNERS LIST

AMERICAN HOMEBREWERS ASSOCIATION

Category 1 • Barley Wine

Gold Bob Grossman
Haddonfield, NJ
Homebrewers of Philadelphia & Suburbs
English-Style Barley Wine

Silver Jeff Swearengin
Tulsa, OK
Fellowship of Oklahoma Ale Makers (FOAM)
American-Style Barley Wine

Bronze Andrew Moon & Bernie Moon
East Syracuse, NY
Salt City Homebrew Club
American-Style Barley Wine

Category 2 • Belgian- and French-Style Ale

Gold Mel Thompson
West Palm Beach, FL
Palm Beach Draughtsmen
Belgian-Style Dark Strong Ale

Silver Tom Hamilton
Salt Lake City, UT
Zion Zymurgists Hops (ZZ HOPS)
Belgian-Style White (Wit)

Bronze Curt Hausam
Salem, OR
Oregon Brew Crew
Belgian-Style Dubbel

Category 3 • Belgian-Style Lambic

Gold Charles Gottenkieny
Plano, TX
North Texas Homebrewers Association
Belgian-Style Lambic

Silver Matt Weaver
Wilsonville, OR
Oregon Brew Crew
Belgian–Style Fruit Lambic - Raspberry

Bronze Charles Gottenkieny
Plano, TX
North Texas Homebrewers Association
Belgian–Style Fruit Lambic - Raspberries, Vanilla

Category 4 • Mild & Brown Ale

Gold Jim Holiday
Olathe, KS
Kansas City Bier Meisters
Irish-Style Red Ale

Silver John Allen
Alpharetta, GA
Central Florida Homebrewers
American–Style Brown Ale

Bronze Jeff Carlson
Grand Rapids, MI
Prime Time Brewers
American–Style Brown Ale

Category 5 • English-Style Pale Ale

Gold Jim Buckett
Chagrin Falls, OH
India Pale Ale

Silver Joe Formanek
Bolingbrook, IL
Urban Knaves of Grain (UKG)
India Pale Ale

Bronze Fred Hartwig
Independence, MO
Pint and Pummel
India Pale Ale

Category 6 • American-Style Ale

Gold Chris Lavoie
Albany, NY
American–Style Pale Ale

Silver Rod Parsons
Eureka, CA
American–Style Pale Ale

Bronze Kurt Zyla
Lebanon, NJ
Morristown Mashers
American–Style Pale Ale

Category 7 • English–Style Bitter

Gold Al Rose
Howell, MI
English–Style Strong (Extra Special) Bitter

Silver Paul Shick
Cleveland Hts, OH
Society of Northeast Ohio Brewers (SNOBs)
English–Style Ordinary Bitter

Bronze Jeff Reilly
Houston, TX
Foam Rangers Homebrew Club
English–Style Best (Special) Bitter

Category 8 • Scottish–Style Ale

Gold Steve Jones
Johnson City, TN
State of Franklin Homebrewers
Scottish–Style Export Ale

Silver Rick Georgette
West Bloomfield, MI
Scottish–Style Export Ale

Bronze John B. Avard, DC, Chris A. Columbus & Matthew W. Goody
Manchester, NH
Amoskeag Brewers Club
Scottish–Style Light Ale

Category 9 • Porter

Gold Robert M. Brotschol
Woodhaven, NY
Malted Barley Appreciation Society
Robust Porter

Silver Kevin Spealman
Glen Ellyn, IL
Urban Knaves of Grain (UKG)
Robust Porter

Bronze Jasper Davis & Chris Vermejan
Gray, TN
State of Franklin Homebrewers
Brown Porter

Category 10 • English- and Scottish–Style Strong Ale

Gold Douglas John
Forest, VA
Strong Scotch Ale

Silver Brian Cole
Black Mountain, NC
Mountain Ale & Lager Tasters (MALT)
English Old Ale/English Strong Ale

Bronze Curt Hausam
Salem, OR
Oregon Brew Crew
English Old Ale/English Strong Ale

Category 11 • Stout

Gold Deb Nelson & Frank Nelson
Apple Vally, MN
South Metro Wort Mongers
Imperial Stout

Silver Curt Hausam
Salem, OR
Oregon Brew Crew
Foreign-Style Stout

Bronze Bob Adams
Owensville, MO
South Gasconade Brewing Society
Oatmeal Stout

Category 12 • German-Style Bock

Gold Leo Vitt
Rochester, MN
Minnesota Timberworts
German-Style Doppelbock

Silver Joseph Hughes
Jupiter, FL
Palm Beach Draughtsmen
German-Style Helles Bock/Maibock

Bronze Jerry Janis
West Palm Beach, FL
Palm Beach Draughtsmen
German-Style Eisbock

Category 13 • German-Style Dark Lager

Gold Thomas Plunkard
Warren, MI
Ann Arbor Brewers Guild
Munich-Style Dunkel

Silver Wesley Wilson
Honolulu, HI
Homebrewers' on Pacific Shores (HOPS)
German-Style Schwarzbier

Bronze Mike Riddle & Dan Hagewiesche
Napa, CA
Homebrewers of Marin and Elsewhere (HOME)
German-Style Schwarzbier

Category 14 • German-Style Light Lager

Gold Rick Georgette
West Bloomfield, MI
Dortmunder/European-Style Export

Silver David Hartwig
Lone Jack, MO
ZZHops
Dortmunder/European-Style Export

Bronze Dean Fikar
Fort Worth, TX
Cowtown Cappers
Munich–Style Helles

Category 15 • Classic Pilsener

Gold Thomas Plunkard
Warren, MI
Ann Arbor Brewers Guild
American-Style Pilsener

Silver Steven Gardner
Jacksonville, FL
German-Style Pilsener

Bronze David Koster
Phoenix, AZ
Bohemian-Style Pilsener

Category 16 • American-Style Lager

Gold Russ Bee
Rockwell, TX
North Texas Homebrewers Association
American–Style Lager/Ale or Cream Ale

Silver Bill Wright
Juneau, AK
American-Style Premium Lager

Bronze Weston Sampson
Orlando, FL
Central Florida Homebrewers
American-Style Premium Lager

Category 17 • Vienna/Märzen/ Oktoberfest

Gold Ken Schulz
Rockton, IL
Forest City Brewers
Vienna-Style Lager

Silver Rod Parsons
Eureka, CA
German-Style Märzen/Oktoberfest

Bronze Mike Kilian
Fenton, MO
St. Louis Brews
Vienna-Style Lager

Category 18 • German-Style Ale

Gold Weston Sampson
Orlando, FL
Central Florida Homebrewers
German Style Kölsch/Köln-Style Kölsch

Silver Mark G. Humphries
Grand Rapids, MI
Düsseldorf–Style Altbier

Bronze Mike Riddle
Napa, CA
Homebrewers of Marin and Elsewhere (HOME)
German Style Kölsch/Köln-Style Kölsch

Category 19 • German-Style Wheat Beer

Gold Keith A. MacNeal
Worcester, MA
German-Style Weizenbock

Silver Dan Gross
Gettysburg, PA
German-Style Weizen/Weissbier

Bronze Shane Coombs
Warrenville, IL
Urban Knaves of Grain (UKG)
Berliner-Style Weisse

Category 20 • Smoked Beer

Gold Dean Fikar
Fort Worth, TX
Cowtown Cappers
Classic-Style Smoked Beer - Oak, Strong Scotch Ale

Silver Kevin Knox
Pacific Grove, CA
Other Smoked Beer

Bronze Curt Hausam
Salem, OR
Oregon Brew Crew
Bamberg-Style Rauchbier

Category 21 • Fruit & Vegetable Beer

Gold Kevin Knox
Pacific Grove, CA
Fruit & Vegetable Beer - Coconut Wheat

Silver Dennis Waltman & Paul Waltman
Atlanta, GA
Covert Hops Society
Fruit & Vegetable Beer - Raspberries

Bronze George O. Proper
Albany , CA
Classic-Style Fruit & Vegetable Beer-Wheat, Apricot Flavor

Category 22 • Herb & Spice Beer

Gold Chad Middlesworth & Diki Short
Hilo, HI
Orchid Isle Alers
Herb & Spice Beer - Ginger root

Silver Danny Hiller
Boulder, CO
TRIBE
Herb & Spice Beer - Hazelnut Coffee Cream Stout

Bronze John Tantillo & Dan Bleaking
Wilmington, NC
Yeast Coasters
Herb & Spice Beer - ginger root, cinnamon, orange peel

Category 23 • Specialty and Experimental Beer

Gold Steve Piatz
Eagan, MN
Minnesota homeBrewers Association (MhBA)
Classic-Style Specialty Beer - Porter with Brett. Lambicus

Silver Patrick McKee
Aptos, CA
Specialty Beer - Tomato, cilantro, red chili tea, jalapeno, serrano, habanero, roasted anaheim

Bronze James MacDonald
Arvada, CO
Classic-Style Specialty Beer - Belgian White Ale; Malted and Unmalted Rye

Category 24 • California Common Beer

Gold Dave Dixon
Bedford, TX
NET Hoppers
California Common Beer

Silver Ray Taylor
Fargo, ND
Prairie Homebrewing Companions
California Common Beer

Bronze George Huhtanen
Overland Park, KS
Kansas City Bier Meisters
California Common Beer

Category 25 • Traditional Mead & Braggot

Gold Ben Jankowski
Oyster Bay, NY
Bonwit Brewery
Sparkling Traditional Mead - Basswood, Apple & Linden Tree Honey

Silver Thomas J. O'Connor III, MD
Rockport, ME
Maine Ale & Lager Tasters (MALT)
Still Traditional Mead - orange-blossom honey

Bronze Darryl Hickey
Miami, FL
Miami Area Society of Homebrewers
Sparkling Traditional Mead - orange blossom honey

Category 26 • Fruit & Vegetable Mead

Gold Steve Schmitt
Anchorage, AK
Great Northern Brewers
Still Melomel - Sweet; Oak Aged, Rhubarb, Raspberry - Mesquite, Blueberry & Clover Honey

Silver Harrison Gibbs
Los Angeles, CA
Pacific Gravity
Sparkling Pyment - Sweet; Muscat, Orange Bloosm and Wildflower Honey

Bronze Susan Ruud, Ray Taylor, Bob Ruud & Maureen Taylor
Harwood, ND
Prairie Homebrewing Companions
Still Melomel - Sweet, Blackberries, Guajillo and Wildflower Honey

Category 27 • Herb & Spice Mead

Gold Jason Claypool
Highlands Ranch, CO
Sparkling Metheglin Szechuan & black pcorns; clover/starthistle honey

Silver John Carlson
Louisville, CO
Hop Barley & The Ale'rs
Still Metheglin Vanilla, Mango

Bronze Tim Schulz, Ray Taylor, Jim Gebhardt, Gene Pribula, Neil Gudmestad & Carl Eidbo
Walcott, ND
Prairie Homebrewing Companions
Still Metheglin Dry: Plain Honey With Cinnomon and cloves

Category 27 • Cider

Gold Thomas J. O'Connor, III, M.D.
AHA 1999 Cider Maker of the Year
Rockport, ME
Maine Ale & Lager Tasters (MALT)
Sweet Still Cider

Silver Thomas J. O'Connor, III, M.D.
Rockport, ME
Maine Ale & Lager Tasters (MALT)
Specialty Spice Cider

Bronze Wayne Beckerman
Clintondale, NY
Hudson Valley Homebrewers
Sparkling Cider

AHA 1999 CIDER MAKER OF THE YEAR
Thomas J. O'Connor, III, M.D.
Rockport, ME
Maine Ale & Lager Tasters (MALT)

AHA 1999 MEAD MAKER OF THE YEAR
Steve Schmitt
Anchorage, AK
Great Northern Brewers

AHA 1999 NINKASI AWARD WINNER
Thomas Plunkard
Warren, MI
Ann Arbor Brewers Guild

AHA 1999 HOMEBREWER OF THE YEAR
Charles Gottenkieny
Plano, TX
North Texas Homebrewers Association
Belgian-Style Lambic
(This is the first time that a previous Homebrewer of the Year (1997) has repeated!)

AHA 1999 HOMEBREW CLUB OF THE YEAR
Oregon Brew Crew of Portland, OR
& Urban Knaves of Grain of Wheaton, IL
(This is the first time that there has been a tie. And each club earned an amazing 77 points!)

maibock
doppelbock
eisbock
[illegible]
schwarzbier
münchner helles
california common
[illegible]
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier
bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier

The Magic & Miracle of Lagering

Every brewer knows that yeast is a wonderful thing. Accordingly, we spend endless care in keeping it clean and healthy. And, of course, we feed it generously with wort sugars both for its own needs and for our sensory satisfaction. When yeast is doing its job of turning sugars into alcohol and carbon dioxide, we love it.

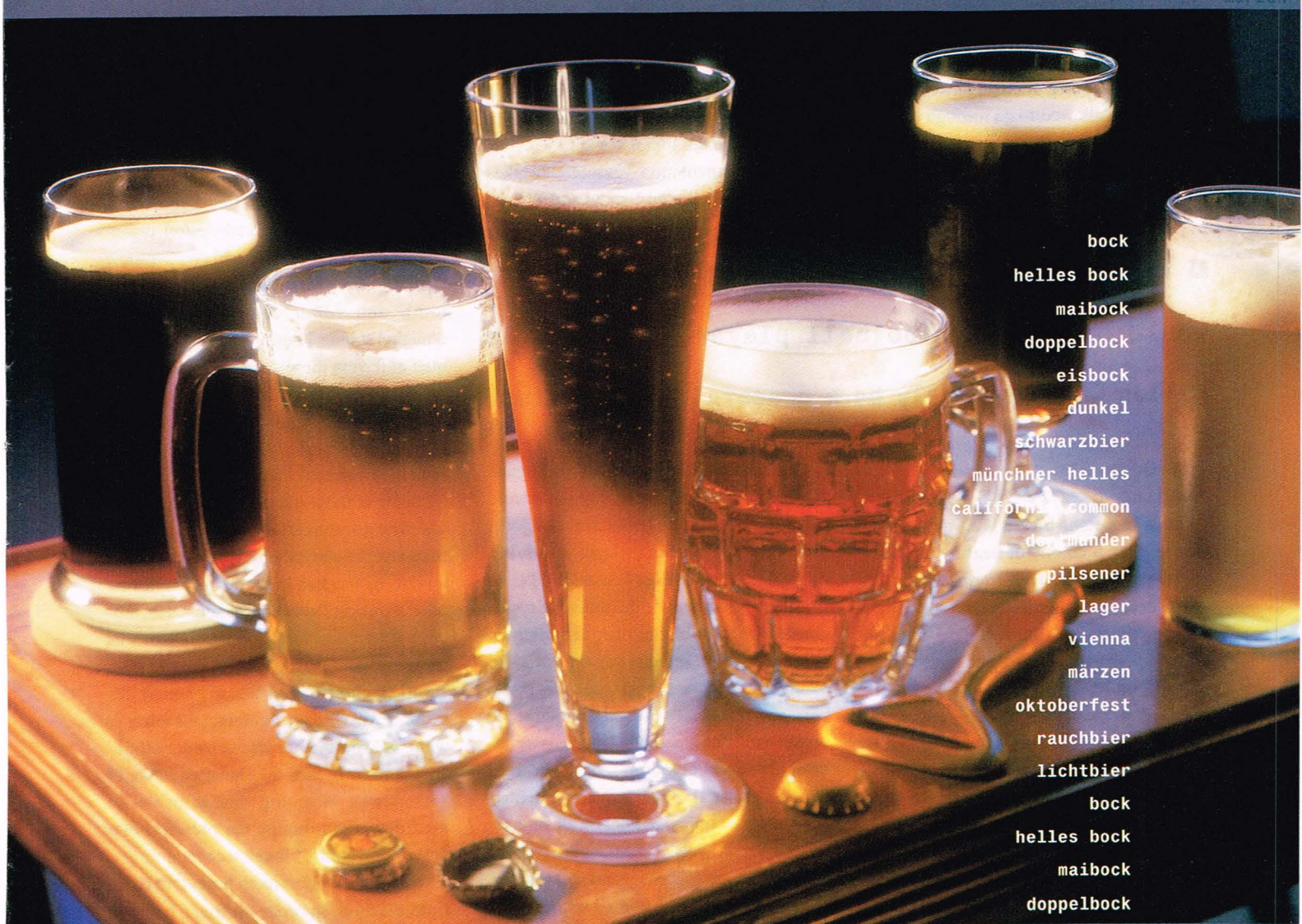
But when it gets out of hand, it can spoil a whole batch. Sometimes the little critters even self-destruct enzymatically, which we call autolysis-and the effect is "yuk." So the conventional wisdom says that brewers should pitch yeast in the right quantity for a good start, provide it with a sanitary environment for its fermentation, but then use fining, racking or filtering, or a combination of these, to get the brew off the yeast as quickly as possible once fermentation has come to rest.

Right?

Well, strangely, there is an entire (and not insignificant) beer culture–which got started in Bavaria some 400 years ago and has since been imitated in breweries the world over–that takes a slightly different approach. Brewers from this beer culture try to keep their brews on the yeast for as long as possible, even after all activity in the fermenter seems to have ceased. They call this aging process *lagern*, which means "to store" or "to warehouse." On the face of it, this practice seems to make neither economic nor brew-technical sense. From a business perspective, would you not expect these rational and efficient braumeisters to be eager to recover their up-front deutschmark investment as quickly as possible by pushing their brews out the door as soon as they are done? After all, raw materials, labor and capital equipment are not cheap. From a beer quality perspective, too, would you not expect them to minimize the risk of spoilage by packaging their brews when they appear to be at their prime? Yet, we know that the lagered beers they produce "over there" rank among the finest in the universe. How come?

These brewers understand that even though there are no visual signs of activity in the lagering tank plenty of important events are happening there. These brewers make deliberate use of the fact that the yeast is actually not done when primary and secondary fermentation are over. They know that a properly managed period of long, peaceful, chilly maturation can alter the flavor of the beer in a positive direction. The changes these brewers initiate in the tank may not be important when you are making a robust, hearty, stick-to-your ribs British-style ale, but they become essential when you are trying to make the types of beer for which the Germans and other central Europeans have become famous. In fact, the Germans are so fond of beer maturation on the yeast that they lager even their ales, such as altbier, kölsch, and most of their wheat beers (weizen or weissbier).

By Horst D. Dornbusch



bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier

bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier

To understand the mechanism of lagering and the contribution this technique makes to the ultimate taste of beer, we must first take another look at the yeast's metabolism. In the dark recesses of the fermenter, all yeast goes essentially through two life cycles.

First is a reproductive orgy right after pitching, during which the yeast produces mostly carbon dioxide and very little alcohol. That's followed by a feeding frenzy during the heady period of vigorous fermentation when it produces both alcohol (mostly enthanol) and carbon dioxide in copious quantities. In lagered beers, the yeast is also allowed to go through a third cycle, a long, restorative sleep, during which it takes many existing compounds out of the brew rather than putting new ones in.

■ If beers were athletes, the stout, no doubt, would be a husky football player, whereas the helles would probably be a graceful figure skater.

The Orgy and the Feeding Frenzy

For a successful brew it is always important to pitch a colony of healthy, vibrant yeast. Once introduced to the wort, the yeast becomes a remarkably Darwinian critter, concentrating immediately on the preservation of the species, that is, the yeast embarks on an orgy of reproductive activity. The brewer, of course, eager to encourage this spontaneous increase in the stock of one of his key raw materials, is more than willing to encourage the heavy breathing that must undoubtedly be going on behind those fermenter walls by supplying the merry yeast buds with plenty of oxygen for their pleasure. Only after the uptake of oxygen are the yeast's cell walls sufficiently permeable for metabolic exchanges. An ample supply of oxygen at this stage, incidentally, also reduces the production of hexanoic-acid ethylester, a compound that can give beers the undesirable flavor of old apple peels.

As the French microbiologist Louis Pasteur (1822-1895) already observed in his path-breaking 1875 tome, *Études sur la bière*, under the presence of oxygen yeast metabolizes glucose, a monosaccharide (or single-molecule sugar), and derives from this simple, but hardy meal the energy to grow and multiply with abandon. Once all the oxygen is used up, the exhausted yeast cells begin to shift their attention to replenishing their depleted nutritive resources. Like hungry sharks tearing at a dead tuna, they start devouring the other digestible sugars in the beer. This second, the anaerobic phase of the yeast's life cycle, we call fermentation. In distinguished parlance, the two cycles together, the orgy and the frenzy, are referred to as the Pasteur Effect: Oxygen suppresses fermentation; its absence stimulates it.

During fermentation, yeast readily takes up fructose (a monosaccharide) and maltose (a disaccharide, or two-molecule sugar). Trisaccharides, which are three-molecule sugars, such as maltotriose and raffinose, can be fully fermented by lager yeasts, but not by ale yeasts. Lager yeasts, unlike ale yeasts, can metabolize melibiose, a disaccharide fraction of maltotriose, which is, chronologically, the last sugar to be used by the yeast. In ales, melibiose stays in the brew and contributes to the flavor difference between the two types of beer. Oligosaccharides are sugars of four or more molecules (complex sugars). These can be fermented by wild yeast strains, but not by ale or lager brewers yeasts. Polysaccharides are types of complex sugars (oligosaccharides) that are capable of being reduced to fermentable monosaccharides, whereas dextrins are polysaccharide fractions that cannot be reduced to saccharides that are fermentable by brewers yeasts. Dextrins, however, can be fermented by wild yeast strains, in which case their fermentation products contribute a medicinal flavor to the finished beer.

During its frenetic munching, however, yeast cannot effectively control all that it releases. In addition to the desirable compounds of alcohol and carbon dioxide, it also issues forth many compounds that may be of great importance to the health and welfare of the yeast, but that do not contribute pleasantness to the flavor of the beer. We call these compounds fermentation by-products. The amounts and variety of these trace elements vary from one yeast strain to the next but, for all strains, they increase with fermentation speed and temperature. There are several broad categories of yeast byproducts, which all go by fairly unpronounceable names: higher (or "fusel") alcohols (such as 2-methyl-1-propanol, 2-methyl-1-butanol, 3-methyl-1-butanol, and 2-phenol-ethanol), esters (such as acidic-acid ethylester, acidic-acid isobotylester, acidic-acid isopentylester, hexanoic-acid ethylester, dodecanoic-acid ethylester, and lactic-acid ethylester), organic acids (such as octanoic acid and decanoic acid), carbonyls (especially diacetyl and acetoin), and sulfur compounds (mostly dimethyl sulfide, known as DMS). The bouquet of flavors these substances add to the beer range from fruity, bananalike, applelike, to soapy, cheesy, sour, medicinal, ciderlike, rancid, stale, solventlike, buttery, butterscotch, to vegetablelike.

Some of these trace elements have very low taste thresholds for humans, but unless they are present in veritable excess they tend to be masked in many beer styles by other, stronger flavor components. Hop bitterness (alpha acids), hop aroma (such as myrcene) and maltiness (especially from caramel, chocolate and black malts), for instance, all tend to counteract the effect of what we would otherwise consider off-flavors in beer. In fact, the signature flavor of some brews, including most British-style ales, downright require the presence of a certain amount of these trace elements, especially the butterscotch notes that come from diacetyl, in order for these beers to taste pleasant and authentic.

As with most things in life, it's moderation that counts. When there are too few trace elements, most beers would taste pallid; when there are too many, most beers would taste awful. But when these elements are in the brew in just the right proportions, they are in balance with the malt and the hops, and they add complexity and depth to the finished product. The "right amount,"

PHOTO BY RICHARD HARRIS PHOTOGRAPHY

however varies from one beer style to the next. A creamy, toasty stout, a hefty Scotch ale, or a hop-bitter, aromatic IPA, for instance, can use many more of these trace elements for a balanced, non-cloying flavor, than, for instance, a delicate Munich helles, which can be overpowered by even a small amount of these by-products. That's precisely why different beers require different yeast strains, different fermentation temperatures, and different cellar regimens, and why lagering is one of those steps, without which certain beers just wouldn't taste right.

Lagering, the Restorative Sleep

By the time the beer gets around to being lagered, most of the carbohydrates in the brew have already been converted and the yeast knows programmatically that it will soon be time to start another orgy. For this new round of reproduction, it now concentrates mostly on its constitutional health and it gathers up—it reabsorbs from the brew–everything it needs to be a strong progenitor again. In this quiet process, the yeast performs a true miracle and we all know that miracles can take a long time. Thus, lagering must be performed on the yeast, slowly, before filtering. After filtration, beer no longer matures, it just gets old.

The key to successful lagering lies in the selection of appropriate yeast strains (both of the bottom- and top-fermenting varieties) that can tolerate cool to cold fermentation as well as frigid cellar temperatures without descending into complete dormancy. Vigorous primary fermentation of a typical lager beer usually takes about 7 ± 2 days at a temperature of 46-48 degrees F (8-9 degrees C). It may take a bit longer if you ferment your wort closer to the bottom edge of the yeast's tolerance, which, for lager yeasts, is at about 41 degrees F (5 degrees C). After a gravity drop of 90-92% of the difference between OG and FG, you can transfer the beer to a secondary fermenter.

When the brew has almost reached its terminal gravity, which is about 2.5-3 °P (1.010-1.012) for most pale lagers, it should be cooled by about 2 degrees F (1 degree C) per day until the beer has reached a temperature of 38-41 degrees F (3.5-5 degrees C), at which point you can transfer it into a lagering or conditioning vessel. There the beer is allowed to mature for 4-6 weeks, or longer. While cooling off the brew, never "crash" the temperature, as this could shock the yeast into dormancy and thus impede proper lagering activity. The ideal lagering temperature is about 28-37 degrees F (-2 to +3 degrees C). Never lager a beer much above this range, as it would simply spoil! During fermentation and lagering, you may wish to rack the beer carefully (but avoid oxygen pick-up!) several times off any sedimented dead yeast cells and organic debris. This improves the flavor of the finished beer.

If you live in an area where nature is generally not on your side, a spare refrigerator (though a space and energy hog) is often the best "cellar" solution for the home lager maker. Household refrigerators usually have a temperature range of approximately 40 degrees F (4 degrees C) for the coldest setting, which is pretty much at the top end of the lagering range, and 60 degrees F (16 degrees C) for the warmest setting. Simply find the appropriate control setting for the proper fermentation temperature and, once the beer has reached the right gravity, turn the dial down, bit by bit, every day until you reach the lowest setting.

An explanation of what the yeast actually does to its own fermentation byproducts during prolonged lagering, and how it makes these chemical compounds less a factor in the ultimate taste of the beer, is unfortunately a bit of a chemical tour de force. To me, chemical elements are like people with unremarkable, forgettable names and meaningless phone numbers, but with memorable faces. I usually don't keep cumbersome chemical names in my head (for that I've got a library), but my taste buds always know when these elements are present in the brew. Here are some of the more important processes that occur during lagering:

- Cold lagering promotes the precipitation of residual colloidal complexes that are made up of proteins and polyphenols. These complexes are created when unconverted large-molecular-chain proteins link up with grain and hop phenols, such as tannins, in the brew kettle. The fallout of these complexes has a positive effect on beer stability and reduces protein hazing in the finished product.
- Slowly dissipating carbon dioxide drags many unpleasant-tasting sulfur compounds out of the brew. These compounds include sulfur dioxide, which contributes "green-beer" flavors and, importantly, the dreaded dimethyl sulfide (DMS), which can make your beer taste like cooked vegetables. Escaping carbon dioxide also drives off hop-derived mercaptan, which is partially responsible for skunky flavors in beer exposed to light.
- Excess amounts of undesirable acetic acids, lactic acids and amino acids react with alcohols and glycol during lagering and are reduced to less offensive, fruity-tasting esters, whose amounts can almost double during lagering, but whose effect on beer flavor tends to be marginal because these esters have a much higher taste threshold to humans than do their precursors.
- Tyrosol, responsible for sharp, unpleasant bitterness in beer, is also greatly reduced during lagering. *(continued on page 62)*

maibock
doppelbock
eisbock
munchner helles
california common
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier
bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier

Whoops! Is That a Lager?

Today, perhaps nine out of ten beers consumed in the world are lagers, not ales. But would you believe that lagers were invented only by accident more than four centuries ago simply because some Bavarian duke issued a beer-political ordinance, which he believed was in the interest of public health? Yes, so it was, but in ways that this late-medieval aristocrat never imagined!

This is how the story unfolded.

The year was 1553, the place was Munich, the ruler of the day was Duke Albrecht V of the mighty House of Wittelsbach (a resilient dynasty that occupied the Bavarian throne between 1180 and 1918). The city was sweltering under one of its customary summer heat spells, and the people were angry: The brewers had done it again. There was nothing to be had but sour, medicinal-tasting beer. And when Bavarians complain about beer, their rulers take notice!

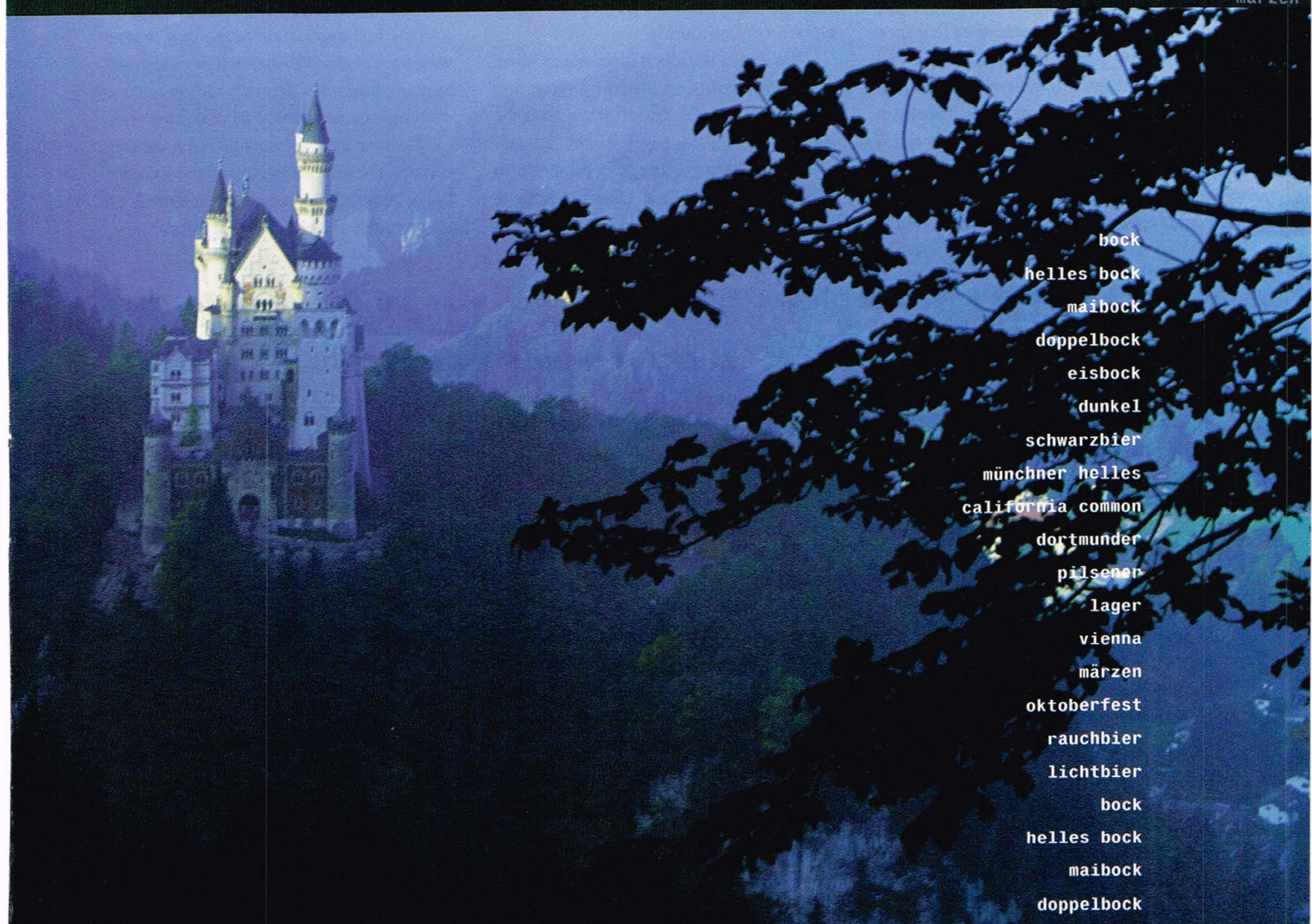
Medieval Red Tape

Cleaning up the people's drink had been a perpetual political issue in Bavaria for centuries because, next to God, there is nothing more important to a true Bavarian than his or her beer. Unfortunately for the medieval drinker, it was not uncommon then for beers to be made from just about any raw material. The typical mash tun might have contained any combination of starchy produce, including barley, wheat, rye, oats, millet, peas and beans. Though hops had been used as a flavoring for beer since the eighth or ninth century, medieval brewers had no qualms about adding caraway, juniper, salt, pith, soot, chalk or even hard-boiled eggs to "refine" their beers.

Fermentation was in open, usually wooden, and invariably unsanitary fermenters. There is no doubt that not only brewers yeast, but also wild yeasts and bacteria were regular residents in these vats. The beers that resulted were mostly ales, since top-fermenting *Saccharomyces cerevisiae* tend to become dominant under such conditions—except in the depth of winter, when wort temperatures drop so low that only bottom-fermenting, lager-making *Saccharomyces uvarum* can still crank.

As early as 1363, the Munich city fathers set up the machinery designed to keep their brewers honest. The 12 city councilors decided to oversee all beer production themselves, in person. But obviously, strict inspections did not provide for much public relief, in spite of the fact that by 1372 there were only 21 brewers left in the city. Beer quality was still unreliable, yet beer became so scarce that is was all drunk anyway, usually the minute it was fermented.

By Horst D. Dornbusch



bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier

It is clear from the records that medieval Bavarian brewers or regulators didn't have a clue about the true source of fermentation. In fact, they considered yeast a fermentation waste product, a sign of putrefaction, rather than the benevolent microorganism that is responsible for the entire show. There are tantalizing hints, however, that some Bavarian brewers must have been aware of the two types of fermentation—warm, top and cold, bottom—and of the different beers they produce. They must have learned that their winter beers generally tasted cleaner and kept better than did their summer brews, because there is a mention specifically of cold-fermented beer in a Munich city council record of 1420. That same year the council also insisted that all beer be aged for at least eight days before it could be sold.

tom-fermenting beer." Perhaps the phrase "if properly...cooled" is of greatest significance here, since only two years later the mighty ruler of Bavaria himself outlawed summer brewing altogether and, by accidental implication, warm top-fermentation with it! Albrecht V decreed that brewers were allowed to make beer only between St. Michael's Day (Sept. 29) and St. George's Day (April 23). Only warm- and top-fermented wheat beers were still permitted to be brewed year-round.

This decree is a much underappreciated, yet pivotal event in human civilization because, after 1553, and unbeknown to the Bavarian regulators and brewers, the only nonwheat beers that could be made in Albrecht's realm were lagers. Much of Bavaria is nestled in the foothills of the Alps

tioning are the key defining characteristics that separate an ale from a lager.

The summer brewing prohibition for barley beers was rescinded only in 1850, by which time Bavarian brewers had started to pack their fermentation cellars with lake ice from the previous winter to keep the temperature constant and low, no matter what the weather was like outside. By 1872, Carl von Linde had invented the refrigerator, which he called an ammonia cold machine, and the first application of the new device was—you guessed it—in the fermenters and lagering tanks of a Munich brewery. Now even lager could be made all year anywhere.

As we now know from hindsight, the two decrees, the *Reinheitsgebot* and the summer brewing prohibition-issued by members of the Wittelsbach clan in the 16th century,

■ In 1810, the Bavarian Crown Prince Ludwig I married Princess Therese of Sachsen-Hildburghausen and threw the people a party, which the people decided to repeat every year at the anniversary of the lofty nuptials—and the Munich Oktoberfest was born.

A Giant Step for Beer

By 1447, the Munich city council decided to get really serious about beer quality. It demanded that brewers use only barley, hops and water in their brews. Still no mention of yeast, though! This city ordinance was the forerunner of the famous all-Bavarian beer purity law, the *Reinheitsgebot*, which was issued on April 23, 1516, by the co-rulers Duke Wilhelm IV and Duke Ludwig X. The *Reinheitsgebot* is still on the books today, but now as a federal law for all of Germany, and it includes yeast as a required beer ingredient. It also allows for wheat in beermaking, but only for ales. Thus, there are no wheat lagers in Germany. In North America, where the *Reinheitsgebot*, of course, has no muscle, you might try to brew one, just for kicks!

The first official mention of yeast comes much later, in 1551, again in a Munich city council ordinance. It states that "barley, good hops, water and yeast, if properly mashed and cooled, can also produce a bot-

and, unlike most other parts of Germany, it is blessed (or cursed, depending on one's viewpoint) with relatively cold winters and relatively hot summers. In Bavaria, therefore, you simply could not make ales in the winter, since even the most robust of top-fermenting ale yeasts tend to go dormant below about 45 degrees F (7 degrees C), when many bottom-fermenting lager yeasts are still active.

After Albrecht's decree, beers had to be stored ("lagered") in casks for the summer months, which was done in underground cellars or tunnels. The brews of spring, therefore, the March beers (or Märzenbier in German), tended to be brewed a bit stronger, at about 6% ABV or higher, to give them better keeping qualities. Since beer was not filtered in those days, the long, cool maturation of the beer on the yeast also produced–again unbeknown to those early lagermeisters–the chemical changes that we now associate with typical lager flavors. In fact, bottom fermentation and cold condi-

changed not only Bavarian brewing practices but the course of world brewing history forever. These regulations inadvertently led to a gradual, more than 400-year-long evolution of the Bavarian everyday brew from a murky, darkish and often rough concoction (usually an ale) to the modern, clean, all-barley-based Bavarian lagers in all their splendor and variety. In due course, the lager came to be regarded as a new, strictly Bavarian beer style, as opposed to the old (alt) ale styles that continued to be produced in the rest of Germany (hence the name "altbier" for the traditional German ale). Today, this Bavarian lager-style of beermaking dominates brewing techniques the world over.

The Lager Grows Up

Early Bavarian lagers, like all medieval beers, were dark and somewhat smoky because of the crude kilns that were common then. These kilns resembled small buildings in which the moist, germinated

grains were dried on perforated tile floors, with a smoky wood or charcoal fire in the basement and a flue for ventilation in the roof. Only after Daniel Wheeler's 1817 invention of the indirect-heat cylindrical drum kiln were brewers able to get clean, pale grains and make pale beers. The modern dunkel (German for "dark") is the present-day descendent of that original, 16th-century brown lager, which was initially called "red" beer to set it apart from "white" (wheat) beer. The name *dunkel* for this beer style came in vogue only around the middle of the 19th century, when wheat beers went into a decline and the helles ("pale") lagers started to emerge.

The lagered beers that survived the summer in medieval Munich were usually finished off in October, when it was time to empty the remaining casks so they could receive the first batches of the new season. In 1810, the Bavarian Crown Prince Ludwig I married Princess Therese of Sachsen-Hildburghausen and threw the people a party, which the people decided to repeat every year at the anniversary of the lofty nuptials—and the Munich Oktoberfest was born. It provided a glorious opportunity (as if the Bavarians needed an excuse!) to pour the last of the March lagers down the hatch.

The strong bock beer became popular in the 17th century. Brewed since about 1250 as an ale in the Lower-Saxon town of Einbeck, bock became "Bavarianized" in 1610, when it was first brewed and served as a lagered beer in Munich. Later, the Paulaner friars of Munich brewed a very strong, 7%-ABV version of the bock, a doppelbock, which they considered a "liquid bread." By 1780, the monks had turned their liquid bread into a commercial product and called it Salvator. Since then, it is common for doppelbocks to feature the suffix "ator" in their names.

With improvements in malting techniques, ever paler lagers started to appear in the 19th century. One such was the deep-golden Vienna lager, first made in 1841 by the Dreher brewery of Vienna. It had an alcohol content of roughly 4.5% ABV. The first truly pale lager appeared a year later, in 1842, in Bohemia (now part of the Czech Republic). It was created in the city of Plzen—or Pilsen in German; hence the name Pilsener for this new beer. Brewed with very pale Moravian malt, hops from the Bohemian region of Zatec (whose German name is Saaz), and Plzen's exceptionally soft, acidic water, this aromatic brew has since become the world standard for fine, golden-blond lagers.

■ Without a doubt, pale lager has become the default beer of humankind.

As beers became paler, they also became cleaner, literally, thanks to the invention in 1878 of mechanical beer filtration by a Bavarian named Lorenz Enzinger. The filter removed yeast cells and other suspended particulate from the finished beer before it was packaged. It is no coincidence, therefore, that the traditional ceramic beer steins of Germany began to give way to glass beer mugs only around that time. Before the advent of cleanly kilned malt and beer filtration, all brews were somewhat turbid and of uncertain color. More likely than not, they were much less pleasing to look at than to drink. Only at the end of the 19th century did beer no longer need to be hidden from a drinker's view, and brewers dared present it to the public in its translucent beauty.

The first pale Munich lager, the *helles*, was introduced by the Spaten brewery in 1894. It was a shade paler, a bit maltier and a touch less hop-aromatic than the Pilsener from Bohemia. By the roaring 1920s, this beer had taken the beer halls of Germany by storm. In northern Germany, brewers experimented further with the pale lager. They made it more assertively dry and hoppy than is common in Bavaria. This northern German beer is known as a Pils or Pilsener (spelled with a middle "e," unlike its almost-namesake, the Bohemian Pilsner). In the second half of the 20th century, this Pils gradually replaced the helles as the most popular beer all over Germany, except in Bavaria.

Brewers outside Germany, particularly in Holland, Scandinavia and North America also jumped on the pale-lager bandwagon. Many of them added adjuncts such as rice and corn to the grist to produce a superpale, marginally to moderately malty, usually very dry beer. Eventually many of these mass-produced lagers also came to be made with coloring agents, preservatives, artificial enzymes or enzyme enhancers, chemical foam stabilizers, artificial sulfate- and nitrate-based yeast nutrients and sugar. Perhaps the North American "lite" in a can is the logical end result of this quest for chemically engineered, pasteurized lightness in beer, though cynics may argue that the only next step after "lite" is pure water. Today you can travel to Australia, Costa Rica, Turkey, China and order a beer. Chances are that what you will be served is a pale lager in one form or another. Without a doubt, pale lager has become the default beer of humankind.

Yet the dark lagers of old still have a small foothold in certain beer markets, especially in Bavaria, where the dunkel lager is a staple on most beer menus. The darkest of the dark lagers, the schwarzbier (black beer) also still has its aficionados. It is almost as opaque as a stout, but lacks the stout's roasty notes. Brewed on a foundation of pale and Munich malts (to an alcohol level of 4.5-5.5% ABV), its color comes from specialty malts that have been kilned very slowly at a relatively low temperature. Therefore, even in this dark brew, the clean lager taste is always evident. An unusual dark lager is the rauchbier (smoked lager), a specialty brew that originates in the Franconian city of Bamberg in northern Bavaria. It owes its smoky, bacony flavor to the use of 90-100% rauchmalz (smoked malt) in the mash tun. Rauchmalz is prepared in a direct-fired kiln that is heated by beechwood logs, a process that is similar to the kilning of peat moss-flavored malt for Scotch whiskey. Rauchbier is one of the very few German beers with toasty overtones.

It might be idle to speculate if there would be lagers today if it hadn't been for good old Albrecht's decree of 1553. In the 19th century scientists such as Theodor Schwann, Louis Pasteur and Emil Christian Hansen started to figure out the mechanisms of the yeast's reproduction and metabolism, and they began to classify brewers yeasts into *(continued on page 62)*

A Description of Lager Styles

Describing a beer style is like describing a sunset. You can list certain attributes you've observed. You can compare it to others you've experienced. But without first-hand knowledge, it's impossible for the reader to have a true understanding of the experience.

Still, there is value in attempting to put into words what is, in essence, a sensory experience. Like studying a guidebook before you travel, familiarizing yourself with the unique aspects of your destination can heighten your senses to the upcoming experience. In regard to beer judging, concise style descriptions are essential to ensure that individual examples are critiqued from a common baseline.

Each of the following descriptions of lager styles is divided into five sections. The sections entitled *The fine print* and *The specs* are derived from AHA and BJCP (Beer Judge Certification Program) guidelines and a number of other sources. The remaining sections, *In brief*, *When to brew*, and *When to drink*, are blatantly subjective.

As you read the descriptions below, remember that this is merely a starting point to understanding the diversity of this broad classification of beer. There's no substitute for extensive hands-on research.

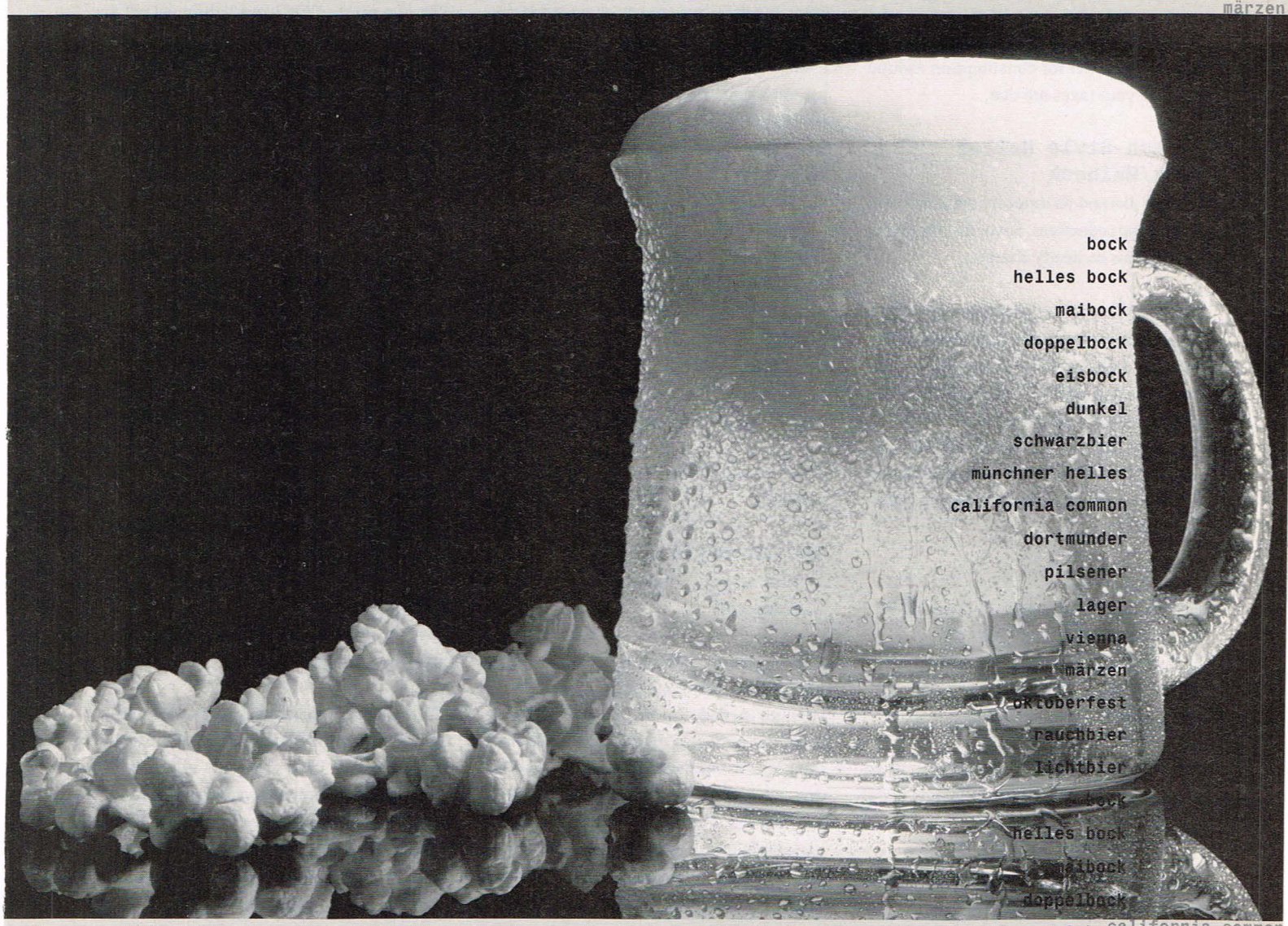
Traditional German-Style Bock

In brief: Rumors that bock beers are made from the bottom of a barrel are untrue. People are always making up lies about the rich and powerful.

The fine print: This dark lager is noted for its malt character and alcoholic strength. German law dictates that bocks must be fermented from a starting gravity of over 1.064 (16 °P). Traditional bocks range in color from deep copper to dark brown and are medium- to full-bodied. A medium hop bitterness counters the malt sweetness, but hop flavor and aroma are low. Bock is German for goat, so goats are often pictured on the labels of commercial bock beers.

The specs:
OG (Balling/Plato): 1.066-74 (16.5-18.5)
FG (Balling/Plato): 1.018-24 (5-6)
% alcohol (wgt./vol.): 5.0-6.0 (6.4-7.6)
IBUs: 20-30
Color (SRM/EBC): 15-30 (30-59)

By Dan Rabin



bock
helles bock
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schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier

■ You think you're a hotshot brewer? Here's your chance to prove it. Any faults with a beer of this style will be easily detectable.

When to brew: Under the sign of Capricorn, the goat (December 22 to January 19).

When to drink: Bocks are traditionally brewed in winter for consumption around the time your taxes are due.

German-Style Helles Bock/Maibock

In brief: Behind its innocent appearance is an alluring seductress. Savor each moment as it reveals its heady charms.

The fine print: These light-colored versions of traditional German bocks (helles is German for light or pale) range from light straw to deep golden. These are medium- to full-bodied beers with a malt character evident in both flavor and aroma. Hop bitterness is generally low, with aroma and flavor of noble-type hops at low to medium levels.

The specs:
OG (Balling/Plato): 1.066-70 (16.5-17.5)
FG (Balling/Plato): 1.012-20 (3-5)
% alcohol (wgt./vol.): 5.0-6.0 (6.4-7.6)
IBUs: 20-35
Color (SRM/EBC): 4-10 (8-20)

When to brew: Invest a day in February to brew this one. It'll pay big dividends come spring.

When to drink: May 1, when many countries (not the U.S.) celebrate May Day by paying tribute to the workers of the world. Have a toast to the labor that produced this praiseworthy beverage.

German-Style Doppelbock

In brief: Like a perfect date, this beer is sweet and full-bodied.

The fine print: Doppelbock is a stronger version of a traditional bock beer, though not doubly so as the name implies. Dark grains contribute to a deep amber to dark brown color, but there is no roasty character in this full-bodied lager. The flavor is dominated by a malty sweetness with a low hop flavor and no hop aroma. The alcoholic strength of this beer is evident. By tradition, doppelbocks have names ending in -ator (Celebrator, Salvator, etc.).

The specs:
OG (Balling/Plato): 1.074-80 (18.5-20.0)
FG (Balling/Plato): 1.020-28 (5-7)
% alcohol (wgt./vol.): 5.2-6.2 (6.6-7.9)
IBUs: 17-27
Color (SRM/EBC): 12-30 (24-59)

When to brew: When the leaves begin to fall.

When to drink: Shortly before proposing marriage.

German-Style Eisbock

In brief: A real ice beer, but this one won't leave you cold.

The fine print: Eisbock is an extra-strong version of a doppelbock. Its high alcoholic strength is produced by freezing a doppelbock and removing the ice, thus increasing the concentration of alcohol (the alcohol doesn't freeze). This is a very full-bodied beer with an intense sweet malt character and subdued hop bitterness. Hop flavor and aroma are not detectable, and color can range from deep copper to near black.

The specs:
OG (Balling/Plato): 1.092-116 (23.0-29.0)
FG (Balling/Plato): n/a
% alcohol (wgt./vol.): 6.8-11.3 (8.7-14.4)
IBUs: 26-33
Color (SRM/EBC): 18-50 (35-99)

When to brew: When you're well-stocked with homebrew and you have a lot of patience. Many months of aging are required for this beer to reach its peak.

When to drink: On Valentine's Day with a special friend.

Munich-Style Dunkel

In brief: A classic dark German lager with the emphasis on malt.

The fine print: This lager is brewed with Munich dark malt producing a distinct chocolate malt character and dark color. This light brown to dark brown beer has a slight sweetness balanced with a low to medium hop bitterness. The flavor and aroma of noble-type hops are low but perceptible.

The specs:
OG (Balling/Plato): 1.052-56 (13.0-14.0)
FG (Balling/Plato): 1.014-18 (4-5)
% alcohol (wgt./vol.): 3.8-4.2 (4.8-5.4)
IBUs: 16-25
Color (SRM/EBC): 17-20 (33-39)

When to brew: Around the winter equinox, the darkest days of the year.

When to drink: This beer goes well with Beethoven's Symphony No. 5, another classic German composition.

Schwarzbier

In brief: Literally "black beer," this is a unique dark lager.

The fine print: The roasted malt used in this lager imparts a dryness and dark color. Ranging from dark brown to near black, this medium-bodied beer has some maltiness and roastiness, but none of the burnt taste often associated with roasted grains. Hop bitterness is low to medium, and flavor and aroma from Noble-type hops are at low levels.

The specs:
OG (Balling/Plato): 1.044-52 (11.0-13.0)
FG (Balling/Plato): 1.012-16 (3-4)
% alcohol (wgt./vol.): 3.0-3.9 (3.8-5.0)
IBUs: 22-30
Color (SRM/EBC): 25-30 (49-59)

When to brew: When you've got some roasted grain and you want to brew a lager.

When to drink: In the fall and beyond. As the days grow dark, your lager should too.

Munich-Style Helles

In brief: A pale and malty Munich original.

The fine print: This lightly-hopped pale lager has a distinct malt emphasis and lacks caramel character. Its medium body is fuller than pilseners, and its color is light straw to golden. Hop bitterness is low.

The specs:
OG (Balling/Plato): 1.044-50 (11.0-12.5)
FG (Balling/Plato): 1.008-12 (2-3)
% alcohol (wgt./vol.): 3.8-4.4 (4.8-5.6)
IBUs: 18-25
Color (SRM/EBC): 4-5.5 (8-11)

When to brew: Brew in winter to be ready for spring.

When to drink: When a fine spring day gets you thinking about all the projects you need to do around the house, pour yourself a helles-and stop thinking.

Dortmunder/European-Style Export

In brief: This golden lager is a good traveler.

The fine print: Intended for export, this style is brewed stronger than other German light lagers in order to travel well. Medium-bodied and straw to deep golden in color, this crisply refreshing lager has a good balance of malt and hops. Its malt flavor is less sweet than a Munich helles, and there is no caramel character. It has a medium hop bitterness, and a low but perceptible hop flavor and aroma.

The specs:
OG (Balling/Plato): 1.048-56 (12.0-14.0)
FG (Balling/Plato): 1.010-14 (3-4)
% alcohol (wgt./vol.): 4.0-4.8 (5.1-6.1)
IBUs: 23-29
Color (SRM/EBC): 3-5 (6-10)

When to brew: Before your camping trip to the lake.

When to drink: Around the campfire, as the air gets cool.

German-Style Pilsener

In brief: The German version of the classic pilsener style. Betcha can't drink just one.

The fine print: This German classic is better attenuated, and therefore drier, than its Bohemian counterpart (below). It is medium-bodied with some residual malty sweetness in both flavor and aroma. Color ranges from light straw to golden. It is well-hopped with a prominent bitterness, and has medium flavor and aroma of noble-type hops. This beer is also characterized by its dense, rich head.

The specs:
OG (Balling/Plato): 1.044-50 (11.0-12.5)
FG (Balling/Plato): 1.006-12 (2-3)
% alcohol (wgt./vol.): 3.6-4.2 (4.6-5.4)
IBUs: 30-40
Color (SRM/EBC): 3-4 (6-8)

When to brew: Brew a double batch in the late spring.

When to drink: On a hot summer day, while you're cooking up a batch of brats on the grille.

Bohemian-Style Pilsener

In brief: Complex and satisfying, this original light lager is one of the world's great beers.

The fine print: Soft brewing water accentuates this legendary beer's malt and hop character. With color ranging from gold to light amber, this beer is medium-bodied with some malty sweetness balanced by a medium hop bitterness. Hop aroma and flavor are present with the floral essence of Saaz hops in evidence. There may be low levels of diacetyl.

The specs:
OG (Balling/Plato): 1.044-56 (11.0-14.0)
FG (Balling/Plato): 1.014-20 (4-5)
% alcohol (wgt./vol.): 3.2-4.0 (4.1-5.1)
IBUs: 35-45
Color (SRM/EBC): 3-7 (6-14)

When to brew: In February, when fresh Saaz hops become available.

(continued on page 63)

Is It Worth the Effort?

By George J. Fix

To the average homebrewer, the term "lager" is a descriptor for beer styles; namely numbers 12 (*Bock*) through 17 (*Vienna/Maerzen/Oktoberfest*) on the AHA category description list. The one common factor in these styles is the type of yeast used, not the way they're processed. On the other hand, historically, the reverse is true. A "lagered beer" has generally been one that has been afforded an extended cold maturation, independent of the type of yeast used. Arnold finds that extensive cold storage goes back to the very beginning of monastery brewing (approximately 50-100 A.D.), if not sooner. This possibly pre-dates the systematic use of what today is a genetically narrow band of microbes called lager yeast . However, this begs the absolutely fascinating open question of exactly when lager yeast entered monastery brewing.

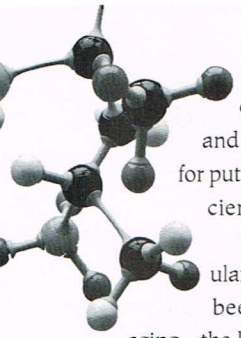
In Bavaria lager beers were also called summer beers because they were brewed from September to April and cold lagered during the summer months . When refrigeration was introduced near the end of the 19th century, brewing was possible year round. Yet the three-six month cold storage still found favor, and six-nine month cycles were common for high gravity lagers.

An interesting twist occurred in the U.S. among ale brewers in the sense that, early on, extended cold storage was employed. Greves, an English brewer who visited the U.S. just before the turn of the century, commented on this point. He cited two reasons for this departure from traditional British ale brewing practice. First, he noted competitive pressure from lager brewers, who tended to promote the theme that beer clarity and beer purity were synonymous. Cold storage is one of the best ways to clarify beer, a point discussed below. Very likely, these influences affected German ale brewers in the Rheinland as well. The second reason cited by Greves was the unfavorable climatic conditions in the U.S., and therefore the need for cold maturation to promote beer stability before distribution. Greves praised the overall quality of American ales, but he concluded that cold storage was not needed in the U.K.

Reduced Aging Times

One of the most obvious trends in brewing practice in the 20th century has been the gradual reduction of aging times. "Common beer" using short two-three week cycles have been present throughout this century, but it was not until the last part of the century that short cycles were used for premium products. Even Pilsener Urquell, arguably the flagship lager, has been affected by these trends. It was brewed on a six- month cycle throughout much of the 20th century. This was cut to three months in the post-World War II era, and it is now produced using cylindrical conical fermenters with a short brewing cycle. Critics of this trend

bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier



cite competitive pressures and a relatively flat beer market for putting a premium on plant efficiency. Lighter flavored beers were also increasing in popularity during this period. These beers tend to require less aging—the limiting case is water, which requires no aging!

Defenders of short aging periods argue differently. First, given the increased understanding of beer fermentation that has occurred in the last few decades, it is now possible for brewers to reduce green beer characteristics in the main fermentation—in previous times one of the main purposes of aging. Also, there has been vast improvements in yeast management as well as considerable improvements in the quality of brewing materials, most notably malt. These also reduce brewers dependence on aging.

As homebrewers we are free of many of the pressures facing commercial brewers. As a consequence, we can and do put beer quality above any other consideration. Thus, if extended cold storage will improve beer, it will be employed by most homebrewers.

On the other hand, it makes little sense to cold lager beer beyond the point where improvements stop. This begs the central questions associated with this article. Namely, exactly what does cold maturation do for us, and how much is enough?

We shall define cold as below 2 degrees C (36 degrees F), although some of the mechanisms discussed below can also take place at slightly higher temperatures.

Beer Clarification

The most obvious benefit of cold maturation is the precipitation of haze active polyphenols and proteins. The cold conditions also encourages yeast flocculation. It is my experience that the beer should clarify within the first week of storage. This is possibly why two-week cycles for ales and three-week cycles for lagers are so widely used in commercial brewing. Failure to clarify during the first week of storage is usually due to technical errors. Poor quality malt and/or dysfunctional yeast are obvious culprits. Errors in mashing and sparging cannot be ruled out either. The solution in these cases is not to extend the aging period, but rather to correct original problem.

Chill Proofing

Extra measures are needed to chill proof beer. Additives like silica gels and polyclar can remove the relevant haze active constituents. I have found that extended cold storage (say 8-12 weeks) at 0-2 degrees C (32-36 degrees F) will achieve the same effect. The recently developed ice brewing procedure provides an interesting alternative. In this process beer temperature is reduced to just below its freezing point so that very small ice crystals are formed. Extensive data has shown that the beer obtained after separation from the ice crystals is fully chill proofed. In commercial practice, where this process is automated, the temperature is reduced to a couple of degrees centigrade below the beer's freezing point. The latter varies with alcohol content, but it is near -2.3 degrees C (27.9 degrees F) for beers of normal strength. The contact time with the ice crystals is brief, typically less than one hour. In homebrewing higher temperatures and longer times are used. I have found that holding the beer at -3 degrees C (26.6 degrees F) for 48-72 hours is adequate.

Reduction of Diacetyl

The most widely studied green beer compound is undoubtedly diacetyl. There is good reason for this, since it can be responsible for some highly unpleasant flavors, especially in packaged beer as it ages. There is ample evidence that the long extended cold storage, in contact with yeast, was the primary tool used by turn of the century brewers to combat off flavors like diacetyl. In modern practice, there is a decided preference for reducing diacetyl in the main fermentation.

This is achieved through proper yeast management and, in particular, using yeast that have very low bacterial and mutant levels. It can happen at the fermentation end point that diacetyl levels are slightly above acceptable levels. In this case, best results are usually obtained by kraeusening the beer with fresh wort and yeast, rather than relying on extended aging. It should be noted that there is much more to flavor maturation than reducing diacetyl levels. For example, research on immobilized yeast reactors has shown that diacetyl can be reduced to normal levels with only a few hours of maturation. Nevertheless, the overall quality of beers produced with these systems has not been impressive.

Reduction of Sulfur Compounds

Fermentations conducted at ambient temperatures 18-20 degrees C (65-68 degrees F) should end with all relevant sulfur compounds well below their threshold. Exceptions are usually due to infection by sulfur-producing gram negative microbes. These can be found in infected wort and/or in pitching yeast. With lagers fermented at 8-12 degrees C (46-50 degrees F) the situation is more complex. The removal of volatile sulfur compounds in a cold fermentation is greatly reduced over what occurs at higher temperatures, and this can lead to a situation where several sulfur compounds are above their flavor threshold.

Lager brewers disagree about how much is too much. However, there is widespread agreement that lager beer will be insipid if all sulfur-bearing compounds are reduced below their threshold. In addition, residual sulfur can act as an oxygen scavenger, and this may be responsible in part for the excellent flavor stability of traditional lagers. Nevertheless, most lager beer needs some maturation to reduce sulfur levels, and it has been my experience that objectionable sulfur levels can be reduced to acceptable levels within one week of storage at 0-2 degrees C (32-36 degrees F).

Failure to achieve this reduction can be due to several factors in addition to those cited above. A common culprit is high DMS levels in chilled wort, which may be due to the malt or wort production procedures used.

Yeast related issues tend to have more damaging effects. While there is a difference with respect to sulfur production among strains, pitching rate is even more important. Ideally, lager yeast should be pitched at a rate of 1-2 million cells per milliliter for each degree Plato; e.g., between 12 and 24 million cells per milliliter for 12 °P (1.048) wort. Underpitching can lead to problems, but so can overpitching. For example, using

AOB FILE PHOTO, MOLECULAR MODEL

very large yeast starters, with cell counts a factor of five or more above the ideal, can lead to excessive sulfur levels . It can also create a variety of off flavors due to yeast autolysis. Synthetic fuels are produced using elevated pitching rates, but flavor is not an issue with these products! As with the other defects mentioned above, the best approach is to correct the original problem and not to rely on ageing.

Flavor Maturation

This in many respects is the most interesting part of lagering in the sense that the goal is not damage control, but rather taking a sound beer and improving it. Two mechanisms are fundamental. One concerns polyphenols. Extensive data shows that anaerobic cold storage favors the precipitation of phenols in the higher oxidation states. That is, cold anaerobic storage will reduce the beers redox potential. This promotes rounded flavors and a smooth palate for conventional lagering (0-2 degrees C, 32-36 degrees F), discernible improvements will be seen through 6-8 weeks. In the ice brewing process, the times are shorter as noted above.

The second effect is a slow esterification of fusel alcohols. The reduction of higher alcohols promotes a greater elegance of taste, even when these alcohols are below threshold. The esters so formed tend to be of the desirable type, and add to the beer's complexity. This effect is enzymatic, and depends on having viable yeast present in maturation to keep the beer "alive." Ideally this should be between 500,000 and 750,000 cells per milliliter. This effect also depends on time. When Pilsener Urquell was fresh and brewed on a 3-6 month cycle, it displayed these effects to perfection.

Dry Hopping

As Greves noted in his paper, the addition of hops during cold maturation was a uniquely American practice. The most important historical examples showing the benefits of this procedure was (arguably) the Ballantine Ales, back in the days when Ballantine was an independent family-owned brewery. Their flagship product was Ballantine XXX, which was dry hopped during a cold three-month maturation period. This ale was noted for its full and attractive hop aroma, which was accompanied by a well defined but mellow hop bitter. Dry hopping will always achieve these effects, at least for a short period. The problem is that the aromatic compounds are unstable and can quickly disappear. Ballantine XXX in its prime was a national beer and, as such, subject to market abuse. Yet, typically around five million barrels were sold each year. The hop aroma was its signature, and, hence, the stability was a crucial point. The extended cold contact time played a fundamental role, since it was during this period that the aroma compounds became bound in the beer. Nugy suggests that one month of cold contact time with hops yields one month of stability for the aroma compounds. This is consistent with what has been reported about the Ballantine ales, and it is also consistent with my own brewing experiences.

■ This in many respects is the most interesting part of lagering in the sense that the goal is not damage control, but rather taking a sound beer and improving it.

Carbonation

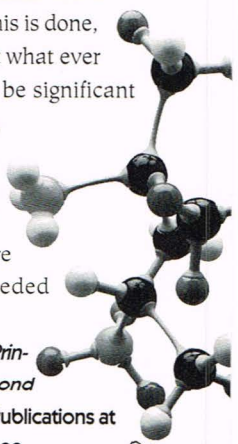
The traditional carbonation of lagers takes place during cold storage. Beer is transferred from fermenters to maturation tanks with approximately 1% (by weight) of fermentable sugars present. The secondary fermentation which takes place creates sufficient CO_2 to saturate beer. It has been my experience that 2.8-3.0 volumes of CO_2 will be dissolved at equilibrium. Thus, it is desirable to take pressure and temperature readings so that adjustments can be made to desired levels. A three-month cycle for this method is ideal if the beer is held under an appropriate counter pressure. I have found that one atmosphere (14.7 psi) is adequate.

I have personally not seen any difference in foam quality that can be attributed to the way beer is carbonated, either forced or natural. However, it has been my experience that people who are sensitive to carbonic acid, and dislike gassy beers, tend to prefer (by a wide margin) the flavor of the beers made with traditional carbonation when CO_2 levels are in excess of 2.4 volumes. The reasons for this are not altogether clear, but it could be that the traditional carbonation has CO_2 more tightly bound up with other constituents.

Conclusion

To lager or not to lager is a question to which brewers will likely come to different answers. I recommend that brewers not blindly follow the rigid rules set up by others on this matter, but rather be guided by test brews. I have found the following to be useful: (a) Do three batches of your everyday beer and lager for three, eight and 16 weeks, respectively. (b) Do three batches of your favorite high gravity beer and lager for three weeks, six weeks and nine months respectively. (c) Do two test batches, one being forced carbonated and the other carbonated by the traditional method. It is, of course, desirable to control for extraneous effects. This is hard to do in a homebrewing content. However, the key items to control are yeast, brewing materials, and oxidation. In particular, the test brews should be staggered so that they can be bottled at the same time (or nearly so). If this is done, then it is my experience that what ever bias that may exist will not be significant enough to alter conclusions.

I realize that this program requires a lot of brewing, but then it also gives us an excuse to do more brewing, as if any of us needed such a reason!



George Fix's latest book is *Principles of Brewing Science, Second Editon*, available from Brewers Publications at (888) 822-6273 in the fall of 1999.

maibock
doppelbock
eisbock
münchner helles
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier
bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier

Secrets of the Double Decoction

During mashing, the reduction of complex sugars and of insoluble proteins to simpler amino acid chains is entirely an enzymatic process. Before mashing, the malt is only 15 to 25% soluble (CWE). Mashing should yield an extract equal to 65 to 80% of the weight of the dry malt. Not all of this extract is fermentable; in fact, the varying percentages of unfermented "rest extract," i.e., dextrins, proteins, and peptides, give each beer its malt character. The part of any extract that is unfermentable dextrins (sweetness and flavor) and proteins and peptides (body) is controlled by manipulation of the times and temperatures of the mash.

Why Decoction Mash?

Although decoction mashing serves to raise the temperature of the mash to the protein, saccharification, and lauter-rest temperatures, its more important function is to cause several significant changes in the boiled portions.

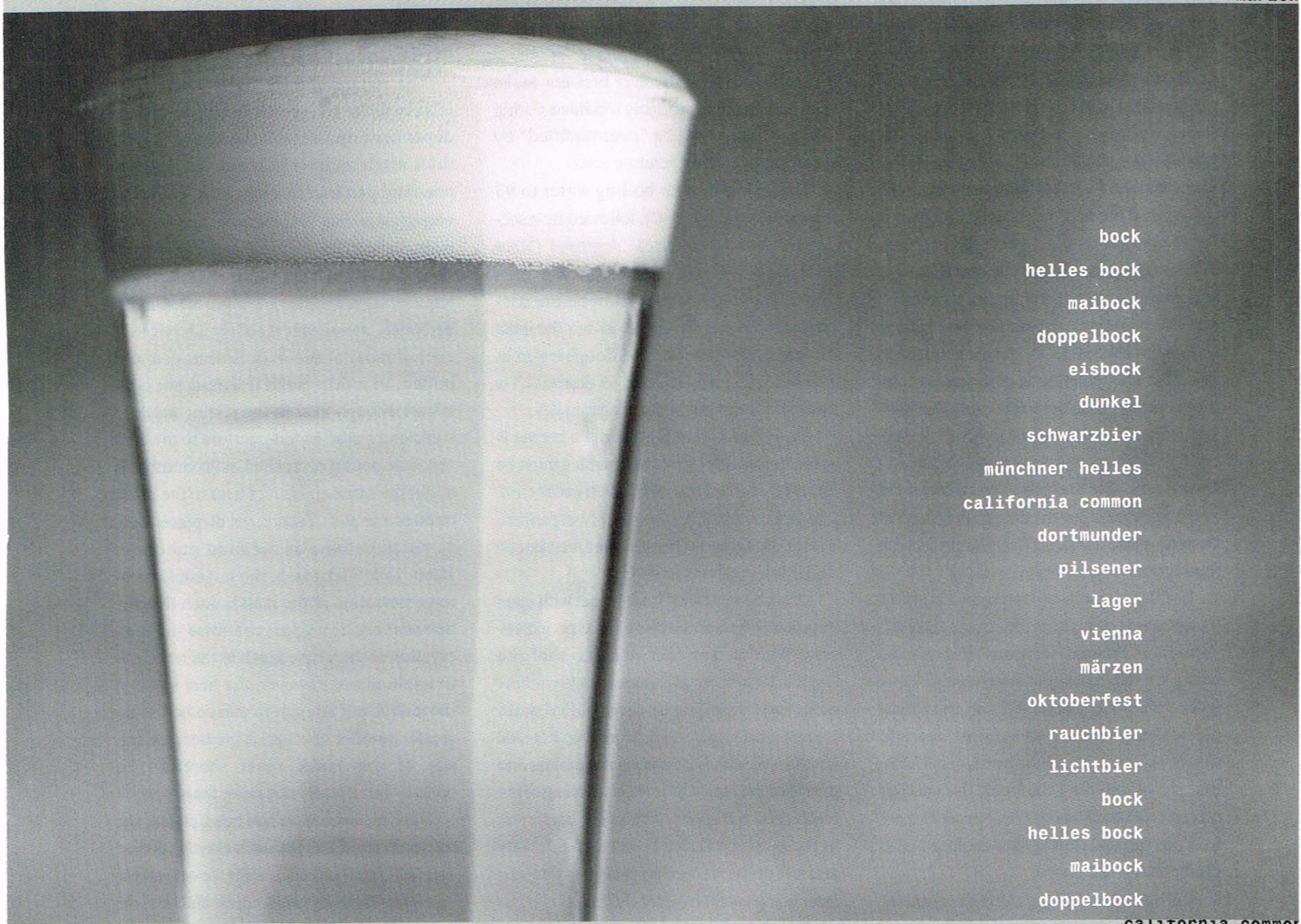
Not even the most thorough infusion mash can eke out the quantity or quality of extract that is obtained by decoction mashing. There are several reasons for this. During decoction mashing, the thick part of the mash passes through the diastatic-enzyme temperature range two to three times. Boiling also reduces the size and complexity of malt starch and protein—a process that is absolutely essential when mashing-in difficult malts. Malts such as dark Munich, having only one-third the enzyme strength of pale malt, cannot otherwise be satisfactorily mashed.

Since boiling destroys enzymes, the enzymes in the unboiled mash portion must be preserved. In a mash that is satisfactorily solubilized during doughing-in, the enzymes are washed into the free liquid when the mash is flooded to raise its temperature to 95 degrees F (35 degrees C). The thickest part of the mash—containing the heaviest and least accessible concentration of native starch and protein—can then be boiled without decimating the enzyme population.

The heavy decoction is quickly heated to 150 to 158 degrees F (65 to 70 degrees C), without resting at 122 degrees F (50 degrees C), so that no further enzymatic acidulation of the mash occurs.

There are two good reasons for passing by this rest, and both are based on the pH sensitivity of the diastatic enzymes. First, the dextrinization of native starch by alpha-amylase (pH optimum 5.7) is far more effective at the higher pH of this first decoction than later when the whole mash comes into the saccharification/dextrinization range at a far lower pH. Second, the same high pH that stimulates alpha-amylase activity retards beta-amylase activity (pH optimum 4.7). Because native starch is far too complex to be successfully reduced by beta-amylase until alpha-amylase has reduced it to shorter amylose chains and smaller amylopectin fragments, resting the decoction at saccharifying temperatures is not productive.

By Gregory J. Noonan



bock
helles bock
maibock
doppelbock
eisbock
dunkel
schwarzbier
münchner helles
california common
dortmunder
pilsener
lager
vienna
märzen
oktoberfest
rauchbier
lichtbier

■ A much thinner mash increases the proportion of maltose, and thus wort attenuation.

It is quite enough that the manageable small dextrins replace the native starch, even when mashing for a high-maltose extract.

Regardless of the diastatic power of the malt, unconverted starch is invariably entrapped within poorly solubilized malt particles. As the decoction is heated above 167 degrees F (75 degrees C), the particles burst, and their contents are absorbed into the liquid extract. This makes them accessible to alpha-amylase activity during the diastatic-enzyme rest of the main mash. This otherwise lost extract increases both the quality and the quantity of the extract yield.

The acidity of worts generally decrease after mashing, as they are heated to boiling (the more so with rising liquor alkalinity), because heat disassociates carbonic acid in solution to H_2O and CO_2, causing the pH to rise. This phenomenon is of less concern to the decoction-mash brewer because the mash is stirred and portions of the mash are boiled, both of which actions decompose HCO_3, and because the acid and protein rests lower the mash acidity. Boiling the decoctions also precipitates more inorganic calcium phosphate than is otherwise achieved.

Boiling also dissolves protein gum. At lower temperatures, protein gum is unaffected by enzyme activity and passes through mashing largely unconverted. Only when thick mash is boiled can the proteolytic enzymes successfully degrade dissolved gum to albuminous fractions; instead of clouding the beer, the smaller proteins enhance its body and head. Protein trub precipitated during wort cooling is also dramatically decreased.

Boiling also deoxygenates the mash, reducing hot-side aeration and allowing it to settle in well-defined layers in the lauter-tun. Only the absence of residual protein gum makes this effective filter bed possible; when an infusion mash is employed, such a dense filter bed likely results in a set mash.

In mashing techniques that do not use a decoction sequence, the proteolytic and diastatic enzymes are destroyed before the mash achieves optimum temperatures for the dissolution of starch particles and protein gum. The extract content, clarity, character, fullness, maltiness, and body of the finished beer are negatively affected. Where the malt is reasonably well modified and evenly crushed, however, the traditional three decoctions may not be necessary; even a single-decoction (or step) mash is never advisable with British ale or brewers' malts that have been thoroughly modified during malting and would be "overmodified" by exposure to low temperature rests.

Doughing-in with boiling water to 95 degrees F (35 degrees C), followed by a second infusion to 122 or 131 degrees F (50 or 55 degrees C), only a limited protein rest, and a single, thick decoction before saccharification is sufficient for all but the most undermodified malts, and doughing-in at 122 or 131 degrees F (50 or 55 degrees C) is sufficient for most modern lager malts.

During decoction mashing, the brewer is at his busiest, because two mashes must be handled at the same time, with great care. The brewer must be thoroughly organized before plunging into the sometimes hectic decoction mash cycle.

Decoction mashing is often met with open skepticism by brewers who have no experience with it. The fact remains that the beguiling maltiness of European lagers is only achieved by boiling undermodified malt. Extract yield is increased. Moreover, hot-side aeration is reduced, because the boiling and mixing of the mash deaerates it. Boiling of the mash does not lead to astringent harshness in the brew, probably because the density and pH of the decoction prevents phenols from being leached out of the husks.

There are two widely accepted programs for decoction mashing. The first, described here, employs a protein rest at 122 degrees F (50 degrees C) and saccharification/dextrinizing at 149 to 158 degrees F (65 to 70 degrees C). It is best suited to malts of below 37% soluble nitrogen.

The second program is better suited to higher-protein modern malts with a soluble nitrogen ratio of 37 to 40%. A combined proteolysis/saccharification rest is made at 131 degrees F (55 degrees C), allowing proteases to reduce large proteins to body- and head-building polypeptides and beta-amylase (temperature optimum 126 to 149 degrees F [52 to 65 degrees C], pH 5.4) to reduce amylose to maltose and glucose, and amylopectin to ß-limit dextrins. Dextrinization is then accomplished separately, usually at 158 to 162 degrees F (70 to 72 degrees C).

Three-Decoction Mash

First Decoction

The volume of thick mash to be boiled, relative to the volume of the whole mash, is dependent upon mash thickness. A very thick mash requires that only its heaviest one-third part (mostly grain mass, with only enough liquid to fill the spaces between the grain particles) be boiled, along with very little of the mash liquid. Thinner mashes require that proportionally more of the mash be boiled, along with more liquid, because even if most of the malt is removed and boiled, in a thin mash it would not contribute enough heat to the resting mash to sufficiently raise its temperature to the next rest. One pound of crushed malt contributes about the same amount of heat to the mash as does one pint of water, yet displaces only as much volume as six fluid ounces of water. In a thick mash, the favorable heat-to-volume ratio of the malt is such that the heaviest one-third part can raise the temperature of the whole mash to the next rest. In a thin mash, however, the heat value of the malt is not enough to overcome the far greater amount of water. A greater percentage of the mash must therefore be boiled—but usually not more than 40%.

After the decoction has been pulled, the rest mash (cold settlement) is closely covered and held undisturbed, except for occasional mixing to disperse temperature and enzyme activity. At the end of each decoction cycle, the mashes are remixed to raise the temperature of the whole to the next rest.

Protein Rest (First Thick Mash)

With traditional lager malts, the character of the finished beer—its body, clarity, lack of chill haze, stability, and resistance to spoilage—is largely established during the protein or "albumin" rest. This "softens"

poorly modified malt and improves mash runoff by decomposing heavy, gummy, insufficiently modified malt particles. During the rest, complex protein globules are decomposed by proteolytic enzymes to less troublesome fractions. With relatively unmodified lager malts, proteases, peptases, and proteinases progressively dissolve the peptide links within the protein coils to liberate coagulable albuminous fractions, peptides, and amino acids. It is albumin (proteoses, peptones, and polypeptides), not protein, that gives beer its body and enables it to raise and support a frothy foam head.

The protein-rest temperature should be 122 to 131 degrees F (50 to 55 degrees C), although temperatures from 113 to 140 degrees F (45 to 60 degrees C) support proteolytic enzyme activity. It should be kept in mind, however, that at the lower end of the temperature range, head-and-body polypeptides may be denatured to peptides and amino acids, reducing the body of the beer. Proteinase (temperature range 104 to 140 degrees F (40 to 60 degrees C), optimum 122 to 140 degrees F (50 to 60 degrees C), pH 4.6 to 5.0, solubilizes and breaks down simple proteins to peptones, polypeptides, and peptides. Peptidase (optimum range 113 to 122 degrees F [45 to 50 degrees C] pH below 5.3) dissolves polypeptides and peptides to individual amino acids, which fuel yeast growth in the early stages of fermentation. In any all-malt beer, however, there are generally sufficient amino acids to support fermentation.

Extract efficiency is also enhanced by the protein rest. Extract is exposed by the dissolution of membranous proteins, and complex amylopectin may to some extent be dismantled by debranching enzymes (maltase, dextrinase).

Phytase continues its activity during the rest, reducing phytin from the aleurone layer and embryo of the malt to phytic acid. Other acids also rapidly form during the rest, further lowering the pH toward the optimum values for saccharification, the clarification of the wort during boiling, and subsequent yeast fermentation. During this rest, the pH should drop again to below 5.4.

Other nonproteolytic enzymes (most notably cytase, temperature range 113 to 131 degrees F [45 to 55 degrees C], pH 5.0, and beta-glucanase, range 95 to 131 degrees F [35 to 55 degrees C]) actively dissolve pectins and other constituents of the malt hemicellulose during the protein rest.

A thick mash improves enzyme performance. In a thin mash, proteolytic and other heat-labile enzymes are destroyed in the course of the rest; in a thick mash, they may survive into the saccharification range.

The protein digestion can be overdone, however. Devoid of proteoses and peptides, the beer would lack body and a froth head. It would be very stable, but very empty-tasting. Without any coagulable proteins to adhere to, hop tannin would not precipitate from the boil, and the beer would taste "rough." Reducing nitrogen complexes too far would result in the presence of an excessive amount of simple nutrients in early fermentation, which would encourage bacterial contamination.

The degree of protein degradation achieved during this rest may be fairly judged later on by the thickness and slickness of the protein sludge covering the settled grist in the lauter-tun. It should be moderately thick and powdery rather than gummy.

The rest temperature must be reached by effective mixing, accomplished by lifting the mash from the bottom of the tun. It is essential that the return of the decoction be competently handled so that temperature dispersal is absolutely even. Attempting to correct wide temperature fluctuations within the remixed mash is never easy.

In the event that the strike temperature is reached before all the decoction has been returned, the remainder of the boiled mash is force-cooled to 122 degrees F (50 degrees C) before it is returned to the main mash.

The objectives of the albumin rest should be accomplished in less than two hours, or the malt is entirely unsuitable for use in brewing. Usually after five to twenty minutes at 122 to 131 degrees F (50 to 55 degrees C), the heaviest part of the mash is again drawn off, to begin the second decoction. Up to 30% of the malt nitrogen can be expected to have gone into solution at its conclusion.

Saccharification Rest

Malt starch occurs as long straight or complex-branched chains of linked glucose, $C_6H_{10}O_5$. During the saccharification rest, alpha- and beta-amylase reduce that starch to simpler fractions. *(continued on page 65)*

maibock
doppelbock
eisbock
dunkel
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Techniques for Secondary Fermentation

Whether or not a beer will be extensively lagered, a secondary fermentation in a closed fermenter allows for the slow reduction (conditioning) of the remaining fermentable extract. In the secondary fermentation stage of lagering, the beer is free from the flavor impairment of sedimented trub and degenerating yeast cells. Seven to twenty-one days may be required for the yeast to deplete the fermentable sugar left after the kraeusen period has ended. Traditional lagering entails holding the beer for a further two to seven weeks for clarification and stabilization.

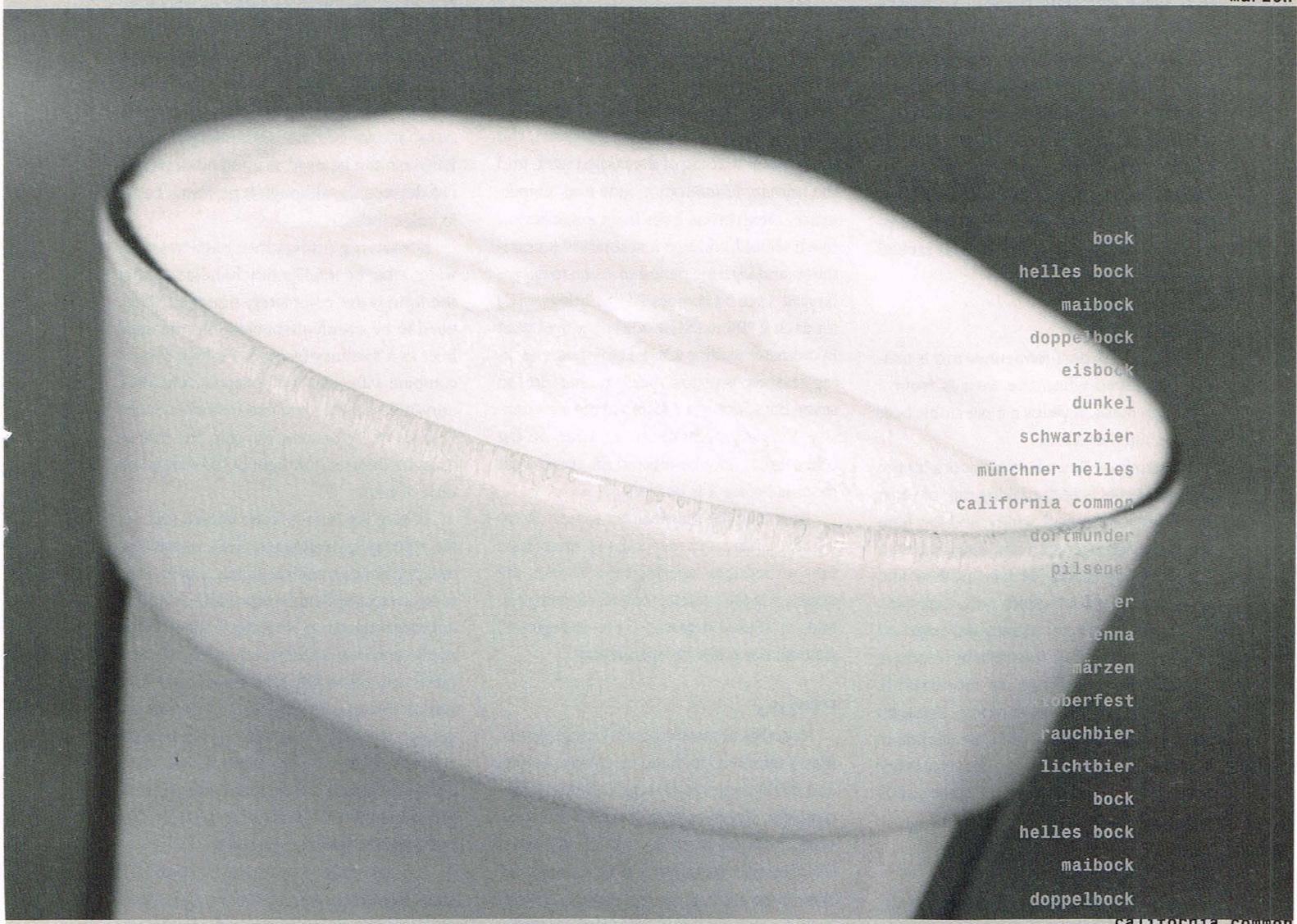
During the secondary fermentation phase, the beer is slowly attenuated. It is slowly cooled to 33 to 37 degrees F (1 to 3 degrees C) — or to as low as 30 degrees F (-1 degree C) to settle dusty yeast — to allow the yeast to settle thoroughly and to inhibit the activity of any microorganisms possibly contaminating the ferment.

Because the potential risk of airborne contamination is great during the slow, cold ferment, the beer absolutely must be protected from contact with the atmosphere by being fermented in a closed vessel fitted with a fermentation lock. Contamination is otherwise a major risk at this point; yeast activity is slow, because the beer no longer contains abundant extract and nutrients, yet bacteria may be capable of significant dextrin, protein, or yeast-waste fermentation. Even though the pH is below their optimum, given a warm enough temperature even a few wild yeast or lactic-acid bacteria might rapidly propagate and ruin the beer.

Reproduction by the culture yeast will have entirely ceased during this stage of fermentation; further attenuation relies solely on the metabolic activity of the relatively few remaining yeast cells. It is imperative that conditions be conducive to the continued metabolism of the fermentable extract by these yeast cells and that they not be subjected to temperature shock. If the yeast culture needs regeneration, then an active starter culture or 5% kraeusen beer is added.

The duration of the secondary fermentation and the temperature at which it should be conducted are determined by the maltotriose and dextrin content of the post-kraeusen beer. If its reduction in density has naturally slowed and the hydrometer reading is still about one-third the value of the original wort reading, then the beer is rich in dextrins. It should be fermented out in the secondary at 33 to 41 degrees F (1 to 5 degrees C), depending on the temperature preferences of the yeast strain, for at least fourteen days. When the post-kraeusen density is much less than one-third the value of the wort density, it indicates that the beer is lacking in dextrins and should undergo a secondary fermentation at 34 to 37 degrees F (1 to 3 degrees C) for not more than ten days before the temperature is reduced for lagering. Lagering times will also be shortened.

By Gregory J. Noonan



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Dark Beer

Long fermentations often darken the color of the beer. Consequently, when lagers are brewed for paleness, secondary fermentation may be carried out at higher temperatures (36 to 39 degrees F [2 to 4 degrees C], but not above 40 degrees F [5 degrees C]) over the shorter time period.

Since beer for draft need not be brewed for a long shelf life, it may also be fermented at higher temperatures (34 to 41 degrees F [1 to 5 degrees C]) and for a shorter period of time. When the hydrometer reading drops less than .2 °Plato/1 degree of gravity over a twenty-four-hour period and is within .4 °Plato/2 degrees of gravity of its anticipated terminal gravity, it can be assumed that there is just enough yeast and fermentable extract left in solution to support cask carbonation. The beer is racked into a keg or cask.

Lagering

A long, cold, post-fermentive rest is usually employed when the wort is from a decoction mash. It yields a more stable beer with a smoother flavor.

Lagering mellows harsh flavors by the combined effects of the falling rate of yeast metabolism, increased acidity, and low temperatures. Astringent tannins coagulate with haze-forming proteins, precipitating these and other, sulfurous compounds out of solution.

Yeast cells are not usually decomposed during lagering, but the culture becomes progressively dormant as fermentable extract (and to varying extents, glycogen reserves) are depleted. With the decline in available carbohydrates, the yeast reabsorb some of the esters and sulfur compounds from the beer.

Off-Flavors

"Staling" aldehydes give beer stale, papery, cardboardy or sherrylike flavors. When higher temperatures decompose yeast cells, sulfury, stale, and soapy flavors arise.

When the kraeusen tradition is being followed, a lattice of beech chips is laid on the bottom of the secondary fermenter and covered with the nearly fermented, or ruh, beer. From 5 to 15% new beer at up to 39 degrees F (4 degrees C) is roused into it. Where tank construction permits pressurization, and the tank is fitted with some manner of pressure relief, it is common to lager the beer under .2 to 2 atmospheres (3 to 28 psi) of pressure, after the vessel is purged of the atmosphere in the headspace. This can be accomplished by various pressure-regulating arrangements.

C_2H_5OH
Ethyl Alcohol

↓

$C_2H_4O \rightarrow H_2O$
Acetaldehyde

The lagering period is determined by referring back to the mash program, the hydrometer reading of the cooled wort, and the primary fermentation time and temperature. Dextrinous beer from a decoction mash should undergo a secondary fermentation and lagering period of seven to twelve days at 33 to 34 degrees F (1 to 2 degrees C) for each 2 °Plato (SG 1.008) of cooled-wort hydrometer reading (OG). Lighter beer, lacking dextrins, is usually held for only three to seven days for each 2 °Plato of the wort density. Very strong, kraeusened beer, on the other hand, may be lagered for six to eight months before it is bottled.

Reducing the temperature to near freezing several days after secondary fermentation falls off reduces lagering time; in fact, the decrease in the solubility of body-forming colloids at 30 to 33 degrees F (-1 to +1 degree C) necessitates a briefer lager period.

Fining

Whether or not the beer is being lagered, fining improves its head retention, lacing, and clarity, and reduces aging times. It precipitates degenerated yeast cells, haze proteins, and tannins out of the beer. Gelatin and isinglass act as fining substances by enveloping suspended particles in their matrix, and gelatin further combines with tannic acid to form an insoluble precipitate. Either brewers' gelatin, unflavored 95%-pure gelatin, or isinglass may be used, so long as it is dry, smooth, pale colored, and odor free. Finings spoil if they absorb moisture during storage.

Isinglass finings are made from the shedded air bladders of certain fish. They are even more subject to spoiling than gelatin finings, and have a more limited shelf life. Isinglass works quickly and is generally added to the beer only two or three days before the beer will be racked. Isinglass precipitates lipids and can dramatically improve head retention.

When the beer has fermented out, it is ready for fining. A reducing-sugar analysis should show less than 2%. The beer must be colder than 50 degrees F (10 degrees C) for gelatin to react with the ferment; the closer to freezing temperature the beer is, the more efficient the action of gelatin finings will be.

Isinglass finings act more rapidly than gelatin finings do under the same conditions, and far better at warm temperatures. Isinglass can be used at up to 60 degrees F (16 degrees C), although it performs better in colder beer.

Dissolving finings into beer, wort, or water must be intelligently handled so that the finings are completely liquefied. They need to be evenly dispersed into the aged beer in a sanitary fashion. Finings cannot combine with yeast, polyphenols, and albumins unless they come into intimate contact with them. To accomplish this, the finings must be diffused throughout the entire volume of beer.

Where the beer is to be filtered, insoluble polyvinylpyrrolidones, such as Polyclar, and polyamides, such as nylon, can be used to remove polyphenols, especially chill-haze anthocyanogens, by bonding to them. Other media used are diatomaceous earth (kieselguhr) and silica gel. Diatomaceous earth selectively removes particles of a certain and greater size and is the filtering agent most commonly used by small breweries. Silica gel absorbs large polypeptides and proteins, removing them from solution so they cannot combine with polyphenols.

If a strong hop aroma is desired in a lager, liquid hop extract may be added with the gelatin finings, or before other treatment. Even with British ales, hops for strong aroma are never usually added after fining. Hops, and especially extracts, when added with finings, can improve the clarification of beer from a well-mashed and boiled wort by increasing the polyphenols available for coprecipitation with albumin.

If the bottled beer lacks a good foam head or is thin, then the clarifying treatment

should be reduced in future batches. Use of particular malts and brewing techniques precludes the need for clarifying.

Clarifying with Beech Chips

Beech or hazelnut chips one-eighth inch thick by one-half inch wide are laid on the bottom of the lagering vessel to form a loosely woven lattice. As the wood absorbs moisture, extract coats the many surfaces of the chips, bonding weak yeast cells to them and thus clearing the beer.

The chips are first soaked and then boiled for twelve to twenty-four hours in a sodium bicarbonate solution (1.5 pounds/gallon) before being rinsed. The process is repeated, sometimes substituting bisulfate of lime. Finally, the shavings are rinsed in a cold-hot-cold water cycle. The pH of the last rinse should be neutral, indicating that all of the bicarbonate has been washed from the chips. They may be washed and reused until they crack from age.

Real Terminal Extract

When the aged beer is ready to be bottled, its real-extract content can be determined by boiling off the alcohol from a measured volume of the beer, topping it up to its original volume with distilled water, and gauging its density with a hydrometer. The liquid pressure exerted by the fermented beer (sugar analysis less than 2%) is due to unfermentable dextrins, maltotetraose, and soluble nitrogen. Taking a hydrometer reading of a dealcoholized sample is the only means by which the "real extract" may be quantified with absolute accuracy, by removing the "apparent density" effect of alcohol from it.

The amount of unfermentable extract remaining in the finished beer is the direct result of the duration and effectiveness of the proteolytic, alpha-amylase and beta-amylase mash rests, the amount and nature of malt used, the effectiveness of protein/polyphenol bonding in the boil, and the ability of the yeast to ferment maltotriose and isomaltose. Typical bottled lagers have a real density of 3.0 to 5.0 °Plato (SG 1.012 to 1020); richer types average 5.5 °Plato (SG 1.022) to 6.5 °Plato (SG 1.026). Bocks may range even higher. The real density of a fully fermented beer is generally 40% greater than its apparent density.

Full-bodied beers should show 45 to 60% real attenuation, light beers up to 70%. Apparent attenuation is usually 60 to 75 % in the former case and up to 85% in the latter.

Bottling

Naturally carbonated beer must be racked off its sediment into a sterile, closed container and mixed with a quantity of actively fermenting kraeusen beer or priming solution sufficient to produce the desired bottle pressure. When corn sugar (dextrose) is used to carbonate the bottled beer, it should be made up into a solution; dry primings are not recommended. High-quality dextrose should be the only sugar employed for bottling.

Whether kraeusen beer or sugar fuels bottle carbonation, measurements need to be exact, and the solution mixed with the aged beer very thoroughly, without splashing, or inconsistent carbonation results. The character of the finished beer is greatly influenced by the degree of carbonation.

Mixing the kraeusen beer or priming solution into the aged beer should not be done in an aerating fashion but should raise a foam head, indicating CO_2 release. This aids in the prevention of oxidation and contamination of the beer at bottling by forming a protective blanket of carbonic gas above the beer and driving some atmosphere from the head space above.

The bottles into which the beer is siphoned must be biologically as well as physically clean. Commercially, bottles are washed with 3% caustic soda, rinsed, then sterilized at above 170 degrees F (77 degrees C), drained, and rinsed. Clean bottles may be "pasteurized" by soaking them for at least thirty minutes in clean water at above 140 degrees F (60 degrees C) or placing them wet in an oven at 200 degrees F (93 degrees C) for twenty minutes before they are inverted to dry and be inspected.

Any type of bottle may be used, so long as it can be sealed and can withstand the pressure of bottle fermentation. Carbonation in excess of three atmospheres requires the use of a heavy-gauge *(continued on page 68)*

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Lager Yeast Revealed

All lager yeasts can be traced to common European origins. But where they come from and how they differ will surprise you.

Despite the long tradition of lager brewing in this country, craft brewers—both professional and amateur—seem to have developed an aversion to bottom-fermented styles.

If it weren't for Samuel Adams, which is a Bohemian Pilsener-style beer, the entire line-up of leading American craft brews would be ales. Just think about it. It starts off with the national popularity of Pete's Wicked Ale and Sierra Nevada Pale Ale. From there, we can include the many products made by Rogue, Red Hook, Shipyard, New Belgium, Deschutes, Alaskan, Brooklyn, Goose Island, Great Lakes, Kalamazoo and...well, need I go on?

The 1996 Beer Brand Index published by the Institute for Brewing Studies lists 1558 lager beers made in North America—just 22% of the total brand count. Many of these lagers are made by brewpubs with limited distribution and most—like bock and Oktoberfest—represent seasonal specialties made just once during each brewing year.

Homebrewers follow suit. In the 1996 National Homebrew Competition, just 18% of the beers were entered into traditional lager style classifications.

So what does that mean for the average homebrewer? Opportunity, of course.

One of the key things that draws many people into homebrewing is the chance to create wonderful beers they can't buy at their local brewpub or liquor store. In our current ale-dominated beer culture, we homebrewers can make a mark by dipping into lagers.

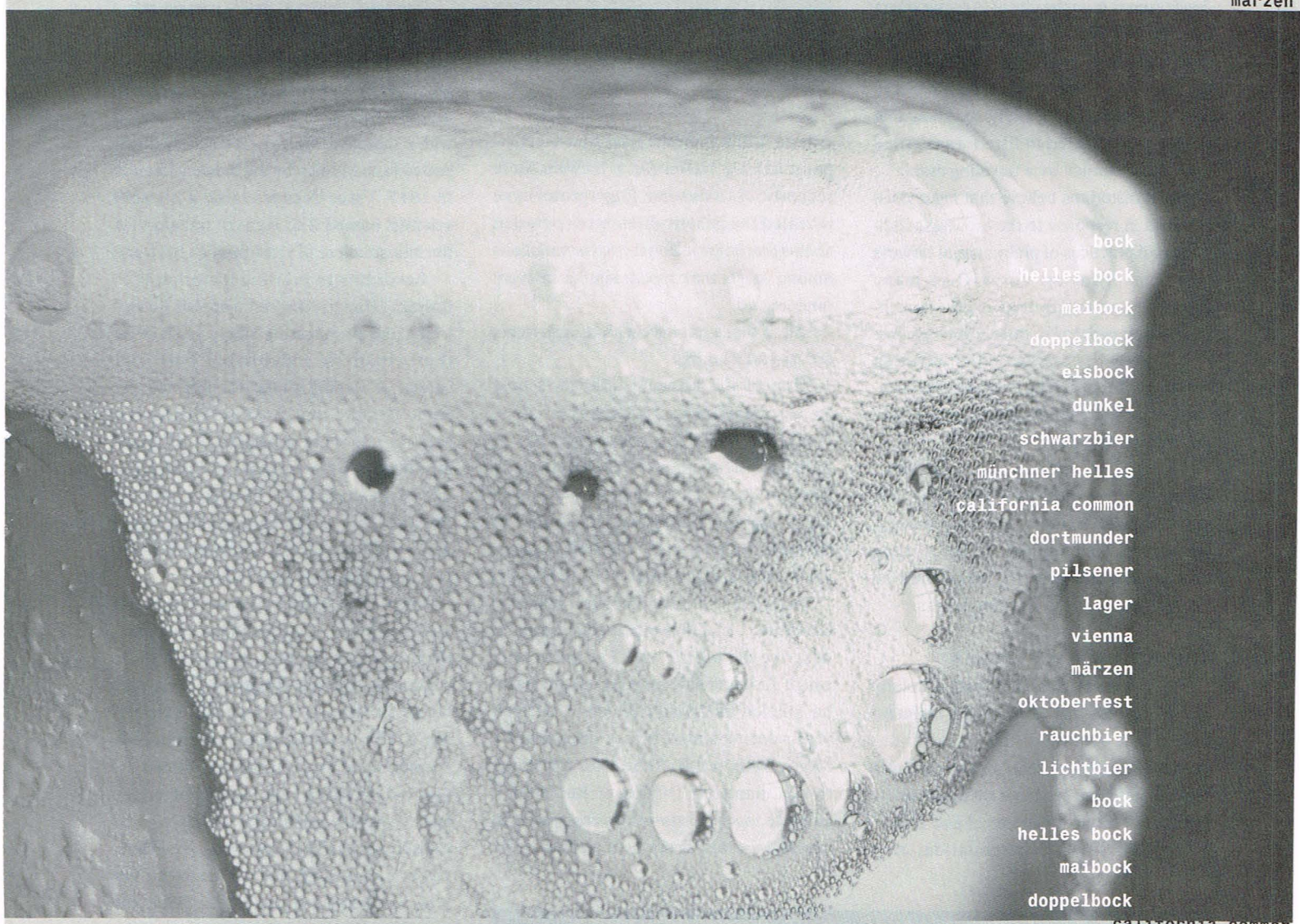
Just imagine downing your own smooth, malty Oktoberfest while others fuss about the oxidized imperfections of the imported versions or the ester-bitten rush job from the local 15-barrel brewhouse. Visualize next summer's barbeque complemented by your own Saaz-infused Pilsener as well as the compliments you'll receive—from all sorts of beer drinkers—on your pale, malt-rich Munich helles. Imagine a cold February night when you reward yourself with the rich lagered smoothness of your own doppelbock.

OK, now hold those thoughts while we learn a bit about lager yeasts. Soon you'll be on your way to realizing your bottom-fermented dreams.

The Lager Revolution

History records 1842 as the dawn of the lager revolution. In that year, a new brewery erected in Plzen in the modern-day Czech Republic made the first of the pale, Saaz-hopped beers that were to conquer the world. Within a few decades, the thirst for this new beer had leapt across the Continent and around the world. To this day, the beer first promulgated in Plzen still serves as the prototype of "beer" around the world.

By Ray Daniels



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Many modern observers mistake the groundswell that emanated from Plzen as the origin of lager brewing. In truth, however, lagers had been made—probably for centuries—in Bavaria long before their magic migrated to Moravia.

Beer historian John P. Arnold cites a passage on Bavarian brewing from about 1420 which "shows that bottom-fermented beer must also have been made."[1] Further evidence comes from the city of Cologne where lager brewing was being resisted as early as 1603 and where, beginning in 1698, apprentice brewers had to swear an oath never to use "bottom yeast."[2] Finally, we know that the lager yeast used in Plzen was carried there from Munich by a traveling monk.

Most historians believe that lager yeast emerged in response to the brewing conditions and practices of preindustrial Bavaria (see accompanying story). Over many decades, yeast that thrived on cool fermentations and perhaps bottom cropping came to dominate the production of Bavarian breweries. The resulting beers found acceptance with beer drinkers and, therefore, with the brewers as well.

As lager emerged to dominate world brewing culture during the late 1800s, the scientific developments of Pasteur and others were quickly applied. Today, cutting edge science still gets focused on brewing yeasts—with some interesting results.

The Science of Yeast

Both in the U. S. and abroad, scholarly and semigovernmental institutes maintain vast culture collections that include hundreds of brewing yeasts. Distinctions between different strains have traditionally been made using biochemical and performance (flocculation, attenuation, etc.) criteria rather than the flavor-based comparisons most meaningful to brewers. More recently, chromosome fingerprints have revealed the genetic differences between strains that help explain the flavor variations among yeasts that appear similar in every other regard.

FIGURE I.
Lager Yeast Types for Popular Wyeast Strains

Carlsberg Type	Tuborg Type
Bohemian #2124	Pilsen #2007
Munich #2308	
American #2035	
Danish #2042	
California #2112	
Bavarian #2206	

All of these data show that lager yeast are basically boring.

One of the brewing industry's best known experts on yeast is Gregory P. Casey, Ph.D. He has done yeast research at Anheuser-Busch and Stroh's and currently works at Coors. As a part of his studies, he has produced chromosome fingerprints of the major brewing yeasts available in America, including those used by homebrewers.

In a 1995 lecture at the Siebel Institute, Casey used snatches of popular culture to describe the big picture. The ale yeasts, which show considerable genetic diversity, he labeled as "Helter Skelter." Weizen yeasts are even more bizarre and earned a Monty Python title, "And Now for Something Completely Different." But when it came to lager yeasts—the yeasts used to produce the vast majority of all beer in the world—the best he could muster was "The Dueling Danes."

In the technical language of a scientific paper on the subject[3], he draws a direct comparison: "While ale yeast demonstrated considerable heterogeneity in their chromosome fingerprints, most lager yeast fingerprints were very closely related, exhibiting similarity to either the original Tuborg or Carlsberg yeast cultures."

The word "original" in this passage refers not to the first lager yeast, but rather to the first single-cell isolates that were carefully managed by breweries. The Carlsberg Brewery, like the Plzen brewery, was founded with a sample of lager yeast carefully transported from Munich by the brewery founder in 1847. Three decades later, a brewery scientist named E.C. Hansen transformed the industrial use of yeast through his work.

According to brewing historian H.S. Corran, "Hansen devised methods for isolating and propagating single yeast cells, thus obtaining indubitably pure cultures....[4]" Using these techniques, he demonstrated that most brewing yeasts then in use were mixtures of different strains and often contained harmful or undesirable organisms. Hansen advocated the use of single-cell cultures for brewery fermentations—a core concept in brewery yeast management even today.

Many lager breweries followed Hansen's lead and by 1896, his methods were practiced by lager brewers on at least three continents. In honor of Hansen's work, lager yeasts took on the species name *carlsbergensis*. This is especially suitable since the chromosome fingerprints produced by Casey show that a large number of today's lager yeasts are genetically traceable to the Carlsberg strain. Only one other race of lager yeasts is recognized, and it is named Tuborg after the brewery of that name. Thus the universe of lager yeasts comes down to the "Dueling Danes" of Carlsberg and Tuborg.

Which Yeast Do You Choose?

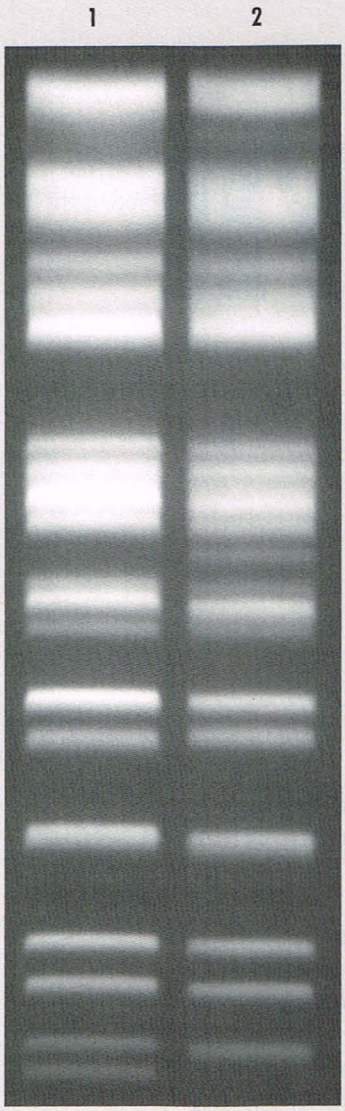
Yeast taxonomy and genetics are fine for Ph.D.s, but brewers want to know about flavor impact in the finished beer. Furthermore, all yeast suppliers offer a number of different lager strains. If there are really only two broad types, how much variation can a brewer

Figure II. General Lager Yeast Recommendations*

Supplier	Best All Around Lager	Accentuates Maltiness	Warmer Temperature Lager Fermentations
Wyeast	Bavarian (2206)	Bohemian Lager (2124)	American Ale (1056)
White Labs	German Lager (WLP 830)	Oktoberfest (WLP820)	San Francisco Lager (WLP810)
Brewers Resource	Swiss Lager (CL670)	Old Bavarian (CL650)	Old German (CL400)

** Other suppliers provide equivalent yeasts; consult product listings for details.*

Lager Yeast Survey: "A Tale of Two Yeasts"



Lane	Yeast Culture
1	"Tuborg" Type Fingerprint
2	"Carlsberg" Type Fingerprint

expect from one strain to the next within the same type?

Casey notes that "...it appears the Tuborg type yeast produces beers which are more estery and less sulfury, than those produced using a Carlsberg type yeast[5]." This gives rise to the *TENS* rule: Tuborg yeasts are Estery and Not Sulfury. Carlsberg yeasts on the other hand, dispense with the esters and instead produce a discernable amount of sulfur character.

Casey's testing of seven popular Wyeast strains found that six were of the Carlsberg type (See Figure I). Only 2007, the Plzen strain, was of the Tuborg variety—a fact consistent with reality since the actual Pilsner Urquell strain is also of the Tuborg type.

As for the flavor differences produced by different strains of the same type, yeast suppliers agree that the distinctions are subtle, but real.

"There are noticeable differences in flavor," says White Labs' Chris White. "The differences are pretty small—not nearly as pronounced as with ales." Still, he says, within his own line the German Lager Yeast (WLP830) is definitely drier and not as malty as the Oktoberfest strain (WLP820).

Brewer and yeast consultant Maribeth Raines also finds subtle differences between same-type strains. "There are always going to be some subtle variations in the character of the finished beer from strain to strain," she says.

Thus brewers in search of the perfect lager have ample *(continued on page 69)*

PHOTO COURTESY OF DR. GREGORY P. CASEY AND COORS BREWING COMPANY

Hometown Pride

BY GREG KITSOCK

Maybe it was an exaggerated case of hometown pride. Maybe it was a barroom bet he made while slightly in his cups.

At any rate, in 1893 a Pottsville, PA, resident named Charles Guetling loaded up his wheelbarrow with a keg of beer from D.G. Yuengling & Son, the local brewery. But he didn't take his sudsy cargo home for a Saturday evening card party.

Instead, he pushed the wheelbarrow 880 miles from Louis Clausman's saloon in Pottsville to the gates of the Chicago World's Fair. Along the way, he suffered blisters, got drenched in the rain and had to rely on the charity of strangers after he ran out of money in South Bend, IN. His canine companion Prince nearly deserted him and had to be tied to the wheelbarrow. On August 13, nearly a month after setting out, he reached his destination. His remuneration? A $25 train ticket home, and a $5 gift from the regulars at Clausman's. Guetling, however, returned a folk hero and probably never had to buy another round in his life.

That's brand loyalty that the makers of Bud or Miller or Coors would trade their eyeteeth for.

The Molson Challenge

One hundred seventy years old, D.G. Yuengling & Son (the name is pronounced YING-ling, although some locals prefer to say YOUNG-ling) proudly proclaims itself "America's oldest brewery." Last year, the Canadian giant Molson challenged that claim before the U.S. Patent and Trademark Office.

Molson can trace its history back to 1786, argued its corporate lawyers. Since Canada is, after all, a part of North America, Yuengling's slogan was a "misdescription" unfairly swaying consumers' buying decisions, they insisted. The patent office, however, judged in Yuengling's favor, ruling that for most beer consumers, America meant specifically the U.S.—possibly not a victory for geography teachers. Yet, Yuengling had been using that slogan since 1957, and Molson never raised a peep of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POTTSVILLE


113
D.G.YUENGLING & SON
EAGLE BREWERY,
Pottsville, Pa.
Porter, Ales & Extra Fine
LAGER BIER

Big Brown Porter

Wendy Aaronson and Bill Ridgely
Rockville, Md.

"This is our latest interpretation of one of our favorite beer styles," write Wendy Aaronson and Bill Ridgely of the Washington, DC-area homebrew club Brewers United for Real Potables. "The beer has won prizes in several homebrew competitions as a brown porter, even though it falls more within the robust porter style guidelines."

Ingredients for 10 U.S. gallons (37.9 L)

- **19 lb pale ale malt (Maris Otter) (8.62 kg)**
- **2.5 lb brown malt 1.13 kg)**
- **1.5 lb chocolate malt (.68 kg)**
- **1 lb biscuit malt (.45 kg)**
- **1 lb wheat malt (.45 kg)**
- **1 lb 60 Lovibond crystal malt (.45 kg)**
- **1.5 oz Perle whole hops (43 g)**
- **2 oz East Kent Golding whole hops (57 g)**
- **Wyeast 1968 London ESB ale yeast**

- **Original specific gravity: 1.058**
- **Final specific gravity: 1.012**
- **Boiling time: 90 minutes**
- **Primary fermentation: 6 days at 65 degrees F**
- **Secondary fermentation: 14 days at 65 degrees F**

Brewers' specifics

Mash in with six gallons of filtered water at 170 degrees F (77 degrees C) to reach mash temperature of 156 degrees F (66 degrees C). Mash one hour and sparge with filtered water at 175 degrees F (79 degrees C) to obtain 12 gallons (45.42 L) of wort. Boil for 90 minutes. Add 1.5 ounces (43 g) of Perle hops 30 minutes into the boil, one ounce (28 g) of East Kent Goldings at 45 minutes, and one ounce (28 g) of East Kent Goldings 60 minutes into the boil. Chill out, aerate well and pitch yeast when the temperature reaches 65 degrees F (18 degrees C). Rack after six days, ferment 20 days total.

protest until Yuengling's sales took off like a bottle rocket during the 1990s.

Porter

In 1998, Yuengling turned out nearly 640,000 barrels, an increase of 35% over the previous year and 500% more than the 127,000 barrels the brewery pumped out a decade ago. Of the total, about 80,000 barrels were Yuengling Dark Brewed Porter, estimates James Helmke, Yuengling's chief engineer. "We're the largest manufacturer of porter in the world," he insists.

First brewed in 1829, Yuengling Porter has been quaffed by generations of anthracite miners, steelworkers and lumbermen—laborers who burn off thousands of calories during a typical work day and want a beer that will provide some sustenance as well as refreshment. In bygone days, it was also a favorite of nursing mothers, who believed that porter "thickened the blood" and promoted lactation. Today, the porter has been discovered by a new generation of discriminating beer drinkers who take it neat, or drink it as a component of Yuengling Black & Tan, a blend of the porter and Yuengling Traditional Lager.

Yuengling Porter is brewed from six-row pale, two varieties of caramel and a little black patent malt. Like Yuengling's other brands, the porter contains a percentage of corn grits. Hopping consists of Yakima Cluster and Cascade, both added to the kettle. The porter is pitched with the same bottom-fermenting yeast that Yuengling uses for its lagers, but the brewery employs a different fermentation cycle.

Yuengling Porter, with an alcohol content of 4.7% ABV and an original gravity of 12.2-12.5 °Plato, is best classified in the brown, rather than robust, subcategory of the style. Michael Jackson describes Yuengling Porter as having "a soft, medium body, a hint of liquorice and a dash of roasty dryness." Roger Protz, in his book *Classic Stout & Porter*, also refers to "the rich, hoppy and liquorice character." Ben Myers, in his recently published *Best American Beers*, describes the porter as "chocolatey" and "effectively a Munich-style dark [lager]." Yuengling, to be sure, is brewed with drinkability in mind: it lacks the in-your-face fruity/hoppy character of micro-brewed porters like those from Catamount and Sierra Nevada.

Yet, its hybrid nature is hardly unique. Several breweries in Eastern Europe and the Baltic area also produce porters with lager yeast, and even Anchor Porter was bottom fermented in its earliest version. If there was any doubt about the beer's pedigree, the judges at the Great American Beer Festival removed it when they granted Yuengling Porter a bronze medal in the Porter category in 1987.

Porter is a dark ale, somewhere between reddish brown and ebony in color, which has a roasty flavor but not the acrid, burnt character that distinguishes a stout. Porter was the first great beer style of the Industrial Revolution in England. The drink is supposed to have evolved from a mixture of pale ale, brown ale and stale beer called "three threads." The name probably derives from the beer's popularity with porters and other laborers.

At the height of its popularity, porter producers built enormous vessels to store their beer, some capable of holding 20,000 barrels of beer. In 1814, one of these enormous vats burst at the Horse Shoe Brewery in London, washing away entire buildings and drowning eight people.

Porter declined in the 19th century, as changing tastes and new malting techniques favored the rise of pale ales. During World War I, the British government limited the production of highly kilned malts as an energy conservation measure. Beer was also reduced in strength. By mid-century, porter had become extinct in the land where it originated. In Ireland, porter had long since evolved into stout (although Guinness produced a porter for the Northern Ireland market until 1973). For a while, the only place you could enjoy a glass of porter was half a world away in the coal-mining regions of eastern Pennsylvania. There, Yuengling shared the slim market for dark beer with Stegmaier Porter, a brand still brewed by the Lion Brewery in Wilkes-Barre, PA.

Allen and Yuengling

Pottsville is located in mountainous Schuylkill County in southeastern Pennsylvania. For better or worse, the area's fortunes have been hitched to the mining industry. According to legend, a wayfarer named Necho Allen in 1790 discovered the rich vein

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of hard coal that runs through the region. After hunting bear on nearby Broad Mountain, Allen fell asleep by his campfire. He was surprised to find the ground ablaze the next morning as a result of the flames igniting an outcropping of anthracite. Allen erected a crude log cabin, which served as a tavern. He tended an orchard of hawthorne trees, whose fruit could be fermented into a bitter wine to satisfy his guests.

Pottsville was growing, however. The Schuylkill Canal, completed in 1825, stimulated trade between the coal fields and Philadelphia. In 1824, Pottsville was a village with five scattered dwellings; by 1840, the population had soared to over 4,000. Clearly, there was a need for a more sophisticated form of hospitality than Necho Allen could supply.

That's where David G. Yuengling came in. The 22-year-old immigrant from Würtemberg, Germany, arrived in America in 1827, intending to exploit the skills he had picked up as an apprentice brewer. He visited Lancaster and Reading first but, evidently finding too much competition, he moved to Pottsville in 1829. His operation, originally called the Eagle Brewery, was located where Pottsville's city hall now stands. After the brewery burned down in 1831, Yuengling relocated to Mahantongo Street, on the slope of Sharp Mountain. The new site provided spring water for brewing and allowed Yuengling to dig tunnels into the hillside for use as fermentation cellars. Unfortunately, there was no way the brewery patriarch could foresee the hardships that modern truckers would face trying to navigate the steep and narrow side streets.

Yuengling produced 600 barrels his first year. By the end of the century, output would increase to 65,000 barrels. Besides porter and lager, Yuengling marketed a variety of long-gone brands, including Brown Stout, Brilliant Ale and Extra Wiener Beer. Originally, beer was packaged only in barrels and half-barrels; bottling was done by independent companies who purchased bulk quantities of beer and transferred it to glass containers with porcelain stoppers. Yuengling didn't do its own bottling until 1895.

Four years before his death in 1877, David Yuengling brought his son Frederick into the family business as a full partner. Frederick died in 1899 before he could purchase the company outright. However, Frederick's son Frank managed to borrow the $500,000 he needed to make the brewery his own. Along the way, several other members of the family established branch breweries in New York City, Saratoga, NY, Richmond, VA, and Trail, British Columbia. None of these survived Prohibition.

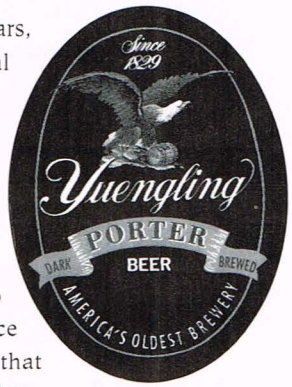
The Molly Maguires

Anthracite mining and ancillary industries brought a tremendous amount of wealth to the area, but it didn't trickle down evenly. On one side of the proverbial tracks were rich businessmen of English, Welsh and Protestant German stock; on the other side were poor immigrants from Ireland, Italy, Poland, Lithuania and almost every other nation in Europe. Violence occasionally erupted, as exploited miners sought to unionize and present their grievances. Between 1862 and 1875, an alleged terrorist organization called the Molly Maguires was accused of 16 killings in the coal fields. In 1969, Paramount Studios released a film version of the Molly Maguires starring Richard Harris and Sean Connery. In the taproom of the Yuengling brewery is a letter from the brewery president to Paramount, granting the moviemakers the right to use Yuengling paraphernalia in their film.

Whether the Mollies were truly guilty or were framed by anti-Union elements is still hotly debated. The group's supposed ringleader, John "Black Jack" Kehoe, was exonerated by the state of Pennsylvania in 1979–101 years after he was hanged for murder. His descendants still operate a bar called Wayne's Tavern in Girardville, PA. Of course, they serve the local beer.

Frank Yuengling oversaw the brewery for 64 years, becoming quite prosperous. His investments ran the gamut from banks to gold mines to Broadway productions, not to mention numerous bars and hotels in Schuylkill County (before Prohibition there were no laws outlawing tied houses).

When the 18th Amendment took effect, Frank was unscathed financially. He's said to have shrugged, folded up his newspaper and calmly predicted, "This will last 10 years, at the most, and we'll be making beer again." The brewery continued to operate during the dry years, producing several near beers, including Yuengling Por-Tor, a non-intoxicating version of their porter. Frank Yuengling also established an ice cream business that lasted into the mid-80s.



After Repeal, Yuengling sent a truckload of its just-released Winner Beer to Washington, DC, as a thank-you gift to President Franklin Roosevelt. Another famous imbiber of Yuengling's beers was novelist John O'Hara, author of *Pal Joey*, *Butterfield Eight*, and a series of stories set in the fictitious town of Gibbsville (a thinly disguised Pottsville). O'Hara, in his youth, inhabited a house built by the Yuengling family that stood about a block away from the brewery. O'Hara took up drinking at an early age, and during his boyhood spent hours searching for a mythical tunnel that connected the basement of his home with the brewery's aging cellars.

As a city of 25,000 in the 1920s, Pottsville briefly fielded its own franchise in the fledgling National Football League. The Pottsville Maroons actually won a championship, but were disqualified for using an ineligible player.

After that it was downhill, as the Great Depression and decreased demand for coal knocked the stuffing out of the region's economy. Yuengling, for the next 50 years or so, would be squeezed hard by a declining customer base and the relentless predations of the large national brewers. By 1950, the facilities were becoming dangerously antiquated. The brewery relied on an obsolete DC generator for its power, and employed a steam-driven ammonia compressor for refrigeration. Fermentation took place in open wooden vessels. There was no palletizer; workers had to stack cases by hand. "The old copper kettle was ready to fall apart," recalls former brewmaster N. Ray Norbert. "It had been put in before 1900."

It was to the credit of the Yuengling family that whatever profits they could scrounge were diverted to modernizing the brewery, piece by piece. This *(continued on page 70)*

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AMAHL TURCZYN

Here are the last recipes from the 1998 National Homebrew Competition.

Last year saw a number of stunning recipes, and we are all excited to see what this year's NHC brings. In the next issue of *Zymurgy* we'll see the gold-medal-winning recipes from the 1999 NHC, which at the time of this writing is winding down to the final round of competition.

For now, though, as winter approaches, let's take a look at some outstanding cold-weather brews. Ross Kahn's "Olde Lumpy" barley wine is powerful enough to take the chill out of the coldest night and still keep hop fanatics happy. Regular NHC champion Terry Durant comes through again with a clean, chocolatey brown porter; or for something even darker, try Joe Formanek's many-malted "Jooky Rainy Day Stout." Then, from one of the nation's homebrewing capitals, Olathe, KS, comes Ed Miles' "Honey Do Dunkel," a shining example of the dark Munich classic. And just for variety, a lighter late-Fall offering: brewing wizard George Fix's much-revered "Pre-Pro" American Pilsener. When hasn't this beer won in the NHC? Revel in the best of 1998 while you still can, because the '99 final round recipes are coming up next!

Every gold-medal winning recipe from the AHA 1998 National Homebrew Competition was printed in the 1998 Nov/Dec *Zymurgy* (Vol. 21, No. 4) "Winners Circle."

Barley Wine

AHA 1998 NATIONAL HOMEBREW COMPETITION BRONZE MEDAL

Ross Kahn, Boulder, CO

"Olde Lumpy XXXX"

English-Style Barley Wine

Ingredients for 5 U.S. gal (19 L)

- 15 lb pale malt (6.8 kg)
- 5 lb 80 °L crystal malt (2.3 kg)
- 3 lb light dry malt extract (1.3 kg)
- 4 oz Chinook hop pellets, 11.9% alpha acid (113 g) (60 min.)
- 2 oz Cascade hop pellets, 6% alpha acid (57 g) (10 min.)
- 2 oz Willamette whole hops, 4.9% alpha acid (57 g) (10 min.)
- Wyeast 1065 American ale yeast
- forced CO_2 to carbonate

- Original specific gravity: 1.105
- Final specific gravity: 1.020
- Boiling time: 60 min.
- Primary fermentation: 7 days at 70 degrees F (21 degrees C) in glass
- Secondary fermentation: 21 days at 70 degrees F (21 degrees C) in glass
- Tertiary fermentation: 150 days at 40 degrees F (4 degrees C) in stainless steel

Brewer's Specifics

Mash grains at 155 degrees F (68 degrees C) for one hour. Add malt extract at sparge.

Judges' Comments

"Malty sweetness is balanced with intense hop bitterness. Complex esters and alcohol. Huge beer."

"Good for hop lovers."

Porter

AHA 1998 NATIONAL HOMEBREW COMPETITION SILVER MEDAL

Terry and Gary Durant, Westminster, CO

"Brett's Portland Porter"

Brown Porter

Ingredients for 5 U.S. gal (19 L)

- 10 lb pale malt (4.5 kg)
- 1.25 lb 90 °L crystal malt (.57 kg)
- .75 lb chocolate malt (.34 kg)
- .5 flaked barley (.23 kg)
- 1 oz Eroica whole hops, 13.9% alpha acid (28 g) (60 min.)
- 1 oz Yakima Kent Golding whole hops, 5.4% alpha acid (28 g) (60 min)
- White Labs English ale yeast
- 1 cup light dry malt extract (237 mL) to prime

- Original specific gravity: 1.061
- Final specific gravity: 1.026
- Boiling time: 60 min.
- Primary fermentation: 7 days at 62 degrees F (17 degrees C) in glass
- Secondary fermentation: 23 days at 62 degrees F (17 degrees C) in glass

Brewers' Specifics

Mash grains at 153 degrees F (67 degrees C) for 60 minutes.

Judges' Comments

"Easy to drink! Excellent balance of flavors nice job."

"Light, smooth-some hop, roast malt toward the end. Very nice, drinkable porter."

Stout

AHA 1998 NATIONAL HOMEBREW COMPETITION BRONZE MEDAL

Joe Formanek, Lisle, IL
"Jooky Rainy Day Stout"
Foreign-Style Stout

Ingredients for 5 U.S. gal (19 L)

- 4 lb pale malt (1.8 kg)
- 4 lb Pilsener malt (1.8 kg)
- 2 lb Special pale malt (.9 kg)
- 2 lb English roast barley (.9 kg)
- 1 lb aromatic malt (.45 kg)
- 1 lb 50 °L crystal malt (.45 kg)
- 1 lb wheat malt (.45 kg)
- 1 lb Quaker oats (.45 kg)
- .5 lb Munich malt (.23 kg)
- .5 lb chocolate malt (.23 kg)
- .5 lb CaraMunich malt (.23 kg)
- .5 lb black patent malt (.23 kg)
- 3 oz Northern Brewer whole hops, 5.1% alpha acid (85 g) (90 min.)
- 1 oz Golding whole hops, 6.4% alpha acid (28 g) (15 min.)
  Wyeast 1056 American ale yeast
- .5 cup corn sugar (118 mL) (to prime)

- Original specific gravity: 1.074
- Final specific gravity: 1.022
- Boiling time: 90 min.
- Primary fermentation: 8 days at 65 degrees F (18 degrees C) in stainless steel
- Secondary fermentation: 4 days at 65 degrees F (18 degrees C) in stainless steel

Brewer's Specifics

Mash-in at 126 degrees F (52 degrees C) for 30 minutes. Raise mash temperature to 140 degrees F (60 degrees C) and hold for 15 minutes. Raise to 150 degrees F (66 degrees C) and hold for 90 minutes. Mash-out at 175 degrees F (79 degrees C) and hold for 15 minutes.

Judges' Comments

"Wonderfully sweet caramel notes followed by dry roasted bitterness. Wonderful stout. Just bump up roast a bit and you'll be there. Hop rates are perfect."

German-Style Dark Lager

AHA 1998 NATIONAL HOMEBREW COMPETITION BRONZE MEDAL

Ed Miles, Olathe, KS
"Honey Do Dunkel"
Munich-Style Dunkel

Ingredients for 5.5 U.S. gal (20.8 L)

- 7.25 lb Pilsener malt (3.3 kg)
- 3 lb Munich malt (1.36 kg)
- .5 lb 80 °L crystal malt (.45 kg)
- 1 oz chocolate malt (.28 g)
- 1.5 oz Tettnanger pellet hops, 3.5% alpha acid (43 g) (60 min.)
- .5 oz Saaz whole hops, 5.2% alpha acid (14 g) (20 min.)
- .5 oz Saaz whole hops, 5.2% alpha acid (14 g) (10 min.)
  Wyeast 2206 Bavarian lager yeast
  forced CO_2 to carbonate

- Original specific gravity: 1.058
- Final specific gravity: 1.012
- Boiling time: 90 min.
- Primary fermentation: 7 days at 50 degrees F (10 degrees C) in glass
- Secondary fermentation: 64 days at 35 degrees F (2 degrees C) in glass

Brewer's Specifics

Mash grains at 151 degrees F (66 degrees C) for 150 minutes.

Judges' Comments

"Malt is good and there is not too much dark grain."

"Well made, clean. Just a little more of that smooth, rich malty character would make this a classic."

Classic Pilsener

AHA 1998 NATIONAL HOMEBREW COMPETITION SILVER MEDAL

George Fix, Arlington, TX
"Pre-Pro"
American-Style Pilsener

Ingredients for 13.5 U.S. gal (51 L)

- 20 lb pale malt (9 kg)
- 4 lb flaked maize (1.8 kg)
- 2 oz U.S. Tettnanger whole hops, 3.2% alpha acid (57 g) (120 min.)
- 2 oz U.S. Crystal whole hops, 4.5% alpha acid (57 g) (45 min.)
- .5 oz U.S. Columbus whole hops, 12% alpha acid (14 g) (30 min.)
  Wyeast 34/70 lager yeast
  forced CO_2 to carbonate

- Original specific gravity: 1.060
- Final specific gravity: 1.012
- Boiling time: 90 min.
- Primary fermentation: 10 days at 50 degrees F (10 degrees C) in stainless steel
- Secondary fermentation: 6 weeks at 35 degrees F (2 degrees C) in stainless steel

Brewer's Specifics

Mash-in pale malt and hold at 104 degrees F (40 degrees C) for 30 minutes. Add maize, raise temperature to 140 degrees F (60 degrees C) and hold for 30 minutes. Raise mash temperature to 158 degrees F (70 degrees C) and hold for 30 minutes.

Judges' Comments

"Excellent, refreshing beer. Commercial quality; very clean."

"Clean, crisp flavor. Good malt, hop balance. DMS perfect-adds to flavor."

Amahl Turczyn is a 1998 GABF Gold Medal-winning professional brewer and the former AHA Project Coordinator.

Dear Professor *(from page 13)*

and lagered for 10 weeks at 37 degrees F (3 degrees C). At this point I added .5 ounce of Saaz hop pellets and shut the fridge door.

The next morning I opened the fridge and, much to my dismay, found the airlock oozing and hissing like a mad snake. A little quick work and cleaning took care of the airlock, but it took another three weeks for the beer to settle down enough to bottle and keg.

The brew was fermented out. The OG was 1.052. At racking time it had dropped to 1.014 and to 1.013 at bottling.

I've had similar experiences with other varieties of hops bought from different sources. The common thread is that I've always used pelletized hops for dry-hopping.

The good thing to say is that I haven't noticed any terrible side effects except a few "hot" bottles when I'm not patient enough to wait out the new action in the fermenter before bottling.

Have I introduced "baddies" to my fine brews? Have I incited an aerobic riot among the little yeasties? Or have I started some other nasty something or other? Help!!

Just another ABNORMAL Brewer,
Tony McCauley
Broomfield, MI

Dear Tony,

Hold on just a minute there while I scratch my head.

(scratch, scratch, scratch, {idea})

Hmm, you got your primary pretty durn cold. I'd guess that it's holding a lot of carbon dioxide. Introducing hop pellets or any other bubble-generating matter would serve as a dandy way for carbon dioxide to escape. That's my guess. Seeing that your ferment only went down one additional point of specific gravity it doesn't seem that you've introduced excessive contamination. Next time I'd just recommend leaving some head space in your secondary for those foamers making their way out to the world.

Escaped,
The Professor, Hb.D.

Secondhand Fridge

Dear Professor Surfeit,

Last spring I purchased a secondhand refrigerator for the purposes of summer brewing and/or lagering. After spending the better part of a day getting it through my basement door, I discovered that, at its lowest setting, the temperature would not get above 40 degrees F (4 degrees C). This is obviously too low for ales, and still a bit low for primary lager fermentation.

I seem to recall reading somewhere about a thermostat one can add to a refrigerator to allow for higher temperature. As it is, I have been using an electric timer, one designed for house lights, to create an on-off cycle of 12-hour units. Is this bad for my brew? I should think that there is a lot of thermal layering in my carboy. Will it affect the final product? My beer has been better than in the past when I had to ferment at 80 degrees F (27 degrees C), but I think it could be better. Any ideas?

PS: I don't know if this is common practice, but I have found that when I soak my bottles in sanitizer they empty much faster if they are given a good spin. This creates a whirlpool inside the bottle and allows air to displace the liquid much faster.

Thanks for your help.

Matt Diggs III
Dayton, OH

Dear Matt,

Simplify your life and improve your beer. Invest about $30 for a thermostatically controlled on/off switch that literally turns your refrigerator on and off by cutting the power supply when it reaches your temperature setting. Disconnect your fridge's thermostat so it is always on as long as the power is on. It's easy and effective. There are many advertised in Zymurgy *and I'm sure your local homebrew shop will be able to guide you as well.*

Yeah. How about that spin. Be careful, though, if you get it spinning the wrong way, well, you'll end up in a vortex yourself.

Spun out,
The Professor, Hb.D.

Fear of Lagers

Dear Professor Surfeit,

I am trying really hard to relax and not worry and I have certainly had many homebrews however anxiety has taken hold. I write to you because my various homebrew

It's the Beer Talking *(from page 5)*

Upcoming in November/December *Zymurgy*

The 1999 National Homebrew Competition gold medal recipes will appear in the Winners Circle section of the November/December ***Zymurgy***. These are the best homebrew recipes in the country over the past year, so be sure to check it out.

Zymurgy on the Web

Our page count in ***Zymurgy*** is based on how much advertising we generate. We have budgeted for an additional two articles to be written and put on the Web. They would be too costly to print, but they are comparatively inexpensive to produce for the web. To give you more for your membership dollars, we will be putting up articles in ***Zymurgy*** on the Web area of the members only section of www.beertown.org.

We are planning articles that have a more technical or controversial slant.

Homebrewer and homebrew shop owner Paul Gatza is the director of the AHA.

suppliers just don't have answers for me and I thought you might!

My ales are working fine but my lagers—much worrying. I brew with liquid yeast (Wyeast). I primary in a glass carboy. After very successful primary (much activity and kraeusen) when only two or so blubs per minute come through the lock I rack with great care to a secondary fermenter. Then nothing. I know it can't be done as it was still visibly fizzing in primary. SG is still only half way down and it's only been a week. This happened two times now (egads, 10 gallons.) Am I leaving all the yeast behind with the sediment? I don't see you mention that in your book, but is it possible? The first time this happened I had to jump start everything with amylase and nutrients.

As I said, my ales carry on nicely in secondary, this is only a problem with my lagers. (Not really lagers, as I am brewing at room temperature to make a steam beer.) If you could respond I would be very grateful.

With unfortunate anxiety,
David Savage
E. Falmouth, MA

Dear David,

Don't worry. Your fermentation sounds quite normal. Quite frequently fermentation will appear to have totally stopped after racking. But don't forget there's a lot of dissolved carbon dioxide in your primary fermentation that hasn't been disturbed. Until you siphoned it. Then whammo—all that dissolved carbon dioxide that is slowly releasing itself and stirring up yeast has evolved out during siphoning. Your secondary is quiet. The beer has less dissolved carbon dioxide and everything seems still, except your worrying mind—until now. Relax. Don't worry. Have a homebrew.

Evolving gas,
The Professor, Hb.D.

Ignorant on a Higher Level

Dear Professor Surfeit,

I changed my procedure for chilling wort in an attempt to enhance trub removal. On the three batches of lager beer brewed using the new procedures, I did something kind of weird that I haven't ever heard of or read about before. The problem is that now I am even more ignorant and confused as to the proper procedure of wort oxygenation at the yeast pitch. (On the plus side, I now feel that I am ignorant and confused on a higher level.)

Some explanation of my new brew procedure is in order. I took my old immersion-type wort chiller and fashioned two garden hose type counterflow wort chillers out of it. I run cold tap water through the first and circulate ice water through the second.

On brew day I always let the boiled wort sit in my covered brewpot for 30 minutes in order to settle the hops and the hot break trub. Then the wort gravity flows through the screened spigot in the bottom of the brewpot through both wort chillers and into a trub removal carboy. The wort enters the chillers at 200 degrees F (93 degrees C) and exits into the carboy 30 seconds later at 38 degrees F (3 degrees C). This shock chill makes for an impressive cold break. The snowy trub settles slowly out of suspension, leaving behind wort that is clear and brilliantly black.

I'm not to the weird part yet.

I ferment in a stainless-steel soda keg. I cut the dip tube an inch short so I can use carbon dioxide to rack the beer into a secondary fermenter without oxygenating the brew or disturbing the yeast cake.

When I brewed the first batch I step cultured up to three quarts of sterile starter (Wyeast #2206) like usual. I pitched the yeast at 50 degrees F (10 degrees C) and force oxygenated the wort at 15 pounds pressure. A normal lag time of eight hours resulted a blow-off started in 48 hours.

This is the weird part. On the second batch I planned to start another yeast culture like always, but then I got another idea. Since the first batch needed to be racked into a secondary fermenter anyway, I decided to rack the second batch right on top of its yeast cake without ever even opening the primary fermenter keg.

So I used carbon dioxide to rack the first batch into a secondary fermenter. Then I purged the keg with bottled oxygen, and gravity racked the brilliantly clear wort through the dip tube of the unopened fermenter right on top of the yeast cake at 50 degrees F (10 degrees C). (The key to this is really effective trub removal. Without it I don't think it would ever work.)

But that's when I got stuck. I know a freshly pitched wort needs to be thoroughly oxygenated in order for the yeast to reproduce, but what about in this situation where there is already enough yeast? Should I oxygenate or not? Does the yeast require oxygen for reasons other than reproduction at the pitch? I decided to compromise and force oxygenated conservatively at five pounds pressure, swirling the keg thoroughly to rouse the yeast.

Fermentation started immediately. The blowoff tube goes from the gas fitting on the fermenter into a glass jug half filled with sterile water, and a big bubble a second started right away. In 12 hours full blowoff was making the water/beer mixture in the jug look like it was in a hard boil. Primarily, fermentation at 48 degrees F (9 degrees C) was over in a few days.

I just finished racking the third batch into a secondary fermenter and opened my primary fermenter for the first time in 30 days. The yeast cake was only a little larger than that of a single batch ferment. It was rich and thickly textured and smelled clean and wonderfully pleasant. There was some scum on the top of the keg, but no more than I used to get with a single batch of ferment before I started trub removal.

As all three batches are still lagering, I am not yet able to judge the results.

I am aware that overpitching can cause flavor problems, but I am really intrigued by this method. I think as long as I keep the yeast cake well-fed with fresh batches of wort in order to prevent self-feeding, this should work. Unless your advice or the taste of the beer in question causes me to change my mind, next winter I plan to run consecutive batches through the unopened fermenter from November through March.

I would greatly appreciate any input on wort oxygenation at the yeast pitch under these unique circumstances, and any problems that you see with this method.

Sincerely,
Joe Newcomer
Las Cruces, NM

Hey Joe,

Where you going with that homebrew in your hand?

Hey, I think if the beer tastes great keep on brewing the way you're doing. Yes, one can overpitch and the results are variable depending on the strain of yeast used, the circumstances and "other." Overpitching can result in off-flavors to one person and desirable characters to another. So it is subjective to a certain point.

What you have happening is that yeast will only multiply to achieve a certain population density (about 50 million cells per mL) after that they know enough to cut the screwing around, so to speak. So you introduced some oxygen. That's good. Do that. Because you never know your yeast viability at the end of fermentation. If there was enough yeast to begin with and it was ready to toot into fermentation then the yeast may have used some of your introduced oxygen. What happened to the unused part? Well, it probably got scrubbed right out with the carbon dioxide bubbles it created when it fermented. Needles to pins I think you got a good thing going. You want to improve and finesse, then figure out a way to reduce the sediment to about 3/4 cup of yeast paste and that's about optimal for a five- to seven-gallon batch. Yes, keep oxygenating and keep it clean. Good brew is weeks away.

Yagottagoodthinggoing,
The Professor, Hb.D.

Sneaky German Hops

Dear Professor Surfeit,

While I was in Germany with the U.S. Army, I came across my favorite beer Ochsenfurt Bräu. It was Pilsener beer brewed in a little town by the same name located just southeast of Würzburg. They also came out with a Märzen beer in the fall that tasted the same but stronger. It had a spicy aroma and flavor and a good little bite. The spicy flavor and aroma were almost like black pepper.

My question to you is, after three years of trying, what kind of hops and grains could they have been using that would have produced such a beer? Also, while I was there I sampled many beers and every one was different, but they all were about the same color. I've been brewing all grain now for four years and whenever I try to make a beer distinctly different from the last I blow the color, which I have found to be very easy. Do they all have their own yeast to make each beer different?

Still brewing,
Scott Hardy
Montpelier, OH

Dear Scott,

Beer brewing has so many variables it'd be hard to pinpoint what was going on with all those great beers you sampled.

I think I know the character you're trying to describe as spicy and almost like black pepper. Yes, the bitterness has a prickly sparkling sensation that is quite refreshing and nearly defines the style. Try brewing with very soft water using German or Czech-grown Hallertauer or Saaz. These hops in a light lager beer brewed with soft water will get you on the way.

Trying to get the right color in your beer? It gets easier these days with homebrew suppliers being able to tell you the color rating of various grain malts, color charts and simple calculations to predict color. If you're having difficulties keying in on the color you desire, start out with the palest of malt and see how light you can go, then add small amounts of specialty malts to gauge their effect on color. Slow and easy does it. Since you're trying for a Pilsener to begin with you should reach your goal fairly quickly by starting out with just Pilsener malt.

Many brewers have different yeast and surely that affects the flavor, but just as much the particular configuration of the brewery, their decoction process, times and temperatures, equipment and materials all factor into the tremendous and wonderful variation of the German beers you experienced. I'd like to see some of that art learned and utilized by craft brewers in the U.S. so we can continue to increase our choices. Rare is the American brewer who duplicates what we've experienced in Germany.

Keep at it,
The Professor, Hb.D.

Send your homebrewing questions to "Dear Professor", PO Box 1679, Boulder, CO 80306-1679; FAX (303) 447-2825 or professor@aob.org via e-mail.

The Magic and Miracle *(from page 25)*

- The amount of residual acetaldehyde, which contributes a certain rawness to beer flavor, decreases during lagering by as much as 20-70%.
- Likewise diketones, such as 2-3-pentanedione and the volatile, unpleasant butterscotch-tasting diacetyl, as well as their alpha-acetohydroxybutric-acid precursors, are reduced by as much as two-thirds. Diketones are the oxidation products of these acids. As a result of lagering, especially diacetyl–which has an exceptionally low taste threshold of 0.1-0.15 mg/L–is reduced to much more acceptable, fruity-tasting acetoin, which has a many times higher taste threshold of 8-20 mg/L.
- When beer reaches the lagering tanks, it frequently still contains about 10% of the amount of sugar that was originally present in the wort at the time of pitching. About four-fifths of this residual sugar is made up of easily fermentable maltose, the rest is mostly maltotriose. During lagering, the total residual sugar content of the beer usually drops by as much as one-half, which increases the beer's shelf life. It also raises the amount of carbon dioxide in solution.
- Perhaps most important, especially to the commercial brewer, is the yeast's ability to scavenge much of the remaining oxygen out of the brew during lagering. Aldehyde is a product of fermentation and a precursor to ethanol. Oxygen in solution in the finished beer can cause a reversal of this chemical pathway. Aldehydes in the form of oxidized ethanol give beer a cardboardlike stale taste. Since packaged oxygen is the key variable in beer spoilage after the finished product has left the brewery, oxygen scavenging by the yeast during lagering reduces the chance of aldehyde formation in packaged beer, thus making the beer ever more clean-tasting and stable, and extending the beer's shelf life.

To Lager or Not to Lager

Though lagering slows down the productivity of their expensive tankage, German beer makers believe the taste benefits of cold conditioning their brews far outweigh its economic drawbacks. This, of course, begs the question: If lagering is so wunderbar, why should we not want to lager all beers? The answer comes in several parts:

- The trace elements and residual sugars that are eliminated or reduced through lagering constitute a key flavor component in many beers, especially British-style ales. For these beers, lagering would be dysfunctional and inappropriate.
- Slow lagering simply would not occur with yeasts that lack the required cold-temperature tolerance. With typical ale yeasts, except for alt, Kölsch and wheat beer yeasts, the lagering process would just get stuck.
- Some yeast varieties are simply too flocculant to stay in suspension in sufficient enough quantities to perform lagering. Instead, they tend to cake out in the bottom of the conditioning tank. Yet these yeasts make wonderful beers, so we should continue to use them for our pleasure without lagering! Typically, most lager yeasts and even German ale yeasts are relatively dusty. How else could you have a yeast-turbid hefeweizen!

Lager beers come in all shades of color, from the opaque schwarzbier (a black lager), to dunkel (a dark lager), to bock (an amber-to-tan strong lager), to Oktoberfest (a deep golden malty lager), to helles (a straw blond brilliant lager). In all these beer styles long lagering results in an exceptionally clean, crisp flavor. The challenge of brewing an authentic, well-balanced lager usually increases as the color lightens and the hop flavor becomes "nobler," since less robust beers tend to reveal off-flavors more readily. The moderately hopped, malty helles is perhaps the most delicate beer imaginable. It must rely almost entirely on its incredible subtlety to please the palate. If beers were athletes, the stout, no doubt, would be a husky football player, whereas the helles would probably be a graceful figure skater.

So should you lager your brew? The answer for the practical brewer is, perhaps necessarily, tautological: If you aim for a lager style, just using the right ingredients, including the right bottom-fermenting yeast strains, does not guarantee the right outcome. You must also use the right process to get an authentic result. Thus, you must lager if you want to create a lager (or a German ale), otherwise you definitely should not.

Is that a Lager? *(from page 29)*

warm, top-fermenting ale yeasts and cold, bottom-fermenting lager yeasts. They also learned to breed different yeast strains as pure cultures. With these advances, no doubt, somebody would have gotten the lager ball rolling. But one thing is certain: If Albrecht's decree had not happened when and where it did, the history of brewing would have taken a different course. Just think, at least half a dozen of the world's 20-or-so classic beer styles were created in Munich as a result. Only London can remotely rival Munich's accomplishments as a brew center.

There you have it: Lager, the unintended, but momentous consequence of a half-cocked regulatory act...all because Duke Albrecht didn't allow his brewers to fiddle with their mash tuns in the summer!

Horst D. Dornbusch is a recognized authority on German beers. Born and raised in Düsseldorf, Germany, he has lived in North America since 1969. He is founder of the Dornbusch Brewing Company, Inc., in Ipswich, MA, a contract brewing company that specializes in authentic German-style craft-brewed beers. Horst writes regularly for *Zymurgy* and is the author of three books on beer: *Prost! The Story of German Beer* (1997), *Altbier* (1998), and *Helles* (forthcoming in spring 2000), all published by Brewers Publications, Boulder, CO. He is currently working on a book on dunkel, the Bavarian dark lager.

References

For the strictly chemical stuff, George Fix's *Principles of Brewing Science* and *An Analysis of Brewing Techniques*, as well as Gregory Noonan's *Brewing Lager Beer* (all available through the AHA) are great reference works in English. If you happen to read German, two books are positively authoritative: *Abriß der Bierbrauerei* by Ludwig Narziß (Enke Verlag, Stuttgart, 1986) and *Handbuch der Brauerei-Praxis* by Karl-Ullrich Heyse (Getränke-Fachverlag Hans Carl, Nürnberg, 1994).

Horst D. Dornbusch is the author of *Prost! The Story of German Beer* (1997) and two Classic Beer Style Books, *Altbier* (1998) and *Helles* (forthcoming in spring 2000). Horst's books are published by Brewers Publications, Boulder, CO, and are available through the AHA.

Lager Styles *(from page 33)*

When to drink: Beginning on January 1, 2000, and regularly thereafter. When the food supply dwindles, the stock market crashes, and power outages are widespread, you'll need a great beer to keep up your spirits.

American-Style Pilsener

In brief: An interesting and very drinkable American adaptation of a classic European beer.

The fine print: This is a unique American style that was brewed prior to Prohibition. It is brewed with 6-row barley and up to 25% corn (flaked maize). It ranges in color from straw to deep gold and is medium-bodied. It has some sweet flavor and aroma from malt and corn and may have low levels of DMS. It is well-hopped and has medium to high hop bitterness, flavor and aroma, preferably from noble-type hops.

The specs:
OG (Balling/Plato): 1.045-60 (11.3-15.0)
FG (Balling/Plato): 1.012-18 (3-5)
% alcohol (wgt./vol.): 3.9-4.7 (5.0-6.0)
IBUs: 20-40
Color (SRM/EBC): 3-6 (6-12)

When to brew: When you're feeling nostalgic for "the good old days."

When to drink: On the Fourth of July. What better way to pay tribute to America's past?

American-Style Lager

In brief: Bubbly and bland, millions find it inoffensive. Most real beer drinkers find it uninteresting.

The fine print: Clean and crisp is how this commercially popular beer is often described. It is light-colored, light-bodied, highly carbonated, and lacking in malt sweetness. It may have a slight hop bitterness, little or no hop flavor, and no hop aroma. Adjuncts such as corn, rice, and other grains or sugars are often used to brew this beer.

The specs:
OG (Balling/Plato): 1.040-46 (10.0-11.5)
FG (Balling/Plato): 1.006-10 (2-3)
% alcohol (wgt./vol.): 3.2-3.8 (4.1-4.8)
IBUs: 5-17
Color (SRM/EBC): 2-4 (4-8)

When to brew: You think you're a hotshot brewer? Here's your chance to prove it. Any faults with a beer of this style will be easily detectable.

When to drink: When it's the only beer around. However, it makes a good base for beer cheese soup.

American-Style Light Lager

In brief: If you believe that the saying "less is more" applies to beer, this one's for you.

The fine print: In the U. S., regulations state that a "light" beer must have at least 25% less calories than the beer's "regular" version. This beer is extremely light in color and body, and is highly carbonated. It is mildly-flavored with a low hop bitterness.

The specs:
OG (Balling/Plato): 1.024-40 (6.0-10.0)
FG (Balling/Plato): 1.002-8 (1-2)
% alcohol (wgt./vol.): 2.8-3.5 (3.6-4.5)
IBUs: 8-15
Color (SRM/EBC): 2-4 (4-8)

When to brew: When you're almost out of grain, you're almost out of hops, the homebrew shop is closed, but you really want to brew.

When to drink: After competing in a jalapeno-eating competition.

American-Style Premium Lager

In brief: At bit more appealing than a basic American lager, but still not much to get excited about.

The fine print: This is a slightly more assertive version of American-style lager. Adjuncts should not exceed 25%, and sweetness from malt and adjuncts is low. It is medium-bodied and light straw to golden in color. This beer has little or no hop flavor and aroma. However hop bitterness and alcohol may be greater than in an American-style lager.

The specs:
OG (Balling/Plato): 1.046-50 (11.5-12.5)
FG (Balling/Plato): 1.010-14 (3-4)
% alcohol (wgt./vol.): 3.6-4.0 (4.6-5.1)
IBUs: 13-23
Color (SRM/EBC): 2-6 (4-12)

When to brew: After you've volunteered to brew for your bowling league's summer barbecue.

When to drink: When you want to prove to your Joe Sixpack friends that you're not always a big beer snob.

American-Style Dark Lager

In brief: At least it looks interesting.

The fine print: This is a darker colored, slightly more flavorful version of American-style lager. Flavor and aroma of malt are present but at low levels. Light-bodied, and ranging from very deep copper to dark

■ As the days grow dark, your lager should too.

brown, it is commonly brewed with non-malt adjuncts. It is highly carbonated and is low in hop bitterness, flavor and aroma.

The specs:
OG (Balling/Plato): 1.040-50 (10.5-12.5)
FG (Balling/Plato): 1.008-12 (2-3)
% alcohol (wgt./vol.): 3.2-4.4 (4.1-5.6)
IBUs: 14-20
Color (SRM/EBC): 14-25 (28-50)

When to brew: Before the Halloween party.

When to drink: When your 80-year-old Aunt Bitty, who has never had a dark beer, decides she wants to try one.

Vienna-Style Lager

In brief: Like the city itself, sophisticated, yet unthreatening.

The fine print: This light- to medium-bodied beer amber lager can be reddish brown or copper colored. There is a slight malt sweetness and the malt character can be toasty in both aroma and flavor. It has low to medium levels of hop flavor and aroma and finishes dry with a low to medium hop bitterness.

The specs:
OG (Balling/Plato): 1.046-56 (11.5-14.0)
FG (Balling/Plato): 1.012-18(3-5)
% alcohol (wgt./vol.): 3.8-4.3 (4.8-5.5)
IBUs: 22-28
Color (SRM/EBC): 8-12 (16-24)

When to brew: Anytime. You can't go wrong having this around.

When to drink: On the Mexican holiday of Cinco de Mayo (May 5). Several Mexican beers are of the Vienna style.

German-Style Märzen/ Oktoberfest

In brief: A little sweet, with a gentle kiss of hops. A real crowd pleaser.

The fine print: A stronger version of the Vienna style, Vienna and Munich malts give this medium-bodied beer a noticeable toasted malt aroma and flavor. Some malt sweetness is present and is slightly dominant over a crisp hop bitterness. Hop flavor and aroma of noble-type hops is low. Color can range broadly, from golden to reddish brown, and it finishes on the dry side.

The specs:
OG (Balling/Plato): 1.050-56 (12.5-14.0)
FG (Balling/Plato): 1.012-20 (3-5)
% alcohol (wgt./vol.): 4.0-4.7 (5.1-6.0)
IBUs: 18-25
Color (SRM/EBC): 5-15 (8-30)

When to brew: In spring, when it's still cool. It'll be perfect in the fall.

When to drink: In October, of course, and the month before and after, too.

Bamberg-Style Rauchbier

In brief: If you like smoked meats, cheeses, and chili peppers, give this beer a try.

The fine print: This unusual amber lager has an assertive smoky flavor and aroma derived from malt smoked over hardwood. This is a full-bodied beer with a toasted malt sweetness. Hop bitterness is medium, hop flavor is low, and aroma of noble-type hops may be present or absent.

The specs:
OG (Balling/Plato): 1.048-52 (12.0-13.0)
FG (Balling/Plato): 1.012-16 (3-4)
% alcohol (wgt./vol.): 3.4-3.8 (4.3-4.8)
IBUs: 20-30
Color (SRM/EBC): 10-20 (20-39)

When to brew: In early fall, to be ready for the holidays.

When to drink: When you're quitting cigars, and you're craving a good smoke.

Frequent *Zymurgy* contributor Dan Rabin lives in Boulder, CO, and spends his time in search of the perfect beer cheese soup.

Mashing *(from page 41)*

This yields flavorful dextrins and fermentable sugars.

Alpha-amylase very rapidly reduces insoluble native starch to smaller polysaccharide fractions (a mix of some glucose, maltose, maltotriose, and straight-chain dextrins with a predominance of branched "a-limit" dextrins). Given long enough, the alpha-amylase continues to sever 1-4 glucose links, producing more glucose, maltose, and maltotriose, but starch-chain fragments are more effectively saccharified to fermentable sugars by the faster-acting beta-amylase. Beta-amylase has no effect on native starch, but in hydrolytic solution, it reduces soluble starch by cleaving glucose molecules from one end of starch chain fragments and rejoining them in pairs with a water molecule to create maltose, $C_{12}H_{22}O_{11}$.

It is inadvisable to reduce all starch to fully fermentable maltose. Significant quantities of more complex polysaccharides must be carried over into the ferment for the beer to have a sweet flavor and sense of fullness. Partially fermentable dextrins, oligosaccharides, and especially maltotriose support the yeast during the long, cold aging period.

The temperature of the rest may be from 149 to 160 degrees F (65 to 71 degrees C), depending on the nature of the beer being brewed. Precisely hitting the appropriate rest temperature is essential, as a variation of two or three degrees for even five minutes will dramatically alter the maltose/dextrin ratio of the extract.

Mash thickness also affects the fermentability of the wort. A thick mash (less than three-tenths of a gallon of water per pound of malt) induces the greatest overall extraction. A much thinner mash increases the proportion of maltose, and thus wort attenuation.

The reduction of the large starch chains in a thick mash at 155 to 158 degrees F (68 to 70 degrees C), almost excludes any maltose formation whatsoever. The richly dextrinous wort produces a fullness and sweetness complementary to Munich-style lagers and darker beer with a contrasting burnt-malt bitterness. It is seldom suitable for light-colored beers.

Above 160 degrees F (71 degrees C), strong enzyme action ceases; temperatures below 149 degrees F (65 degrees C), on the other hand, seriously limit dextrin formation (by alpha-amylase, temperature optimum 149 to 158 degrees F [65 to 70 degrees C], pH 5.1 to 5.9) while favoring the formation of maltose by beta-amylase. Because starch granules are not gelatinized or dispersed below 149 degrees F (65 degrees C), beta-amylase activity at lower temperatures serves only to eliminate the straight-chain dextrins formed in the decoction, without further significant starch reduction.

For very light beers, the release of ungelatinized starch into solution at 149 degrees F (65 degrees C) is capitalized upon by raising the temperature of the mash from 131 to 149 degrees F (55 to 65 degrees C) over fifteen to thirty minutes; this largely eliminates the amylose liberated during the decoction. The mash is brought to rest at 149 to 151 degrees F (65 to 66 degrees C) to gelatinize and further dextrinize the starch, and to produce a maltose/dextrin ratio that favors lightness on the palate and rapid maturation.

For rather more usual palate fullness and fermentability, the recombination of the mashes requires even more careful handling. The decoction must be returned to the rest mash as quickly as possible, but without creating wide temperature variations within it. The rest temperature should be evenly attained within less than ten minutes.

Most of the amber and gold lagers, and even the pale Pilsener/Dortmunder types, rely on the heavier, richer dextrin complement formed at 152 to 155 degrees F (67 to 68 degrees C). This is the strike temperature of most "character" beers brewed with undermodified malts and a protein rest at 122 degrees F (50 degrees C). Saccharification in this temperature range encourages an alpha-/beta-amylase activity ratio greater than five to one; as a result, the dextrin content of the wort is 25% or greater, and the alcohol content by weight of the finished beer is roughly one-third the value of the wort density (°Plato). Where a combined protein/saccharification rest at 131 degrees F (55 degrees C) has been made, similar results are achieved by a dextrinizing rest at 158 to 160 degrees F (70 to 71 degrees C).

As the mash saccharifies, it becomes thicker, brighter, and browner. The brewer may decide to add brewing liquor to thin an overly thick mash and to speed up saccharification (beta-amylase is more effective in the looser mash). Caution must be used, however; as mash temperatures rise above 149 degrees F (65 degrees C), enzymes are rapidly destroyed in a thin mash. Even in a thick mash, beta-amylase is destroyed in less than an hour at above 149 degrees F (65 degrees C), and alpha-amylase is destroyed within two hours at above 154 degrees F (68 degrees C) in a mash below pH 5.5. This fact must be remembered when

mashing to yield a dextrinous wort; a satisfactory dextrinous wort cannot be formed at below 153 degrees F (67 degrees C).

As opposed to British infusion mashes, which are entrained with air and "float," a decoction mash is stirred regularly, in a non-aerating fashion, to break up any pockets of unmodified starch and ensure uniform conversion. After fifteen minutes at the rest temperature, testing for saccharification with iodine should begin.

Iodine Starch-Conversion Test

Place a small sample of the extract in a porcelain dish. Float common iodine (.02N solution; 1.27 grams iodine and 2.5 grams potassium iodide in 500 milliliters water) onto the extract, drop by drop, until a distinct layer of iodine is formed. Note any color change in the iodine at its interface with the mash liquid. Also observe the intensity of the color: is it trace, faint, or strong? Blue-black indicates the presence of native starch (amylose); deep mahogany/red-brown evidences gelatinized starch (amylose fragments and large a-limit dextrins), faint red simple a-limit dextrins. A faint mahogany to violet-reddish reaction denotes a mix of small dextrins. Total mash saccharification (a solution of some small a-limit dextrins with maltotriose, maltose, and simple sugars) causes no change in the yellow color of iodine.

Iodine is a poison. *DISCARD ALL TESTS.* Ensure that there is no iodine contamination by washing any article that comes into contact with it. Conduct iodine tests some distance from the mash so that no iodine will inadvertently contaminate the mash.

Most of the starch should be reduced to at least small a-limit dextrins by alpha-amylase. Even for sweet, less-fermented beers, the reaction with iodine should be no more than faintly mahogany-to-red. There should never be a strong color reaction with the iodine; neither, however, should rich beers be saccharified to the point that a negative iodine reaction occurs. A faint mahogany-to-reddish reaction indicates an acceptable extract composition for these beers.

The mash should be held at the strike temperature until saccharification is complete. Infusions of boiling water may be made with less regard to enzyme viability as conversion nears completion. The looser mash improves filter bed formation.

(Note: Koji or other diastatic enzyme preparations should not be used to increase enzyme activity. Although they convert hundreds of times their weight in soluble starch to simple sugar, they do not form dextrins.)

If the mash does not saccharify within one hour, it should be stirred, restored to temperature, verified for proper pH (5.2 to 5.5), and held for thirty minutes more. If the iodine color is not further reduced, addition of diastatic malt or extract may be required.

The efficiency of the malt crushing can be gauged by pressing a sample of the goods until all of the kernel ends and malt particles have been crushed, then separating the liquid from the particulate matter. Repeat the iodine test on the liquid, as above. If the color at the iodine-mash interface is intensely black or blue, then crushing was insufficient or the malt was poorly doughed-in. (Some isolated color from insignificant amounts of exposed starch is to be expected; husk particles themselves will always turn intensely black). Suspicions regarding the efficiency of milling may be verified either by a wort density that is less than predicted or by tasting the dried spent mash. If extract efficiency is below 65% or the spent grains taste sweet, the malt has probably been insufficiently crushed.

Final Decoction

When the starch end point has been verified, the very thinnest part of the mash is removed to be boiled. The decoction is usually 40% of the volume, although a very thin mash may require boiling half of the mash. Because there are fewer starch and albuminous particles in the thinner portion, there is less risk of these being decomposed during the boiling of the runoff. These remain with the rest mash. On the other hand, enzymatic reduction of the dextrins in the thin part of the mash is more quickly terminated, preventing oversimplification of the extract.

The lauter decoction is brought to boiling, while being stirred, in ten to fifteen minutes and may be held at a strong boil for a further fifteen to forty-five minutes, although in modern practice it is uncommon to boil the mash for more than five or ten minutes. The temperature of the rest mash is held at or slightly above the strike temperature during boiler-mash processing.

The boiled extract must be well mixed with the rest mash. Care should be taken that the strike temperature of the final rest, 167 to 170 degrees F (75 to 77 degrees C), is not exceeded. Temperature adjustments may be made by the infusion of either cold or boiling brewing liquor, as required.

Exact temperature maintenance is, as before, critically important. Lower temperatures do not terminate enzyme activity or

expand particles of intermediate starch degradation enough to keep them in temporary suspension, up and away from the bottom of the mash filter bed. At higher temperatures, the starch granules burst, and insufficiently modified carbohydrate and albuminous matter becomes dissolved and unfilterable. Because the diastatic and proteolytic enzymes have been destroyed by the high temperatures, the starch and protein gum have no opportunity to be reduced to manageable fractions. High temperatures also induce the extraction of tannins from the husk.

The mash-out temperature may be maintained for up to one-half hour while the mash is roused up. Thorough mixing allows the mash to settle very slowly and form a well-delineated filter bed.

The lauter mash should be very thin and thoroughly intermixed to encourage the absorption of the malt extract into solution and to temporarily force small starches and proteins into suspension, allowing the husks to freely settle.

Sparging

The liquid level above the filter bed is maintained by the introduction of sparge liquor. Sparge liquor should be gently and evenly dispersed over the top of the mash so it will evenly percolate through the mash and diffuse all the extract from it. The sparging rate should be free from surges and matched to the runoff rate so that the liquid level in the lauter-tun is not changed.

The sparging/runoff rate may be gradually increased, but not so much so that turbidity is caused in the runoff. Set mashes also result from too rapid a flow rate.

High-husk, six-row barley may be run off in less than an hour (a six-inch-deep bed may be filtered in as little as one-half hour). Maximum extraction, however, is achieved with a very slow runoff rate, a deeper filter bed, and raking the mash to within six inches of the false bottom. Raking restructures the filter bed, ensuring even percolation of the sparge liquor through the grain and complete extraction of the sugars. A mash that is raked, or that is from finely ground malt, or shows a tendency to set, must be run off slowly. Set mashes that don't respond to being stirred must be cut repeatedly during sparging in order to reopen channels of extract flow.

Within 1 1/2 hours, the greater part of the extract will have been leached from the malt. Although the maximum yield is obtained by restricting the runoff rate so that it takes two to four hours to collect the sweet wort, the small percentage of extract gained is not worth the time and effort.

The temperature within the mash should be carefully maintained during sparging and filtering, although the early runoff will usually be well below 168 degrees F (75 degrees C). In the interest of preventing further enzyme activity, the wort collecting in the copper should be heated to above 170 degrees F (77 degrees C) as it accumulates. Where a large amount of evaporation is required, the sweet wort is brought to boiling and partially hopped as soon as it has covered the bottom of the kettle.

As the color of the runoff pales, its extract content is periodically checked with a hydrometer; when the reading drops to below 3 °Plato (SG 1012, corrected to 68/60 degrees F [20/15.56 degrees C]), the runoff is diverted from the wort kettle.

Below this density, the runoff pH is likely to rise above pH 6, increasing the likelihood that malt tannins, lipids, and silicates will be leached into it. Malt tannins give an astringent taste and are harsher flavored than hop tannins. They are more soluble and are not as readily precipitated in the kettle. Lipids interfere with foam stability, increase ester formation, and are precursors to cardboardy, stale flavors in beer.

Gregory Noonon, owner and brewmaster of the Vermont Pub and founder of the Seven Barrels Brewery, is one of the U. S. masters of lagers. This article is excerpted from his book, *New Brewing Lager Beer* (1996, Brewers Publications). Copies can be ordered from (303) 546-6514.

Secondary Fermentation *(from page 45)*

bottle. Under carefully controlled conditions, thin-walled, "nonreturnable" bottles are sufficient when brewing lager beer of normal carbonation.

Each bottle should be filled to within at least three-quarters of an inch of the top and be left to rest, loosely capped, for several minutes before the caps are secured. This allows air trapped in the neck space to be driven off by the release of carbonic gas. Oxygenation at bottling from splashing the beer or from trapping air in the neck space can be a problem as serious as contamination.

The bottled beer should be held at 50 degrees F (10 degrees C) or above for several days to allow fermentation to be established within the bottle before lowering the temperature. Temperature reduction should be gradual, not exceeding 5 degrees F (3 degrees C) daily. Bottle conditioning should take place away from direct sunlight, and the bottles should not be subjected to major temperature fluctuations.

The beer should be aged in the bottle for an absolute minimum of ten to fourteen days, and preferably thirty days, before serving. Lagered, bottle-conditioned beers usually keep for at least several months. There is an optimum storage period for every beer, when chemical changes within the bottle produce the best taste and aroma, and this should dictate the length of the bottle-aging period.

Imbibing

Handcrafted beers are not usually consumed with the same carelessness as a can of beer at a ball game. They are brewed to be drunk at the right temperature, with discernment and appreciation for the subtler aspects of their character. When bottle-conditioned beer is ready for drinking, it should be carefully poured so that the yeast sediment is not disturbed; a good yeast strain cakes solidly on the bottom of the bottle.

A beer is judged by its flavor, aroma, body, head, color, and clarity. All of these values are subjective, and various standards depend on the type of beer being brewed, the balance of one characteristic against another, and the predisposition and preference of the consumer.

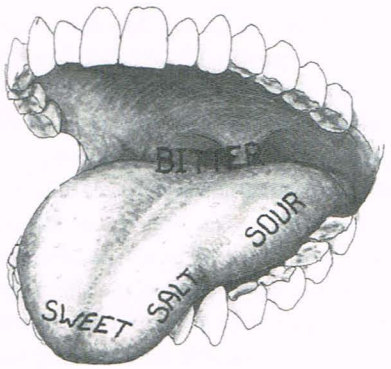

ILLUSTRATION BY GREG NOONAN

Areas for taste

Color, clarity, head formation and retention, and aroma can be assessed before the beer is even tasted. The aroma is usually sampled by swirling the glass and holding it under the nose. The cleanliness and sharpness of the hop bouquet, the balance of roastiness or maltiness, and the intensity and character of fermentation products are the major criteria by which aroma is judged.

Flavor is evaluated by the first sensation, the taste, then by the aftertaste once the beer is swallowed. The body of beer is judged by its fullness and texture, and is closely related to "mouthfeel." The palate fullness of beer is mostly due to the low molecular weight albumins and dextrins carried over to the finished beer, and its viscosity.

Taste perceptions are very generally classified as sweet, sour, bitter, or salty. Sweetness is produced by unfermentable sugars and the breakdown of simple dextrins by saliva. Sourness (acidity) is directly affected by the pH of the beer, and below pH 4.0 it becomes both noticeable and in most cases, objectionable. Bitterness is due to the iso-alpha acids from the hops, and from roasted malt. Saltiness is formed by the mineral content of the wort and generally complements bitterness and accentuates dryness.

In the final analysis, the character of the beer should cater to the preferences of the ultimate consumer.

Gregory Noonan, owner and brewmaster of the Vermont Pub and founder of the Seven Barrels Brewery, is one of the U.S. masters of lagers. This article is excerpted from his book, *New Brewing Lager Beer* (1996, Brewers Publications). Copies can be ordered from (303) 546-6514.

Lager Yeast Revealed *(from page 49)*

room to explore among the many yeast strains available these days. But for those whose lager exploits are more casual, it appears that one good general strain might suffice.

Research presented in my book, *Designing Great Beers,* indicates that the Wyeast Bavarian strain (2206) was the most popular yeast used for production of award-winning bock, Vienna and Märzen-style beers[6]. Only among the hoppy Pilseners did any other strain show significant use. Here, the Carlsberg-type Bohemian (2124) and Tuborg-type Pilsener (2007) strains led the way. Still, the Bavarian is a sound basic lager strain that can also be usedsuccessfully for Pilseners as indicated by David Miller in the *Classic Beer Style Series* book *Continental Pilsener.*[7]

Since these books were published, other yeast suppliers have begun to supply homebrew channels. Today, these suppliers also have utility lager yeasts similar to the Wyeast Bavarian strain. "Our German Lager yeast (WLP830) is so versatile," says White. "It is the Chico Ale yeast of the lager world. If you really want to make the maltiest possible Oktoberfest, you could go with our Oktoberfest yeast, but the German Lager will produce a nice beer as well."

Raines recommends Brewers Resource's Swiss Lager yeast (CL670) for general use in making lagers. "It will make either a good American lager or German lager," she says. For those focusing on malty styles, Old Bavarian (CL650) is the strain she likes. "It is a Weihenstephan strain that highlights the subtle nuances of malty Munich styles," she says.

Finally, some homebrewers may have difficulty achieving the temperature controls required for an authentic lager fermentation. (For ideas, see: Keeping Your Cool) When fermentations are likely to be on the warm side, most yeast suppliers prescribe a strain that will minimize the alelike esters as shown in Figure II. Brewers can achieve lagerlike results with these yeasts if they aerate well, pitch plenty of yeast and keep fermentations as cool as possible. Lagering with these yeasts should be done at normal refrigerator temperatures of 40-48 degrees F (5-9 degrees C).

Keeping Your Cool

Assuming that you are using a traditional lager yeast, primary lager fermentation takes 10-14 days at temperatures between 48-55 degrees F (9-13 degrees C). Secondary fermentation or lagering takes about three weeks at 35-45 degrees F (2-8 degrees C).

A dedicated, temperature-controlled refrigerator makes achieving these conditions easy. Unfortunately, not everyone has the luxury of such hardware. But many alternatives can be found. Here are some ideas:

- **Use Mother Nature.** Make lagers when it is cool or cold outside. This creates opportunities to use ambient outdoor temperatures, especially for lagering.
- **Explore your abode.** Outdoor air comes up the drain of my basement shower stall year-round, creating a perfect 50 degrees F (10 degrees C) chamber all winter long. Some corner or cranny in your house may do the same.
- **Get creative.** Focus all the cooling power of your window air conditioner on the fermenting carboy. Wrap the fermenter in wet rags for evaporative cooling. Plunge the carboy in your picnic cooler and dose it with ice twice a day.
- **Think small.** If your fridge won't fit a 5-gallon glass carboy, maybe you should try for 3-gallon lager batches. And if a glass carboy won't fit, try a soda keg. They can be vented for primary fermentation or closed and laid on their sides for lagering.
- **Build something.** Link an immersible sump pump to a refrigerator temperature controller to build a device that bathes your fermenter with ice water whenever the temperature rises.
- **Beg, borrow or beg some more.** If you have a brewing friend who sometimes make lagers, get him (or her) to let you in on the fun. Scrounge an old fridge you can use for making lagers.

Further Reading

For additional information on lager fermentations, check the following sources:

Daniels, Ray. *Designing Great Beers,* Brewers Publication, 1996.

Noonan, Greg. *New Brewing Lager Beers,* Brewers Publications, 1996.

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1 Arnold, John P. *Origin and History of Beer and Brewing.* Alumni Association of the Wahl-Henius Institute of Fermentology. Chicago, 1911, p. 313.

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4 Corran, H.S. *A History of Brewing.* David & Charles Limited. North Pomfret, Vermont, 1975, pp. 261-63.

5 Casey. p 10.

6 Daniels, Ray. *Designing Great Beers.* Brewers Publications, 1996, pp. 175, 243, 321.

7 Miller, David. *Continental Pilsener. Classic Beer Style Series #2,* Brewers Publications, 1990, p 40.

AHA Board member Ray Daniels completed his first triathlon last May.

Yuengling *(from page 53)*
is the primary reason Yuengling survived while eight other post-Prohibition breweries serving Schuylkill County are all long gone.

Yuengling's fortunes took an upward turn in 1979, on the occasion of the brewery's 150th anniversary. The company received millions of dollars worth of free publicity in the media, including a five-minute segment on the Today show. New blood also helped revitalize the business.

In 1985, Richard Yuengling Jr. bought the brewery from his father, Richard Sr. In 1990 he hired a savvy marketer named David Casinelli, elevating him to a company vice presidency. The two redesigned the brewery's packaging to give it a more detailed, nostalgic look. They also revamped the product line, adding Yuengling Light, Yuengling Traditional Lager (an amber beer that is now the company's top seller), and the Black & Tan. The strategy was phenomenally successful: Yuengling, who had relied heavily on discounting to push beer in the 1980s, was now able to sell his product for import prices in markets like Philadelphia and Richmond. While sales soared, advertising revenue actually went down. The brewery didn't have enough liquid to satisfy demand.

Rationing

That led to rationing in the home markets in and around Pottsville. In 1993, one longtime Yuengling distributor in Pine Grove, PA, published a newspaper ad complaining: "Notice: because of shipments being made out of the county, we may not be able to supply your favorite Yuengling package. Apparently, Yuengling brewery feels they no longer need our business in Schuylkill County. Who made them?"

Yuengling's response could be summed up as "dance with the one that brung you." While craft brewers across the country were expanding rapidly (and not always judiciously), Yuengling bucked the trend by retrenching. To satisfy the home market, shipments to New York, Connecticut and Virginia were cut in half, while deliveries ceased to Maine, Rhode Island and Maryland.

Yuengling attempted to keep up with the demand by building new storage cellars and even entered into a contract brewing arrangement with Stroh in 1996. Finally, after dragging his feet for several years, Richard Yuengling Jr. announced last year that construction would begin on a new satellite brewery to be located in an industrial park outside Saint Clair, PA, a few miles from the current plant. The new brewery—scheduled to go online in fall 2000—will cost $50 million and have a capacity of over 1,000,000 barrels a year.

1999

This year has been a bittersweet year for Yuengling. On March 25, Richard Yuengling Sr., father of the current brewery president, died after a long illness. The elder Yuengling had helmed the business from 1963 to 1985. During his tenure, he had seen the brewery designated a state historic site and placed on the National Register of Historic Places. He was eulogized as "always ready for a party, and the first to tend the Rathskeller bar to share a beer."

Earlier this year, at the end of January, brewmaster N. Ray Norbert retired after 57 years in the beer business, dating back to his apprenticeship as a teenager. He had been with Yuengling since 1942, except for a stint in the Eighth Army Air Corps during World War II. Assuming his position was James P. Buehler, himself a 27-year veteran of Yuengling.

In April, Yuengling announced the purchase of an idled Stroh plant in Tampa, FL. "It was an opportunity we felt we couldn't walk away from," said Casinelli. The brewery, which has a capacity of 1.5 million barrels, should be turning out the first test batches of lager and porter by midsummer. "There's a lot of speculation that we bought this as a stopgap, but that's the farthest thing from the truth," notes Casinelli. Eventually the Florida plant will produce Yuengling beers for the Carolinas, Georgia, Florida and Alabama, while the two Schuylkill County breweries supply the Northeast. There are no plans to go national, although Yuengling may seek new markets in the Midlands and West as opportunities present themselves.

Next Generation

The brewery's future seems assured, but will the Yuengling family continue to run the show as they have for 170 years? Both Anheuser-Busch and Miller have made buy-out offers, according to Richard Yuengling Jr. The offers were politely declined. "We haven't been in the business this long to sell out to anybody," the brewery president was quoted in the press. Fortunately, a sixth generation is waiting in the wings. Yuengling's two oldest daughters, Jennifer and Deborah, have earned diplomas from the Siebel Institute in Chicago and taken jobs at the brewery. Two younger daughters plan to join them eventually.

"I haven't read anywhere that a woman can't run a brewery," says their father with confidence.

Greg Kitsock is a regular contributor to *Zymurgy*.

Yuengling Secrets

"Yuengling is probably the oldest continuously produced porter on the planet," says James Helmke of the brewery. "(The beer) contains pale malt, black malt, and two varieties of caramel malt, as well as corn grits." In addition, the brewery adds some "porterine." Helmke describes this as "a blend of syrups and caramel malt extract." Traditionally, breweries have used this product to turn their normal beer into an instant bock or porter. Why does Yuengling use it when their grain bill contains specialty malts? Apparently, Yuengling has been using porterine in the recipe since 1890, and the brewery doesn't want to tinker with the flavor. "We'd be taking liberties if we left it out," says Helmke.

The recipe call for one type of hop, a traditional North American bittering variety, although Helmke won't specify which; bitterness is 22-25 IBUs. The brewery ferments with a lager yeast , but at a higher temperature than for its lagers, producing fruity characteristics. (Helmke thinks drinkers are picking up the fruitiness when they say the porter has a licorice-like flavor. No licorice is used.) The total fermentation time is 3-4 weeks, not appreciably faster than the brewery's lagers.

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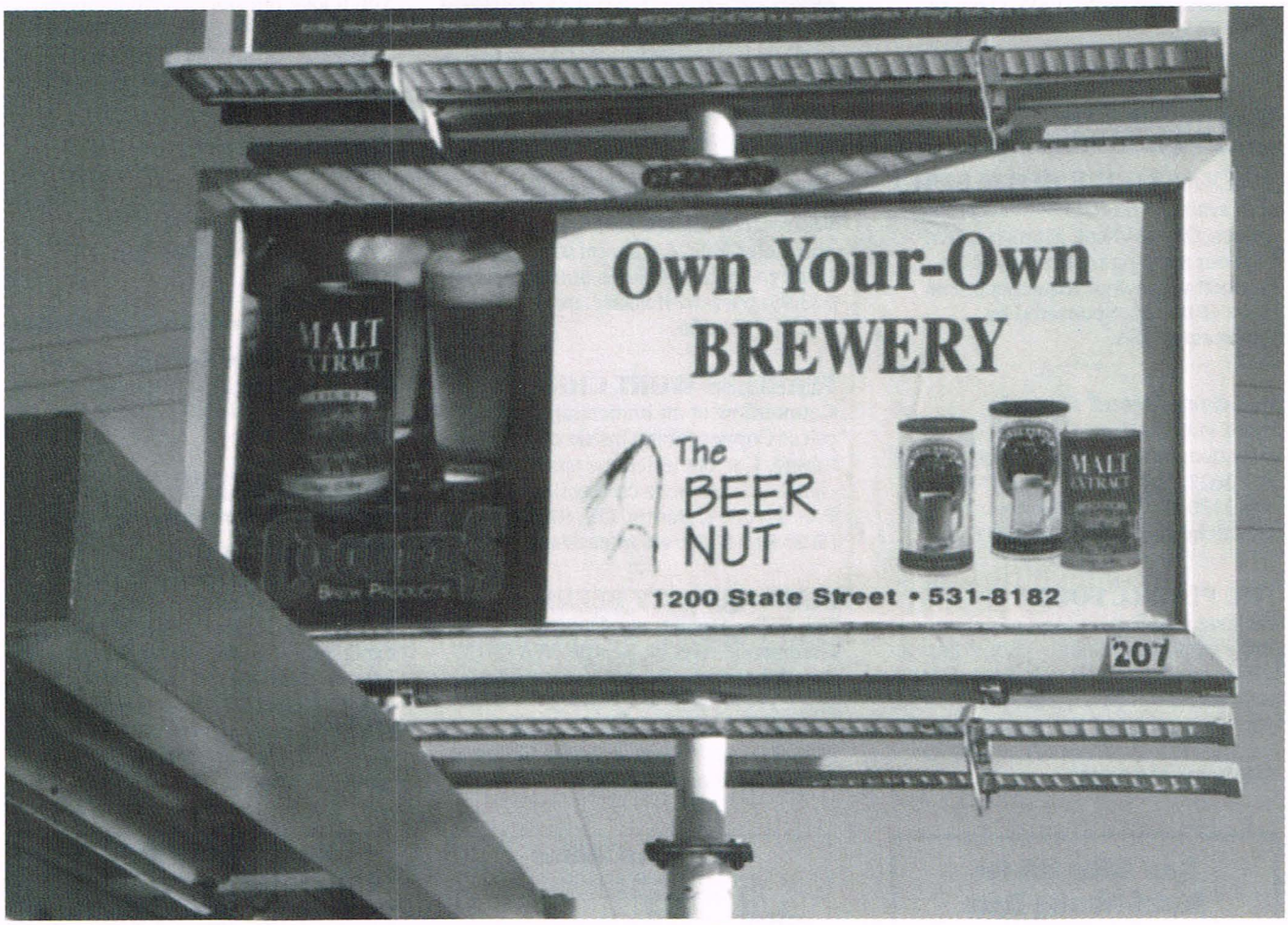
Another Roadside Attraction



Homebrewing along the highway—how's this for fighting visual pollution?

How'd you like to be tooling down the highway and see this billboard.

Well, if you live in the Salt Lake City area, you can. Last May, 15 billboards promoting homebrewing went up in and around Salt Lake, courtesy of Cascadia Importers, who handle Coopers Brew Products, and The Beer Nut, a Salt Lake City homebrew retail store.

"Why billboards?" Cascadia asked rhetorically. "Because 20% of the population of the U.S.—over 50 million people—are homebrewers. They just don't know it yet. We're creating the temptation to become a homebrewer."

By the way, during a generally gloomy time, The Beer Nut's business in 1999 is up more than 30% over last year, and last year was up 30% over 1997. The Beer Nut sold more than 150 beer starter kits the last holiday season. And this is in a market with numerous competitors and a state-sanctioned religion that forbids alcohol consumption.

The moral of this story? Skies aren't as cloudy as they can sometimes seem, and all billboards aren't visual pollution.

Michael Bane is the editor of *Zymurgy*.

PHOTO COURTESY OF COOPERS BREW PRODUCTS AND THE BEER NUT

Boston Ale *Golden Pilsner* *Honey Porter* *Cream Stout* *Lightship* *Scotch Ale* *Triple Bock* *Cherry Wheat* *Double Bock* *Octoberfest* *Cranberry Lambic* *Winter Lager* *Old Fezziwig*

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William Reed (not present)

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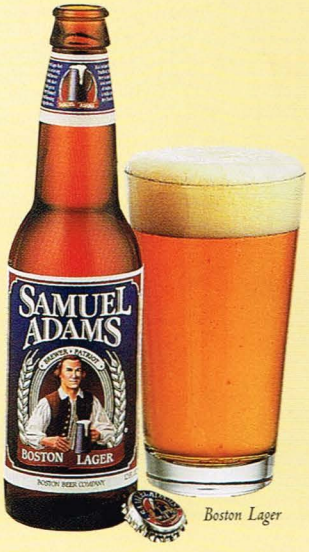
The Brewers of Samuel Adams Beer



Boston Lager