Brew Your Own

February 1998, Vol.4, No.2
Niche Publications Inc.

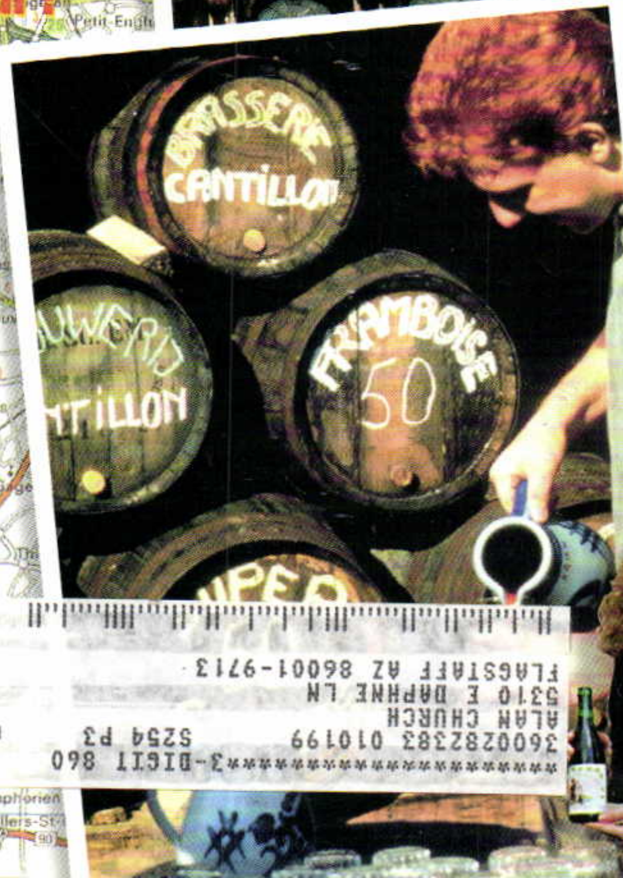
The How-To Homebrew Beer Magazine

Homebrewer in Belgium! A Tale of Yeast Gone Wild

Brew Belgian Abbey Ale — Style of the Month

The Secret Exposed: Brewing With Sugar!

7 Ways to Get to Know Your Yeast



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Cover photos: Belgian Tourist Office

It's Label Contest Time!

Here's a personal message from the Annual division of How Time Flies Inc.: It's time once again for our yearly super-extravaganza, the BYO Gonzo Label Contest. As usual, we'll have a host of great prizes — from kits to cool equipment such as a stainless steel, 10-gallon brewpot. And we'll award the prizes in two major categories, best amateur and best professional, along with a slew of other categories that we make up as we go along.

The deadline to send in your best creations is March 16. So dig out those acrylic paints and camel-hair brushes (Magic Markers? Laser printers?) and get going!

We were talking about the label contest recently when the subject of naming a beer came up. Best name is a typical prize category for the label contest, but choosing a good name for a beer isn't always easy. I mean, how do you go about choosing a name for something that on the surface at least has few intrinsic qualities that lend itself to naming?

I know some people wait until the beer is fully fermented, not to mention generously sampled, before selecting a name. The idea is that they want to get a real feel for the beer so they can find a name that really suits it.

This method is just wrong. Would you wait until your child is fully developed so you could choose just the right name for her? Sure, that would delay the Sierra vs. Chelsea debate you're having with your spouse for about 25 years, but how would your daughter do in junior high school with everybody just calling her "Girl"? By the time she was ready for a name, you might have to go with Unabomber.

Anyway, we figured there are five basic ways people choose a name for their brews.

1. The Close Relation Method. Based on some attribute of the beer, such as color: Rushin' Gold. Or flavor: Hoppy Pale Ale. Or off-flavor: Banana Daiquiri Hefe-Weizen.

2. The Distant Cousin Method. Name based on some chance occurence around the time you were brewing or naming the beer. It rained: Cloudcover Ale. You cleaned the garage: Miracle Lager.

4. Hard Labor Method. Based on something that occurred during the brewing process. Ran out of hops, substituted oregano: Bad Leaf Brown. Pet took a dunk in the fermenter: Hairy Porter.

5. Proud Parent Method. Shows pride of ownership: Joe's Unbelievab-Ale. By Joe, Masterbrewer.

We had a disagreement about one other category. Some people argued that there's a "No Relation Method," in which you choose a name that has nothing to do with anything. You pick it because it sounds nice. Well, I don't believe this method exists. After all, brewing is a personal thing. You're going to put out all that effort, then just choose a name for no good reason? (Then again, maybe we're back to Sierra vs. Chelsea.)

Finally, to get you jazzed about the label contest, I'm going to name the first prize winner. Not the First Prize winner, just the first winner of a prize. It's Bob Turan of Earlton, N.Y. Bob is the first prize winner because, well, so far he's the only entrant!

His labels arrived in October with a note that said, "Sorry — I can't wait any longer!" Wow! Bob sent his labels attached to several very tasty beers, though we were reluctant to try the "Mad-Cow Bovine Brown" that the label proclains is "Not from Contented Cows."

Be like Bob. Send labels. The entry form is on page 4.

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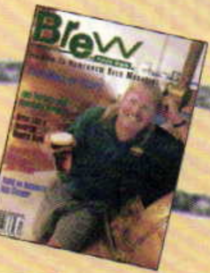
SEND IN YOUR BEST HOMEBREW LABELS AND BECOME FAMOUS!



BYO 3RD ANNUAL LABEL CONTEST

Win Cool Prizes!

Get those homebrew labels in to the editors of Brew Your Own. You could find yourself richer and more famous too! Winning labels will be featured in our June '98 issue. We'll award a ton of brewing-related prizes plus a Grand Prize (to be announced in our March issue.)

Official Entry Blank

Deadline: March 16, 1998

Categories (Enter as many times as you like!)

- ❑ **Professional** *(Designers, Illustrators, etc.)*
- ❑ **Amateur** *(The rest of us!)*

Name ______________________

Address ______________________

City ______________ State ______ Zip ______

Daytime phone ______________________

Send your entries to:

BYO Label Contest
216 F Street, Suite 160
Davis, CA 95616

More Furry Brew Buddies

John Joseph
Cartersville, Ga.

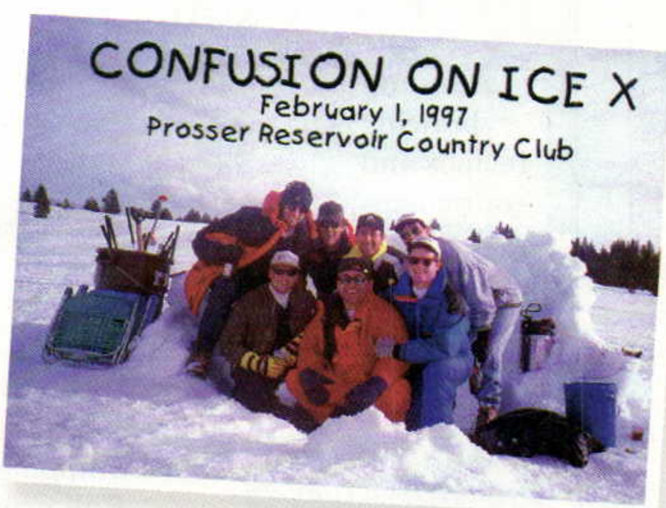
You asked, "Do you have a favorite dog, cat, or other pet who keeps you company when you brew?" Well, I don't know if you would call it keeping me company or not.

Two The Cat knows when he sees the mash tun and brew pot that it's time to get in the way. He loves to lie on top of the kitchen cabinets and dangle his paw (the better to hit your head while you are brewing). When I am sparging, it's a fight to keep him out of the way, out of the mash tun, and out of the brew pot. As a treat at the end, he gets a bite of spent grains while they are still warm.

Scottie The Dog does not get on the cabinets. Instead, he takes the low road and is always underfoot in the kitchen. He, too, likes his grains still warm. Between the two of them, it is a wonder I have not yet tripped and dropped a brewpot full of hot wort all over the kitchen.

The picture was taken while I was brewing the oatmeal stout all-grain recipe from "Oatmeal Stout" (October '97 BYO). I did increase the roasted barley to 0.75 pounds. I racked this stout after a week in primary. Wonderful stuff. I let my wife drink the sample I took for a gravity reading. She liked it so much, she wanted me to bring her a big glass of it. Alas, the trouble with this hobby: the good stuff goes too fast, and the bad stuff lasts forever.

Another brew made it through, despite the best efforts of Two The Cat and Scottie The Dog.



What's the perfect homebrew to accompany snow golf and ice fishing? Confusion Ale.

Confusion on Ice

Some say February is for lovers, while others say it is for furry rodents looking for their shadows. My buddies know that February means Confusion on Ice. Confusion on Ice is an annual golfing, fishing, and beer-consuming reunion of alumni from California State University at Sacramento. It is held each February up in the snowbound country of Truckee, Calif.

Since most golf courses in the Sierras are buried in snow and the lakes are frozen solid, how do we pull this off? Well, a frozen Prosser Reservoir serves as our golf course and ice fishing hole. A short nine-hole course is laid out over the expanse of the frozen lake, and with a sharpened ice auger, nine holes are drilled into the ice. Ice Golf is played with tennis balls because they float when knocked into the cup, and if the playing surface is covered with snow, a tennis ball will be easier to find. Winter rules, of course. Each linkster uses only one golf club, so depending on the course condition, club selection is critical.

Back at base camp, ice fishing holes are drilled and the derby is under way. If fishing is not your forte, participants can jump on a snowmobile and do their best James Bond imitation through the snowy forest area.

All this fun is not possible without the enjoyment of a fine ale. I have been an avid homebrewer for more than three years and like most of my peers have enjoyed many successes and many failures. I have experienced my share of contaminated yeast, broken hydrometers, stuck fermentations, and undercarbonations. These glitches have only made me a better brewer, and I am averaging two batches a month.

I have been banished to the garage to practice my craft, which is fine with me. The garage is my favorite room in the house, complete with stereo, TV, and an old Philco refrigerator converted into an old beer dispenser. Nothing compares with drawing a beer off a Corny keg at the end of the day.

For the 10-year anniversary of Confusion on Ice, I made an India pale ale, a Marzen, and a lighter version of Sierra Nevada Pale Ale dubbed Confusion on Ice Ale. The Confusion Ale was kegged and carted out on the frozen lake (which provides a nice refrigeration in the snow). My buddies were very complimentary of my efforts, seeing as they finished off 10 gallons of homebrew by Saturday night.

Confusion on Ice is my attempt at keeping old college buddies in contact with one another. While we all lead different lives with marriages, kids, and divorces, we still have this yearly event in common. I look forward to the next 10 Confusions as well as the homebrews that will commemorate them. If you happen to be ice fishing on Prosser Reservoir some fine February day, please let my foursome play through.

Tim Munson
Truckee, Calif.

Strange Brew!

What is the most unusual ingredient you have included in a brew? Tell us about it and send us a picture of you and your strange brew. There's a cool BYO T-shirt in it for you. Send your story to Pot Shots, c/o Brew Your Own, 216 F Street, Suite 160, Davis, CA 95616. Or send us e-mail at edit@byo.com. Be sure to include your mailing address!

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Cool Solutions

Dear Brew Your Own,

I started using an immersion wort cooler about six batches ago. I found it took a lot of water to cool 120° F wort down to 75° F. It also took too long. I will soon be brewing out in the Chihuahuan Desert, and water is too precious to waste.

I had an old submergible pump for an evaporative cooler (swamp cooler). If purchased new, it would cost less than $15.

I connect a male garden hose fitting to it. I make ice in a dishpan, place the ice in the sink, and break the ice up with an ice pick. I then fill the sink with water, attach the pump to the wort cooler, and place it in the sink. The return line is placed in the same sink.

I have used this method on two concurrently cooked batches and cooled both with the same ice water. It cooled 120° F wort down to 65° F in less than 20 minutes per batch. This only uses four gallons of water.

Gary A. McKown
London, Ky.

Boilovers

Dear BYO,

I think I have found a solution to the dreaded boilover. Simply spoon the foam off the top of the wort as it forms and there is nothing to boil over. I have used this method on my last five batches with great success.

Bill Krostag
Rio Rancho, N.M.

Kegging and Bottling

Dear BYO,

Reading "Brewing for Special Occasions" (November '97 BYO), I remembered when I brewed for my brother's wedding. I found that kegging and bottling was the way to go. I kegged a Munich Helles and bottled the keg beer.

Extra work, yes.

Worth the time? Definitely.

People just don't understand having to pour into a glass to avoid "that junk in the bottom," so natural carbonation was out. On the other hand I wanted people to have a souvenir bottle. Bottling the keg beer was the extra mile that made the beer a hit for a Trappist monk, as well as Joe six-pack.

William Vanderbloemen
Hendersonville, N.C.

Glass Safety

Dear BYO,

In November you published a letter from someone who found an alternative to siphoning from the carboy. He was told to attach a CO_2 tank and give the carboy/siphon arrangement just enough pressure to push the beer out or to start it flowing.

Glass containers make extremely poor pressure vessels and good bombs. All it takes is one little crack in the glass or a plugged siphon tube and the carboy blows up. I siphon my carboys by filling the siphon tube with water and let the water and initial oxidized beer into a waste bucket. When I have good beer flow, I pinch off the tube and transfer the tube into the secondary or bottling bucket.

Mark Muellenbach
Fond du Lac, Wis.

Wait 'til Next Year

Dear BYO,

I've got a little problem with the December issue. The first thing I see is Old Saint Nick enjoying a frosty homebrew. Nothing wrong with that. Next I see "Homebrew Holidays." Well, I flipped right to that article and took a quick look. There isn't one single recipe that I can brew and have ready for Christmas, this year!

Well, to say that I'm disappointed is an understatement. I got all excited about brewing something for the holidays, only to find out that I probably won't be able to enjoy any of the recipes you presented until the next holiday season. I've got to tell you, I've definitely lost that holiday glow. At least for the rest of the week.

Bob Poirier
East Haven, Ct.

Looks Can Be Deceiving

by Scott R. Russell

Sure I believe in first impressions, but I also know that looks can be deceiving. How many times have we all looked at a beer, homebrewed or commercial, and said, "Wow, what a nice looking beer," only to taste it and be disappointed? How many times have we allowed an expectation to build up as to taste, aroma, richness, bitterness, based on appearance alone? But color and clarity can only tell you so much. You have to taste the beer.

This month's recipe is a beer that promises one thing and delivers another. But in this case what it delivers is a pleasant surprise.

Take a look. The head is creamy, off-white, tiny bubbles, constantly replenished by more rising from the bottom of the glass. The beer itself is crystal clear, a ruby-red color, deep-hued with a hint toward blackness.

Now smell it. Hops, no doubt, noble-type: Saaz? Hallertauer? Yes to both. But something else. Two somethings, actually. A sweetness, not quite cloying, not exactly sugary. Honey, to be exact. And a tart, almost sour fruit aroma that could only be cherries. Now the color makes more sense.

Want to taste it? Sure. Go ahead. Crisp and slightly bitter, tart but fruity sweet at the same time. Yeah, there are hops in there, and honey and cherries. Well balanced; none of them are overwhelming. And somewhere back there, among all the other things, there's malt. Dark malt, but not quite black or chocolate. More than just crystal, though. But how? I'll let you in on a secret I've just discovered. It's called kilncoffee. It's a lightly roasted malt, about 170° Lovibond, recently introduced by Malteries Franco-belges, and it does wonders for brews that need to be dark but not really dark and that shouldn't have a lot of burnt or roasted character. It's the reason this beer seems darker than it really is. I also use the darkest honey I can find, and if it isn't dark enough, I wouldn't be averse to using a little dark candi sugar just for reinforcement.

This is one of those beers that reminds me of an old-fashioned rickety wooden roller coaster. You go up, you come back down. You go around curves, sway side to side, speed up, and then slow way down again. And as you get out of the car, you run to get back in line to get on again. When you open a bottle of this beer, you get hops, then fruit, then hops again. You sip it and you taste sour fruit, then malty sweetness, then hop bitterness, then

Black Honey Cherry Lager
(5 gallons, extract, grain, and adjuncts)

Ingredients:

- 1 lb. medium crystal malt, 60° Lovibond
- 0.5 lb. kilncoffee malt
- 0.5 lb. malted wheat
- 6 lbs. unhopped amber dry malt extract
- 2 lbs. dark honey
- 0.5 lb. dark candi sugar (optional)
- 1.5 oz. Saaz hop pellets (4% alpha acid), for 60 min.
- 1 oz. Hallertauer hop pellets (4% alpha acid), for 30 min.
- 1 oz. fresh whole Hallertauer hops (4% alpha acid), for 30 min. steeping
- 4 lbs. sour black cherries
- 10-14 g. of dry lager yeast or 1 pint (minimum) liquid slurry (Wyeast 2278 or something similar)
- 3/4 cup corn sugar for priming

Step by Step:

Steep the crystal, kilncoffee, and wheat for 30 min. in 3 gal. of 150° F water. Remove the grains and add the extract and honey. Add candi sugar to darken, if desired. Bring to a boil, add the Saaz pellets. Boil 30 min., add Hallertauer pellets. Boil 30 min. Total boil is 60 min. Add the whole hops and the cherries, and steep 30 min. Remove hops and cherries, cool wort. Put steeped cherries in fermenter, add cooled wort along with enough pre-boiled cold water to make 5.25 gal. At 70° F, pitch yeast and gradually chill fermenter to 50° F over the next 24 hours. Ferment at 50° F for three weeks, then rack to secondary, removing cherries. Condition at 45° F for six weeks, prime with corn sugar, and bottle. Bottle age four to six weeks at refrigerator temperature.

Alternatives:

All-grain brewers can replace the amber dry malt with 8 lbs. lager malt and 1/2 lb. each brown and Munich malt in addition to the crystal, kilncoffee, and wheat. Mash in 3 gal. at 150° F for 90 min., sparge with 3.5 gal. at 169° F.

Can't find kilncoffee? If your supplier cannot order some for you, you can, in a pinch, use 1/8 lb. chocolate malt instead, but only steep it for 15 min.

If you want to use cherry juice instead of cherries, add 16 oz. pure black cherry juice to wort with steeping hops. Obviously you won't need to worry about getting it out.

Use a good, fresh yeast culture, and pitch as big as you can manage. Fermenting and conditioning temperatures are very important to this beer, if you want to taste any of the subtleties of the honey and dark malt.

malt again, then honey, then hops, and then all of a sudden it's gone and you have to open up another to confirm all those tastes and aromas you think you just went through.

Reader Recipes

Spontaneous Raspberry

(5 gallons, partial mash)

This is a lambic style that is the result of spontaneous fermentation. It might not work every time. Use yeast if fermentation does not occur within three days.

Peter A. Hearn
Home Brew Mart
San Diego, Calif.

Ingredients:

- 2 lbs. flaked wheat
- 1 lb. six-row barley malt
- 4 lbs. wheat malt extract
- 4 oz. two-year-old oxidized Hallertauer hops (4.5% alpha acid), for 75 min.
- 8 lbs. frozen raspberries
- 1 cup corn sugar for priming

Step by Step:

Do a mini-mash using a steeping bag with 2 gal. 150° F water for 60 min. Remove bag. Add extract and boil 75 min. with Hallertauer hops. Add to 3 gal. cold water in bucket fermenter. Cover with cheesecloth to keep clean. Put outdoors in a shady place. When fermentation is active, put on lid and airlock. When fermentation is complete (usually two weeks), rack and age two months. Add raspberries and age three more months. Prime with corn sugar.

Far North Pale Ale

(5 gallons, extract with specialty grains)

This is a favorite of mine and my friends. Hope you like it.

Kevin McRee
Anchorage, Alaska

Ingredients:

- 6 lbs. Alexander's pale malt extract syrup
- 1 lb. wheat malt extract
- 0.5 lb. cara-pils malt
- 1 lb. crystal malt, 40° Lovibond
- 1.5 oz. Northern Brewer hops (7% alpha acid), for 60 min.
- 2 oz. Cascade hops (4.1% alpha acid): 0.75 oz. for 15 min., 0.75 oz. for 5 min., 0.5 oz. dry hopped in secondary
- 1 tsp. Irish moss
- Wyeast 1056 American Ale

Step by Step:

Steep grains in 3 gal. of 150° F water for 30 min. Sparge with 1 gal. of 170° F water. Add malt syrup and bring to a boil. Add 1.5 oz. Northern Brewer. Boil 45 min. Add Irish moss and 0.75 oz. of Cascade hops and boil 10 min. more. Add 0.75 oz. Cascade and boil 5 min. more. Total boil is 60 min. Top up to 5 gal. Cool to 70° F and pitch yeast.

After primary fermentation rack to secondary and add 0.5 oz. Cascade hops. Ferment to completion and bottle.

OG = 1.060
FG = 1.012 ■

Behind the Nylon Curtain

Mr. Wizard

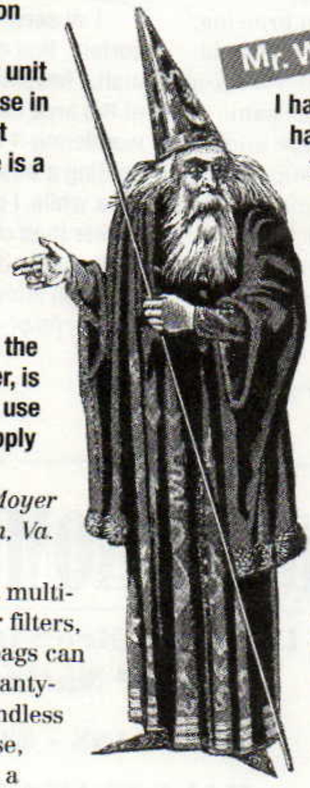
I've been using sections cut out of pantyhose, knotted at each end, as a hop bag during boil. How does this affect hop utilization? It seems logical that there would be less utilization because the hops contact a smaller volume of water per unit of time than if they were loose in the wort. But then, logic isn't always the best tool. If there is a reduction in utilization, is it enough to require an adjustment to the hop quantity?

On a related note, for other boil additions, such as the coriander in a Belgian witbier, is it a bad idea for me to make use of my seemingly endless supply of recycled pantyhose?

Doug Moyer
Salem, Va.

Pantyhose are truly a multi-function item! Dryer filters, hair nets, and hop bags can all be made from leftover pantyhose. Since you have this endless supply of recycled pantyhose, maybe you should consider a marketable item made from them!

In any case, boiling hops in a hop bag probably will result in a decrease in hop utilization. The magnitude of the decrease will vary depending on how much hops you try to cram into the hose and will be minimized by using enough hose not to overly restrict the movement of hops during the boil. Hop utilization requires constant tweaking, and you will need to tweak your hopping rate for your pantyhose bag just like anything else. The best way is to simply use your palate and use more or less hops based upon your results. I honestly don't know of a single fancy calculation that you can use to compensate for decreased utilization due to the weight of hops per length of pantyhose.



As you suggest, pantyhose are not just for hops. You can use them for spice bags, dry hopping, brewing your morning tea, or whatever floats your boat.

Mr. Wizard

I have a two-part question. I have been homebrewing for the past four years. The first three years, in North Carolina, I only remember two bad batches. I moved to Wisconsin one year ago, and I probably have about 50 percent of my batches go bad within the first five to seven days after primary fermentation. I can only describe them with my inexperienced nose as spoiled. My cleaning is meticulous and my routines unchanged. I mostly brew extract with specialty grains. In North Carolina the water was moderately soft. Here, the water is hard and the house has a water conditioner. Do you suspect this is a contamination problem, or could the water conditioner be contributing to my off-flavors?

Michael Aughey
Sun Prairie, Wis.

The problem of spoiled beer is complex and can arise from countless causes. All contamination problems have one thing in common: a microbiological vector. Vectors carry contaminants into beer. Common vectors for beer spoilage are air, water, equipment presumed clean and sanitized but in fact dirty, and ingredients added after the boil such as fruit and, the Typhoid Mary of beer, yeast!

In your case you moved from North Carolina to Wisconsin and most likely changed your yeast source in the process. I would look into the yeast you are using. If you are using dried yeast, have you changed the brand and is the new supply as fresh as your old supply? Dry yeast packets have caused spoilage headaches to many a brewer because the dry yeast can contain potential contaminants (although the overall quality of dried yeast has improved greatly over the last 10 years). Quality varies by producer, and the age and storage conditions of dry yeast need to be monitored. It's important to keep yeast fresh. If your yeast is liquid, ask the same questions. If the freshness and brand are consistent with your old supply, I would still try a different yeast.

After ruling out yeast, take a careful look at your process. Are you doing anything after the wort boil that could introduce bacteria into the system? A practice used by many homebrewers is to "top off" the fermenter with water. If you are topping off your fermenter, make sure the water has been boiled for at least 15 minutes to kill any bacteria in it. Another water-related problem is rinsing equipment after it has been sanitized. If the rinse water carries bacteria, then the sanitizing step is negated.

If all of these points seem consistent with your previous experiences, begin looking at your other raw materials. Malt and hops rarely cause contamination problems because they are boiled, but they may be lending strange aromas that you are mistaking as spoilage. Taste and smell these materials before use since they both can smell strange when old, especially hops that have oxidized. They start smelling cheesy like a block of Wisconsin blue!

If everything still checks out, consider changing your brewing water. Although brewing water rarely imparts aroma to beer (chlorinated water is always a no-no in brewing because of aroma problems), it can certainly affect beer flavor. It sounds as if you are using water from your home water softener as your brewing water. Water softeners work by replacing calcium and magnesium with sodium, and any carbonates in the water pass through unaffected. The purpose of water softening is to prevent the buildup of calcium carbonate and, to a lesser extent, magnesium carbonate on plumbing fixtures and water heaters and to give laundry and dish-washing detergents better cleaning action. This is great for plumbing and washing but not for brewing.

Sodium in beer changes its flavor. At low levels sodium gives beer a sweet flavor. At higher levels sodium begins to make beer taste salty. If you remove calcium from water before brewing and leave the carbonates behind, you will upset the natural pH buffering systems found in water. Calcium works in the mash and in the wort boil to lower wort pH, and carbonate raises wort pH. If both are present in the water, the wort pH is often just right for making great beer. Dublin, London, Burton-On-Trent, Dortmund, Munich, and Dusseldorf are some of the many famous brewing cities with high levels of both calcium and carbonate.

Where you live in Wisconsin, ground waters percolate through lime mineral beds and have high concentrations of calcium and carbonate. Without calcium, carbonate in the water will lead to a higher-than-normal wort pH. In all-grain brewing, high-pH mashes can cause poor yield and can extract astringent flavors from the malt. In the kettle boil the same pH-altering reactions continue and lead to increased color pick-up. At the end of the brew day, worts made from high-carbonate and low-calcium waters will have a higher-than-normal pH (normal is around 5.2 to 5.4). The same is true for extract brewing minus the mashing effects.

Worts with a high pH are more prone to bacterial contamination than normal-pH worts. This condition may allow wort spoilers to grow in your Wisconsin worts that were unable to grow in your North Carolina worts. Try using water that has not been softened or bottled water for your brewing and make sure you have fresh yeast. Hopefully your long stretch of spoiled beers will end!

Mr. Wizard

I've seen various recipes, mostly for porters, that call for the use of brown malt. I have had no luck finding it at any of the area homebrew shops and was wondering if I could approximate it by heating a batch of pale malt in the oven for a while. I guess that it shouldn't be darker than chocolate malt, but just how dark should it be? Could I eliminate this dilemma altogether and use a chocolate malt in its place ?

Alan Berkheiser
Berkeley, Calif.

Yes, you can make your own brown malt by roasting pale malt in the oven. You can also make chocolate malt and black patent malt by the same process. The difficulty in roasting your own malt is control, but it can be done if you are attentive and have a method to quickly cool the malt and prevent further darkening during cooling. Roasting temperatures for brown malt are 450° to 500° F. The malt should be taken out of the oven when the right color is achieved and quickly spread on a cooling rack.

Brown malt is lighter in color than chocolate malt and has a distinctive nutty, roasted flavor. The original brown malts were made by drying the "green" or un-kilned malt over a wood fire and had a smoky flavor to them. This method is no longer used to make brown malts, and today's brown malts lack smokiness. Used in porters and other dark ales, brown malts impart flavors that would not be found if you simply replaced the brown malt with chocolate malt.

Before jumping into home roasting, I would recommend checking around a little bit longer for brown malt. I know of few malt houses that make brown malt, but Hugh-Baird and Beeston in England both have malts that could be classified as brown. Check around with your local homebrew supply shops to see if they can order malts from these companies or check with mail-order companies, which often carry obscure products that small shops find hard to justify keeping in stock.

I personally like the flavor of brown malt in porter and stout and think that buying it would give you better results than trying to make it yourself.

Mr. Wizard

I enjoy reusing recovered yeast from my fermenter. I wash my yeast with cool water that has been boiled and refrigerate the yeast in a sealed jar until I'm ready to reuse it. I've heard that after a number of batches, the yeast should be acid washed to eliminate any possible contaminants such as bacteria. Is there a way a homebrewer can acid wash recovered yeast?

Michael Genito
Cleveland, Ohio

Acid washing is used by some brewers to kill bacteria in their pitching yeast. Brewers who acid wash their yeast have different rules concerning when to acid wash. For consistency some do it every time they use their yeast. These brewers assume that acid washing has an effect on the yeast and should be done before every use to avoid inconsistency. Other brewers only acid wash when they know the yeast has an unacceptably high microbial load. These brewers rely on microbiological examination of their yeast to gauge when acid washing is needed. The rest of the brewers acid washing yeast do it on a regular schedule based upon the age of the yeast, usually somewhere between five and 10 generations.

The procedure to acid wash yeast is fairly simple both in principle and in practice. The idea is similar to chemotherapy: Make the environment severe enough to kill the disease but not the patient. In acid washing the disease is a bacterial contamination and the patient is the yeast. Lucky for brewers and our friends the yeast, beer spoilage bacteria do not tolerate low pH environments nearly as well as yeast. This fact makes pH a suitable tool for yeast chemotherapy. Like human chemotherapy, the treatment is not too good for the patient. Thus the conditions and time must be carefully monitored so that the treatment doesn't inflict undo harm upon the yeast.

There are really only three variables to control during acid washing. 1) pH, 2) temperature, and 3) time of exposure. To acid wash yeast, first cool the yeast to 32° to 36° F. This cool temperature minimizes the damage the low pH environment can cause.

Next, slowly add food-grade phosphoric acid to yeast while gently stirring the yeast. Acid addition continues until a pH of 1.8 to 2.2 is reached. The target pH is brewer dependent, and personal experience is needed to pick a pH that works best for a particular yeast strain. This part of the procedure requires good pH measurement. The best instrument is a pH meter that can be calibrated between uses. A good pH meter will cost $50 to $100 and may be more gear than the average homebrewer really needs. Unfortunately, pH papers don't give continuous readings and don't work very well with yeast slurries. They really should not be used for acid washing.

After the yeast slurry pH is adjusted to the target, it is time to wait. A typical time is around two hours. Shorter times kill fewer bacteria and do less harm to the yeast than do longer times, making the time of exposure dependent on the level of contamination. The last step of the process is to stop! This is done simply by adding the yeast to wort and getting on with the brew day.

Hopefully, this answered your question. There are some brewers, like myself, who would rather use clean yeast than clean up dirty yeast and see acid washing as a temporary solution to the problem. Personally, I would rather keep my yeast young and healthy by routine propagation. ■

Mr. Wizard's Address

Do you have a question for Mr. Wizard? Write to him c/o *Brew Your Own*, 216 F St., #160, Davis, CA 95616. Or send e-mail to wiz@byo.com.

Mr. Wizard, BYO's resident expert, is a leading authority in homebrewing whose identity, like the identity of all superheroes, must be kept confidential.

Tricks to Control Beer Color

by Suzanne Berens

Tahoe Mountain Brewing Co.

"The common thought on color these days is you can get anything you want out of malt, so you don't have to go through any hoops."

Brewer: Keith Wayne

Brewer: Keith Wayne
Brewery: Tahoe Mountain Brewing Co., Stateline, Nev.
Years of experience: 4½ years
Education: BS in fermentation science and completion of Master Brewer's Program, University of California, Davis; Member of Institute of Brewing, London
House Beers: Sand Harbor Honey Blond, Freel Peak Wheat, Cave Rock Pale Ale, Snowflower Red, Mt. Tallac Oatmeal Stout

The color of beer is controlled 90 to 95 percent by malt. If you've tasted a Michelob Dark, you might have noticed that it doesn't taste like a dark (beer) but it looks like one. That has to do with separating color from flavor. That beer has caramel color in it. You can also do that with black malt, which is designed to add color but not astringent flavors associated with black beer.

So the best way to color beer without affecting flavor too much is to use black malt. Use it in flour form and put it in the kettle instead of the mash tun. Use 0.08 pounds per barrel (31 gallons) to give beer about 14° Lovibond. In homebrew terms that would be 0.21 ounces per five-gallon batch. It's an additive. In other words you add the 14° Lovibond to that of your original grain bill to give you the total Lovibond.

An example of how we affect color would be adjusting our barleywine using black malt. We didn't want it over-caramelized, but we wanted it dark. Originally I didn't have enough caramel in there to have a dark beer. If you add chocolate malt or roasted barley, you get flavor reminiscent of stout or porter, which you don't want. So I put 1 percent black malt into the grist. It's dark now. I also add sugar to the kettle, which gives it more browning. And I put in two kinds of crystal malt to give it a nice sweet flavor.

Another example is our stout. It's as black as it gets. We simply use chocolate malt and roasted barley to make 10 percent of the total grist.

When adjusting color, you need to look at percentages. Rather than determining how many degrees Lovibond your beer can vary from batch to batch, look at the percent. Our red is about 40° Lovibond. If we brewed one batch that went to 50° Lovibond, that would be within an acceptable range. We also have a blond, which is at about 6° Lovibond, an appropriate level for that beer. If you increased it five degrees to 11° Lovibond, it wouldn't look right. However, five degrees for the red is a much lower percent and would be okay. Five percent variance is within an acceptable range for Lovibond.

Other factors that affect color to a much lesser degree are pH, oxygen, filtering, and boiling. Boiling obviously darkens the wort mainly due to one chemical reaction called Maillard. You have reducting sugars — maltose and glucose — and you have amino acids, which come mostly from the malt and a small amount from the hops. When you get the sugar and amino acids into solution and heat them, they react. The result of the reaction is melanoidin formation, which is the same thing you get from lying out in the sun. This ends up as caramelization. The hotter the

The Tips

- To color beer without affecting flavor too much, use black malt. Color is controlled 90 to 95 percent by malt.
- Wort boiling can affect color by caramelization.
- The lower the pH of your water, the less it favors caramelization.
- Filtering your beer can reduce color by a very small amount.

wort is, the more caramelization you get. So if you're using a burner, such as propane if you are a homebrewer, you're going to get more color than if you steam. We use steam here.

Decoction mashing can affect color as well. When you boil one-third of the malt, you destroy enzymes but you form color. So if you do a double or triple decoction, you get a fair amount of color in the portions that you boil and add back to the mash.

The pH of water is another factor affecting color. The lower the pH, the less it favors caramelization. When the pH goes up (the water gets more alkaline), you get better darker beers. The effect of pH is a chemical reaction, not an enzyme-driven reaction. There is a slight decrease in the amount of amino acids at the end of the boil. The amino acids that are lost have been turned into color. Burton-on-Trent water, originally used to make pale ale, is more acidic due to the high permanent hardness. Munich water is fairly alkaline, which gives you good darker beers.

Oxygen is another factor. When you pull wort from the boil and inject oxygen into it, the oxygen combines with the sugars and you get darkening.

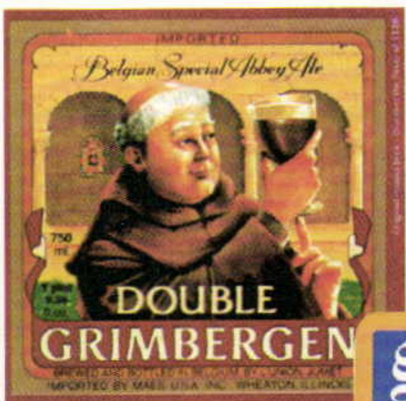
Filtering affects color, but a lot of the change comes from the removal of haze. A pale ale or a red might have an orange tinge. When you filter, that goes away. If you run it through a centrifuge to de-sludge it, then through DE (diatomaceous earth) to filter it, then through a finer filter, say a plate and frame, you get color loss, too, but not much at all. ■

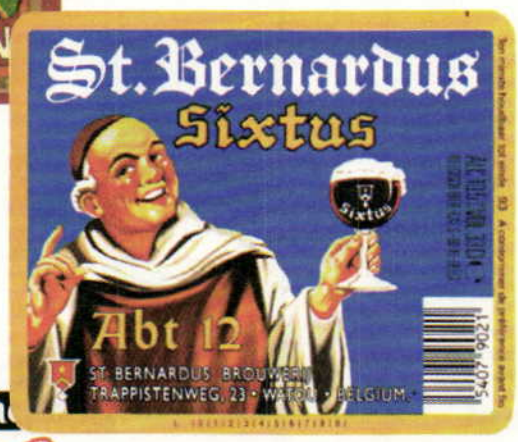
The Belgians Are Coming

by Alex Fodor

Beer taxonimists hate Belgians. No matter how they lump or split, they can't seem to categorize the diverse spectrum of Belgian beers. Why can't they all do the same thing? For example, in Germany one can taste a beer and probably identify the style with ease. The Belgians, however, insist on confusing beer pedants with random acts of cardamom and orange peel. Still, beer lovers are most passionate when Belgian ale is in their glass.

Probably more batches of Belgian-style homebrew are dumped each year than any other beer. Secretive Belgian brewers, unusual ingredients, and obscure yeast cultures make Belgian beers rather difficult to reproduce. Furthermore, strange spices and strange yeasts often work symbiotically in Belgian-style homebrew experiments to create downright funky beer. In a more positive light, abbey ale is a Belgian-style beer homebrewers can make with minimal stress. It's easier than lambic because it doesn't require *Brettanomyces* yeast or *Pediococcus* bacteria.





Abbey ale is a Belgian commercial style based on beers first brewed by Trappist monks. Today six Trappist breweries remain and have exclusive use of the Trappist designation. It is the desire of brewers to make beers on par with the Trappists that begat abbey-style ale. However, the diverse profiles of the six Trappist breweries raise questions about the style. Still, the brews share a few common denominators. The profile is heavily influenced by yeast. This is expressed in the general estery fruitiness as well as other flavors unique to each yeast. The beers are rather high in alcohol. All of the beers are bottle conditioned. There are two subcategories under the title of Belgian abbey ale, dubbel and tripel. These terms are thought to refer to the sweetness of the wort. Single, the medieval monk's daily drink, had a low starting gravity and alcohol. The dubbel was stronger, and the tripple stronger still.

Dubbel begins with an original gravity of 1.060 to 1.070. At 10 to 14 SRM, the final product is a reddish-brown beer with an alcohol content of 4.7 to 5.9 percent alcohol by weight and 6 to 7.5 percent alcohol by volume. Hop aroma and bitterness play a background role in the flavor profile. Bitterness levels range from 18 to 25 IBU and aromatic hops are usually added in small quantities. The base malt of choice for abbey ale is the Belgian pilsner malt, but other pale lager malts may do the trick.

Dabblers in dubbel will want to take advantage of Belgian malts, biscuit malt, and Special B. For a five-gallon batch one-half to one pound of biscuit tends to add a toasty character and some color to the beer. Special B, a very dark crystal malt, contributes body, maltiness, and color to the beer. About one-quarter pound per five-gallon batch gives the desired effects without overwhelming the beer. Other crystal malts may also be used to round out the flavor. All grains should be infusion mashed at 155° F. Sugar is a mandatory ingredient for the kettle. Belgians usually add dark candi sugar, a form or crystalized sucrose that resembles rock candy. Many homebrew shops now carry candi sugar. Though by no means the same, regular cane sugar can be substituted.

Noble hops such as Saaz, Hallertauer, and Tettnanger won't overpower the aroma like high-alpha American varieties can.

The fermentation temperature for abbey ales in general falls at 65° to 80° F. The choice of yeast remains up to the brewer. Yeast with a strong Belgian character is not a requirement. However, the ability of the yeast to finish out a high-gravity fermentation should by considered. Culturing some yeast from the dregs of your favorite abbey ale is always an intriguing option. Grimbergen Dubbel is one of many beers of this style now available to American palates. Michael Jackson describes Grimbergen as "raisiny, chocolatey, and toffeeish." A Grimbergen recently sampled in the United States had hints of plum and a slightly vinous character. Malt predominated the brew, with no distinct intrusion from hops in aroma or bitterness. Wild-type yeast flavors were not as pronounced in Grimbergen as with other Belgian ales such as the Trappist brew Chimay.

The Grimbergen brand also produces a tripel. This golden-colored brew resembles Champagne not only for its effervescence but for its distinct toasty character from the autolyzed (dead) yeast in the bottle. This beer is surprisingly drinkable considering it has an alcohol content of 7.2 percent by weight and 9 percent by volume. Light candi sugar plays an important role in creating this effect by diluting the flavor of the malt while still providing fermentables. The original gravity of tripel spans the range of 1.070 to 1.090. The alcohol content is typically 5.6 to 8 percent by weight or 7 to 10 percent by volume. With an SRM of 3.5 to 5.5, tripel is significantly lighter in color than dubbel. Like most bottle-conditioned Belgian ales, the carbonation of tripel runs fairly high, around 3 to 3.5 volumes. The basic ingredients of tripel are Belgian pilsner malt and candi sugar. The hop profile is similar to dubbel, with slightly more emphasis on aroma hops. Wort aeration and a lot of yeast ensure a complete fermentation of this high-alcohol beer. Other aspects of tripel brewing such as mash temperature and fermentation resemble that of dubbel.

Dubbel Trubbel
(5 gallons, all-grain)

This abbey ale should keep the cloister happy. If you are scared of wild Belgian yeast, try a mixed yeast fermentation using a Belgian strain and a more neutral ale selection. This should put the wild-type yeast character into a more subordinate role.

Ingredients:

- 9.25 lbs. Belgian pilsner malt
- 1 lb. Belgian biscuit malt
- 4 oz. crystal malt, 40° Lovibond
- 4 oz. Special B malt
- 1 lb. dark candi sugar
- 2 oz. Tettnanger hops (4.5% alpha acid), 1.5 oz. for 60 min., 0.5 oz. for 5 min.
- Alcohol-tolerant ale yeast such as Wyeast 1214 (Belgian Abbey)
- 3/4 cup corn sugar for priming

Step by Step:

Mash grains into 3.5 gal. of water to reach a conversion temperature of 155° F for 90 min. Sparge with water at 168° F until a volume of 6 gal. is collected.

Bring to a boil and add candi sugar. Boil 30 min. and add the first hop. Boil 55 min. more and add remainder of the hops. Boil 5 min. more for a total of 90 min. Cool and aerate. Pitch yeast at 75° F.

Ferment at 65° to 80° F. After fermentation rack to secondary. Prime with corn sugar and bottle. Age for at least one month before consuming.

OG = 1.065
FG = 1.013-1.018

Tripel Tippel
(5 gallons, extract)

It has all the flavor and three times the alcohol. This is a caffeine-free beer.

Ingredients:

- 5.5 lbs. light malt extract syrup
- 5 lbs. light only malt extract
- 1.5 lbs. light candi sugar
- 0.8 oz. Perle hops (8% alpha acid), for 60 min.
- 0.75 oz. Saaz hops (3.5% alpha acid), for 5 min.
- Alcohol-tolerant ale yeast such as Wyeast 1214
- 3/4 cup corn sugar for priming

Step by Step:

Bring 4 gal. of water to a boil. Stir in malt extracts and sugar until all are fully dissolved. Return to a boil for 30 min. before adding hops. Add Perle hops and boil 55 min. more. Add Saaz hops and boil 5 min. more for a total boil of 90 min. Add 2.5 to 3 gal. of cold water to help cool the hot wort, thereby bringing the total volume up to 5 gal. Aerate wort and pitch yeast at 75° F.

Ferment at 65° to 80° F. After primary fermentation rack to secondary and age for two to four weeks before bottling. Prime with corn sugar at bottling. Allow bottles to condition for one month before respectfully consuming.

OG = 1.085
FG = 1.018-1.025

Tipsy Trappist
(5 gallons, partial mash)

This recipe is for a Trappist-style ale. It might best be described as a dubbel with the kick of a tripel. Look out tipsy Trappist, here comes the monsignor!

Ingredients:

- 5.5 lbs. light malt extract syrup
- 1 lb. pale lager malt
- 3 lbs. Munich malt, 20° Lovibond
- 1 lb. wheat malt
- 0.5 lb. biscuit malt
- 1 lb. dark candi sugar
- 2.5 oz. Styrian Goldings (5.5% alpha acid), 1.5 oz. for 60 min., 1 oz. for 5 min.
- Alcohol-tolerant ale yeast such as Wyeast 1214
- 3/4 cup corn sugar for priming

Step by Step:

Mash grains into 2 gal. of water to reach conversion temperature of 155° F for 90 min. Sparge with water at 168° F until a volume of 6 gal. is collected.

Bring to a boil. Add extract and candi sugar. Boil 30 min. and add 1.5 oz. hops. Boil 55 min. more and add 1 oz. hops. Boil 5 min. more for a total boil of 90 min. Cool and aerate. Pitch yeast at 75° F.

Ferment at 65° to 80° F. After fermentation rack to secondary. Prime with corn sugar and bottle. Age for at least one month before consuming.

OG = 1.075
FG = 1.013-1.018 ■

BATTLE FOR

BUD PEEN

BREWERS GO

THE BEER

by John Naleszkiewicz

There's a battle waging for your beer. The battle takes place every time you brew, whether you realize it or not.

On one side are you and your yeast. On the other side are bacteria and other beer spoilers. Now about the rules: Each side can do whatever it takes to win. After all, this is war.

The spoilers can hide in cracks and crevices or even float in on dust particles. Fortunately, you have a powerful arsenal: sanitizers, disinfectants, even the much-dreaded high-temperature blast.

The key is to maximize your advantage. There are times to bring on the shock troops (sanitizers and disinfectants), and there are other times when the regulars (cleansers and general cleanliness) will do just fine.

Cleaning

An object is considered clean when it contains no visible deposits of dirt or grime. For glass this means that when the glass is examined, it is free of film or discoloration on the surface. For metal, vinyl, rubber, or plastic, this means there are no deposits that could be removed through scrubbing or by using cleansers. Remember that metal, vinyl, rubber, and plastic can become permanently discolored through exposure to heat or certain chemicals. This type of discoloration does not alter the container's ability to be clean and usable for brewing

HEAD TO HEAD WITH GERMS

purposes. For example a vinyl hose can go from clear to cloudy white if it is repeatedly exposed to high temperatures. This does not impact its utility as a siphon hose.

It's not always enough to use a good cleanser; you occasionally have to use a brush and scrub. That's why most homebrewers have a collection of brushes for cleaning their equipment. This can include bottle brushes, carboy brushes, and even special hose brushes that can be pulled through your hoses to clean them. Besides using brushes, you need a good detergent. The detergent makes it easier for the brush to do its job. There are a variety of cleaners, some liquid and some powdered, that can be used to help you get your equipment clean (see Homebrew Cleansers, page 23).

As a rule of thumb, all of your brewing equipment should be clean when you use it. The dirt deposits make a great hiding place for bacteria to accumulate, just waiting for the opportunity to begin reproducing. This means that you should check all the equipment, utensils, and other parts individually to make sure that they are free of all dirt deposits and slime. Especially check your hoses to make sure that they are clean on the inside and free from small cracks. Small cracks make wonderful places for bacteria to hide, and it is virtually impossible to clean cracks. This means that any of your hoses or plastic containers that develop small cracks should no longer be used.

Another place to check is where these hoses connect to something else. The connection point is an area where there could be accumulations or deposits of some type. These could easily be the home of the beer spoilers.

Sanitizing

When something is sanitized, it has been treated to make it virtually free of germs, or disinfected. This treatment can come from using chemicals that are able to destroy or incapacitate bacteria and fungus, or it can come from exposure to extreme heat. Either way, the effect is that any germs that were present before treatment have been killed or permanently disabled.

So you can use either chemical disinfectants or high heat to sanitize your equipment. Typically, using heat for sanitizing vinyl or plastic is not a good idea. You end up with a gooey puddle of mess. With this in mind, most homebrewers usually use chemical disinfectants for sanitizing. (The sidebar Homebrewing Sanitizers, page 24 identifies some commonly available disinfectants.)

When to Sanitize

So when do objects need to be sanitized, and when can you get away with clean? By considering the entire brewing process, it's possible to identify those times when the wort is most susceptible to contamination by bacteria or wild yeast and thus requires as sanitary conditions as possible. With this in mind, the three times that are most critical for proper sanitation are during primary fermentation, transferring from primary to secondary, and during priming for conditioning. (If you are conditioning your beer by using CO_2, then this third exposure does not apply.) It is during these periods that your wort, which is an extremely appealing host to both wild yeast and bacteria, is most exposed.

During other stages of the brewing process, sanitation is not as critical, but general cleanliness — at the least — should never be overlooked. This is usually because even if the bacteria do get in, there will be less for them to eat so they won't reproduce as quickly or they will be killed off by the following stage of brewing before they can get much started. It is during their reproductive cycle that bacteria and wild fungi produce all their beer-spoiling tastes and smells.

For example it is not uncommon to have quite an assortment of unwanted germs and fungi during the mashing process. These have been hitching a ride with the grains for quite some time. There they lie, dormant and just waiting for the right conditions to begin growing. But you don't really need to worry about these potential beer spoilers. That's because the

Homebrew Cleansers

Ammonia

Used to wash bottles and containers, but it is difficult to work with because of the strong odor. Rinsing is required. Use about one cup in five gallons of water. Do not combine ammonia with any chlorine products. This will cause the release of poisonous chlorine gas!

B-Brite (Sodium percarbonate/sodium silicate).

Made for sanitizing surfaces that come in contact with beer. No rinsing required. Follow the directions on the container. Product of Crosby and Baker.

Detergents

Any good detergent can be used to wash the surfaces of glass and plastic containers. These can be either liquid or powdered, but the liquid detergents are easier to use. Rinsing is required. Use as directed.

Sodium Hydroxide (caustic soda, lye)

Used to clean stubborn stains from glass and stainless steel. Do not use on aluminum. Rinsing required. Use as directed. Very dangerous to use. Wear gloves and goggles.

PBW (Buffered alkali with active oxygen)

As strong as caustic but not as hazardous because the active oxygen in the product enhances the weaker alkali. Easily rinsed. Use as directed. A product of Five Star.

Tri-Sodium Phosphate (TSP)

Excellent and safe cleaner for glass. Rinsing required. Use as directed. Skin and eye irritant, so wear gloves and goggles.

Washing Soda

Can also be used to wash glass and plastic containers. It is especially good for removing labels from bottles. Rinsing required. Use one-quarter to one-half cup in five gallons of water.

amount of time devoted to the mash is far too short for the bacteria to get into reproducing very much before they get zapped during the boil. An adequate boil (20 minutes) is also the reason tools used during this period, such as the brewpot and stirrer, should be clean but do not have to be sanitized. The heat of the boil will take care of it. The boiling wort can also be used to sanitize tools to be used immediately after the boil, such as immersing a chiller in the wort for 10 minutes before the end of the boil.

If Not Now, When?

Both primary fermentation and priming are times you are expecting the yeast to do some work for you. To get the yeast to do this work, you offer it food in the form of sugar. When this sugar is available to the yeast the beer

CIRCLE 57 ON READER SERVICE CARD

Homebrew Sanitizers

Before You Sanitize...

You must clean your equipment before you sanitize if you are using a no-rinse sanitizer. Really light soil can usually be cleaned and sanitized in one step with sanitizers that need a rinse.

Chlorine Bleach

This is an excellent sterilizing agent. You should rinse the items thoroughly with very hot water after soaking or rinsing with a bleach solution. Use about two ounces of bleach in five gallons of cold water.

Iodophors

Iodine-based sanitizers are good disinfectants for glass and stainless steel. Not recommended for plastic because of staining. No rinsing required for the foaming (iodine and acid combination) iodophors. Rinsing is required for non-foaming iodophors. Use as directed. Use gloves because it can stain your skin.

Rinse Your Trouble Away

Some sanitizers require a thorough rinsing after use while others do not. The disadvantage to using a sanitizer that requires rinsing is that you run the risk of reintroducing some germs during the rinsing process. How great this risk is depends on how free of germs your water supply is. If you are on a municipal water supply, you probably can rinse with no problems.

spoilers, also suspended in the wort, can get activated and steal that food for their own undesirable purposes. Remember, unfermented wort is an excellent growing place not just for brewing yeast but just about any sugar-eating bacteria or fungus, and there are quite a few of them out there. So the real problem is to keep out as many bacteria as possible during those times when they could begin growing and spoil your beer.

Now, a few bacteria in the wort won't have much of an opportunity to affect the flavor of your beer. It's all a game of numbers and population size. For the bacteria to have much impact, they need time to reproduce and grow their population. You want the yeast population to get big very quickly. That's why you pitch an actively fermenting yeast starter.

Once the yeast is in place, it will get busy doing things that the bacteria may not like. First, the yeast starts consuming all the oxygen in the wort. In a fairly short time there will be none left. Many of the wort-spoiling bacteria need oxygen to reproduce. Second, the yeast will start making alcohol, which makes the environment even more unpleasant for bacteria and slows them down, especially as the alcohol concentrations get higher.

Bacteria actually act faster than yeast, but then there is so much more yeast in the wort than there is bacteria (at least there had better be or you're wasting your time). This is one reason that you should always use an actively fermenting yeast starter and a proper pitching rate when pitching into the cooled wort. It helps ensure the yeast will quickly overpower any bacteria that may be present in your wort.

Considering that there are three times when your wort is most susceptible to attack by beer spoilers, these are the times that you should maintain sanitary conditions at their highest. Sanitation during primary fermentation is many times more important than it is during priming for conditioning. This is because the amount of sugar available during conditioning is much smaller than during primary fermentation, and the presence of alcohol in the already fermented beer acts as a natural disinfectant.

During the primary fermentation phase of brewing, all the equipment and utensils that come into direct contact with the cooled and unfermented wort need to be sanitized. Specifically, this includes your fermenter, hoses used to transfer cooled wort, and your fermentation lock and stopper (just in case the kraeusen — the foam formed on top of actively fermenting wort — gets high enough to touch them during primary fermentation).

During priming everything should be very thoroughly cleaned, at least. After all, this is your last chance to spoil a nice beer by not taking the time to perform a few simple steps. It makes sense to thoroughly clean all the siphon hoses, the bottling vessel, the bottles, and the caps.

One standard procedure is to sanitize the bottles in a weak solution of bleach and water, then rinse them with very hot tap water with a jet washer attachment. If you are kegging your beer, be sure to clean and sanitize the keg and its fittings. Make sure that everything that touches the beer during the bottling process is at least visibly clean, and you can take the extra step to sanitize. After all, anything that touches the beer can potentially introduce something unwanted to the brew.

In fact it's a good idea to boil the priming sugar or priming malt extract in a couple of cups of water before adding it to the fermented beer. This is just an extra precaution in case there are any spoilers lurking in the sugar.

Cleanliness is very important in all the brewing steps, but absolute sanitation is not always required. Good cleanliness and sanitation practices are ways of stacking the deck against the germs that want to spoil your beer. Then, by using a good, active yeast starter when you pitch, you can virtually ensure that the homebrewers win and the spoilers lose.

7 Fascinating Facts About Yeast

by Christopher White

Beer is made from just four simple ingredients: malt, hops, water, and yeast. While sometimes overlooked, yeast can be the most important of these ingredients. Its duty is to transform sweet, hopped wort into beer. During this transformation, yeast adds flavor and aroma to beer.

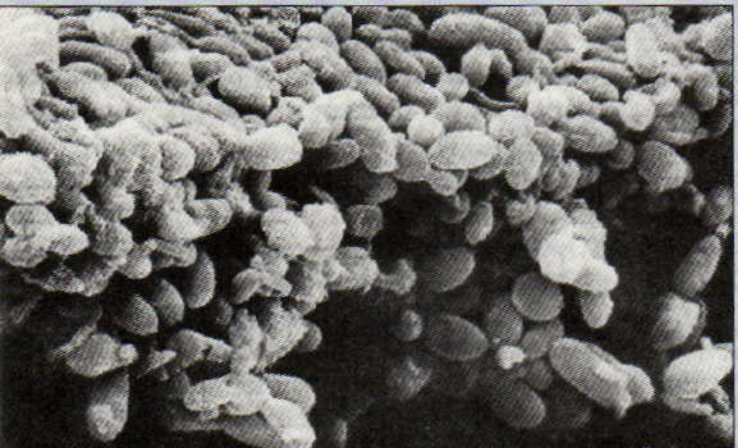
Yeast is a living, single-cell organism commonly found on plants and animals. On solid media (plates or slants) yeast barely becomes visible as a clump at one million cells. Since a single cell, at five microns in size, is not visible to the human eye, yeast was long considered a mysterious organism.

Until the mid-19th century brewers knew very little about yeast. To make good beer they had to rely on ancient practice. With the aid of a microscope, Louis Pasteur discovered that yeast was responsible for beer fermentation in 1866. Fifteen years later at the Carlsberg Laboratory in Copenhagen, Emil Hansen isolated and purified individual yeast strains, and brewer's yeast started to be banked and stored. Many of the pure culture techniques Hansen developed are still in use today.

1. There are more than 500 species of yeast.

Brewer's yeast is just one of 500 species, but within a single species there can be literally thousands of genetically distinct strains. *Saccharomyces cervisiae* is the species in which brewer's yeast is classified (*cervisiae* is the species name).

Old classification split ale and lager yeasts into different species, *Saccharomyces cervisiae* and *Saccharomyces uvarum*, respectively. The basis for the two-species



Each of these brewer's yeast cells is about eight to ten microns in length. They become visible to the human eye in a clump of one million cells.

Although yeast fermented beer in ancient times, it wasn't until Louis Pasteur got behind a microscope in 1866 that yeast's role in beer creation was understood.

classification was not only the fact that lager yeast can ferment beer wort at a lower temperature then ale yeast, but lager yeast can also metabolize certain sugars that ale yeast cannot. The species distinction has made it easier for brewers to classify their yeast. Unfortunately for brewers, recent classifications has united both strains into a single species, *Saccharomyces cervisiae*, due to cross-mating ability. The brewing industry, grounded in tradition, has influenced brewers to hold fast to the use of both names. The tradition may serve brewers well. Not only is the distinction useful for brewers, but future genetic studies may restore the *cervisiae/uvarum* classification anyway.

To brewers all other 500-odd varieties of yeast are grouped as "wild yeast," because they can't perform the same functions as brewer's yeast strains. The characteristics that define brewer's yeast are alcohol tolerance, flocculation (ability to clump together), attenuation (ability to transform sugar into alcohol), and fermentation flavor characteristics. For example *Pichia pastoris* is one popular industrial yeast strain that brewers call wild yeast. It is incapable of producing good-tasting beer because its attenuation is very high due to its fast growth rate, it is very nonflocculent, and it produces objectionable flavor compounds.

2. Yeast is responsible for most of the flavor and aroma compounds in beer.

Yeast contribute more than 600 flavor and aroma compounds to finished beer. Most of these hover around perceivable values, so slight changes in conditions or ingredients can affect flavor profiles. In addition, what compounds yeast do not make themselves, they can affect. For example yeast change the way malt and hop compounds taste and smell. Hops are affected because different yeast strains adsorb different amounts of iso-alpha-acids, which account for 60 percent of beer's bitterness. Malt components are affected because they are metabolized by yeast.

The American Society of Brewing Chemists has created a "flavor wheel" to illustrate and evaluate the flavors and aromas associated with beer. The flavor wheel shows that 59 percent of the aroma (odor) descriptions can be attributed to yeast and 79 percent of the flavor (taste) descriptions also can be attributed to actual yeast byproducts, or components affected by yeast.

When brewers think of yeast flavors, esters (fruity) and diacetyl (buttery) usually come to mind first. Ethanol (alcohol), fusel alcohols (such as iso-amyl alcohol), and sulfur compounds (particularly in lager yeast) also make a large contribution to the flavor profile. A typical fermentation will yield 35 grams of ethanol (the intoxicating element in beer) per liter of beer, which modifies a beer's mouthfeel and flavor. This is one reason low-alcohol beers have a different flavor.

3. The Romans discovered the uses of dried yeast — before the discovery of yeast.

Yeast grows and lives in liquid. For storage purposes it can also be dried once grown. The Romans discovered how to do this when they put baker's yeast (dough) in the sun and could later revive it with sugar. (Of course, they didn't know there was yeast in the dough!) Today, most yeast used in the bread and wine industry is in dry form. However, many brewers prefer to use yeast that is not dried. Why the difference?

Production of dried yeast is different than production of beer. Instead of maltose, the main carbon ingredients in dry yeast production are glucose and fructose. Glucose inhibits maltose-transport genes from being expressed, so dried yeast can take longer to start fermentation if they have never come in contact with maltose. In addition the drying process is not completely sterile, so potential contaminants are introduced into the pitching yeast. The quality of dried yeast varies greatly among producers but has improved significantly over the last 10 years. Today, there is fine quality dried yeast produced.

Besides purity and taste, another drawback of dried yeast is variety of strains. Dried yeast is made in very large quantities, and the availability of different strains is limited. Strains to make true German hefe-weizens or Belgian trappist beers would be difficult to find in dried form.

Liquid yeast, since it is not subject to the drying process, can be produced to a higher degree of purity. Also, the negative effects of the drying process on yeast metabolism and beer fermentation potential are avoided. Unfortunately, liquid yeast is an extremely perishable product and is best within two weeks of production. On the other hand dry yeast can survive and even retain 90 percent viability one year after production.

4. A little waiting is good.

When sweet wort is pitched with yeast, there is a characteristic lag phase before signs of fermentation are evident. This lag phase is an important part of the fermentation process. It can last anywhere from one to 24 hours, depending on the quantity of yeast pitched, fermentation temperature, and oxygen content of wort.

After yeast is pitched into wort, it begins to assimilate into its new environment. The focus on this phase (some split this phase in two parts) is uptake of oxygen and reproduction of new yeast cells. To make new yeast cells, lipids are required. Lipids make up the cell membrane, and a necessary component of these membranes is sterols. To make sterols, oxygen is required. Different yeast strains require different levels of oxygen to produce membrane sterols. Generally, the more flocculent strains require higher levels of dissolved oxygen.

If a wort is pitched with too much yeast, the yeast begin to ferment without multiplying to the appropriate level. This leaves the pitching yeast as the main fermentative agent instead of new, healthy cells. Overpitching leads to low viability in succeeding generations and adds a yeasty flavor to the beer. Conversely, if a wort is pitched with too little yeast, higher ester levels may be produced due to the higher growth required. Underpitching can also leave the beer exposed to potential growth from other micro-organisms. Homebrewers rarely overpitch but often underpitch yeast.

5. Yeast transform sugar into alcohol and CO_2.

Attenuation is the percentage of sugars that yeast consume during fermentation; sugars are transformed into alcohol and carbon dioxide. A 100 percent attenuation would result if a beer fermented all the way down to 1.000 final gravity (FG). For example a beer with an original gravity (OG) of 1.052 and a final gravity of 1.013 would have a 75 percent apparent attenuation. An equation using specific gravity is:

% Apparent Attenuation =

$$\frac{OG-FG}{OG-1} \times 100$$

Attenuation is a function of a yeast cell's metabolism, and metabolism is a function of an individual strain's genetic makeup. Since yeast differ in their genetic makeup, they usually differ in their attenuation range.

Knowing the attenuation range of a particular strain of yeast allows the brewer to judge what type of yeast to use for what type of beer. For a malty ESB a brewer may choose a yeast strain with a low attenuation, while a dry Golden Ale may require a yeast strain with a high attenuation. Each strain has a typical range, and this range is affected by mash temperature, fermentation temperature, pitching rate, and flocculation. For example an increase in the mash temperature can decrease the percentage attenuation because there would be fewer fermentable sugars in solution. Temperature and pitching rate are controllable by the brewer. Flocculation is not.

6. Some yeast strains really stick together.

Flocculation is the special ability of brewer's yeast to clump together following the end of fermentation and either rise to the surface or fall to the bottom of the fermenter, allowing easy removal from the beer. Most species of yeast are not flocculent. It is thought the reason brewer's yeast is flocculent is the natural selection process that has taken place in brewing, dating back hundreds of years. Since yeast was reused in brewing, it needed to be recovered. Usually this was done by skimming the surface of fermenting beer. This selected for yeast that would rise to the surface, hence top-fermenting yeast. When beer is chilled, flocculated (clumped) yeast drops to the bottom. This selection process took place in many breweries, producing many different degrees of flocculent yeast.

For example London is known to be home of a very flocculent yeast. This yeast will form very large clumps even before fermentation is finished. This intensive flocculation sometimes necessitates that a brewer rouse the yeast to get it back into solution to finish the fermentation. On the other hand this simplifies filtration and yeast recovery. Other ale strains such as American/California strains are powdery and do not flocculate out until the beer is chilled. These strains tend to be more attenuative since they are in suspension for a longer period of time. On the other side of the scale, German ale yeast strains from Bavaria that are used to produce hefe-weizens are usually non-flocculent, and this is a desired characteristic of this beer. One aspect worth noting is that hefe-weizen flavors closely resemble wild yeast flavors, and these yeast flocculate like wild yeast.

Flocculation is one yeast

characteristic that is very important to brewers. Professional breweries typically reuse their yeast 10 or more generations, so yeast recovery becomes very important. Homebrewers usually do not reuse their yeast, although they can, so they may not be as concerned about flocculation. On the other hand most homebrewers do not filter their beer, so yeast strains with a greater degree of flocculation can make homemade beer clearer.

7. Yeast would rather keep warm.

The optimum temperature for yeast growth is 90° F. Yeast cell death occurs above 100° F. Why don't we ferment our beers then at 90° F, decreasing the time that it takes to make beer? Why do we make yeast work slower? Because what is best for yeast is not best for beer. As they grow and multiply, yeast produce many compounds, the most noticeable of which are esters. As the temperature of a fermentation rises, more yeast growth occurs, and consequently more esters are produced. At 90° F yeast produce so much acetaldehyde (which tastes like apples) that the beer becomes undrinkable.

The optimum ale fermentation temperature has been found to be 68° F. This temperature strikes the best balance between yeast growth and ester levels for most ale strains. For hefe-weizen-style beers, some brewers like to ferment above 80° F, which increases the level of banana-flavored esters produced by these strains. Most ale strains are unable to ferment or grow at 55° F, which is the most common lager fermentation temperature. This fermentation temperature greatly reduces the ester-forming ability of most lager strains, creating the clean flavor associated with lager beers. Ester levels are kept low, placing the emphasis on malt and hop flavors.

A Matter of Style

Yeast is a single-cell organism that ferments wort into beer. We know only select stains of yeast are capable of producing good beer. Qualities that define good brewer's yeast are attenuation, flocculation, and flavor profile.

Most brewers want a highly flocculent, highly attenuative yeast. Unfortunately, these characteristics usually do not go hand in hand. We know that very flocculent yeast will usually have a lower attenuation percentage. The brewer's best option is to match the style of beer brewed with the characteristics of the yeast strain. Therefore, different styles of beer benefit from the use of different yeast strains. One fun experiment is to split a batch of homebrew into two or more vessels and pitch different yeast. The discovery of different flavors and aromas is truly rewarding!

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Where the Wild Yeasts Are

A Homebrewer's Tour of Belgium's Traditional Lambic Breweries

by Amy Jabloner

Since life is short and airfare deals abound, travel whenever you can. This is my motto. As a beer enthusiast, it seemed only fitting that a recent trip to Holland to visit a friend merited a brief excursion to Belgium — land of wild yeasts and eccentric brews. With a limited amount of time and money, I set out on a trip to see the sights in Belgium, otherwise known as beer paradise.

A trip to Europe is not complete without a visit to at least one museum. Throngs of tourists visit the Louvre, the Rijksmuseum, the Uffizi, and other famous art museums while in Europe. In Belgium tourists can visit museums that are dedicated to a Belgian work of art — beer. These are breweries that disdain modern technology, even such advancements as stainless steel, and brew in a very traditional manner on antiquated equipment. And they produce some of the most highly regarded beer in the world.

Curiosity and a short train ride from Holland led me to Brussels and eventually to the Brasserie Cantillon, also known as the Brussels Gueuze Museum. The Brussels Gueuze

While in Europe, the author couldn't resist the lure of beer paradise and made her way to Belgium.

PAUL ELSON

The last brewery in Brussels, tiny Cantillon, brews just 21,000 gallons annually.

Museum was founded in 1978 with the aim of preserving and promoting the production of traditional lambic beer and maintaining its qualities and reputation. Gueuze, a style of beer distinctive to Brussels and its environs, is made from blended young and old lambics.

The Last Brewery

Lambic, also known as liquid rhubarb or the champagne of beers, is a tart beer made with the help of spontaneous fermentation. Depending upon the definition of a lambic, these beers are hard, if not impossible, to produce outside a limited area of Belgium that includes the Senne Valley and Brussels. It is here that ambient yeasts and bacteria unite to produce this distinctively sour and acidic beer. Although homebrewers and commercial brewers have tried to approximate the flavors of Belgian lambic, brewing a traditional lambic will always be out of reach because of geographic limitations. American homebrewers sometimes call their own versions "pseudo-lambic" or "plambic."

About half a century ago the city of Brussels had approximately 50 breweries operating within its limits. Now Cantillon stands alone. Cantillon is a fully operational, very small, charming craft brewery. The brewery is tiny by modern standards, producing only about 800 hectoliters (682 barrels or roughly 21,000 gallons) of beer annually. (According to the Confederation of Belgian Breweries, all Belgian breweries combined produce 14 million hectoliters of beer, about 12 million barrels, annually.)

After a short walk from the main tourist area in Brussels, I located Cantillon without much difficulty. However, the brewery is very unimposing. After visiting about a dozen breweries in the United States and abroad, I was surprised by the size of the building. No grand elephants led the way to the brewery as at Carlsberg. Instead, I walked right past the brewery since it is considerably smaller than neighboring buildings and its facade is painted in unobtrusive and faded colors.

Paul Cantillon established the brewery in 1900 for blending the lambics of other brewers to create gueuze. Cantillon began brewing its own lambic in 1937. The original equipment, which is still in use, is operated by the original family; Master Brewer Jean-Pierre Van Roy, the husband of Paul's granddaughter, runs the brewery today with the assistance of his family. While I sampled the beers of the brewery, I watched family members pouring and selling beer, corking and washing bottles, and mopping floors. Van Roy gets help from his wife, daughter, son, and son-in-law. No job is too menial. I spied the master brewer himself amiably washing bottles.

Cantillon does not brew from March to October due to concerns about the heat and the possible over-exuberance of the ambient yeasts, so the machinery was idle, but the atmosphere had its own energy. I did not have to see the actual beer being produced to get a feel for the brewery and the brewers. Visitors who drop by the brewery/museum, as I did, can take a self-guided tour with the assistance of a fairly detailed handout and a brief

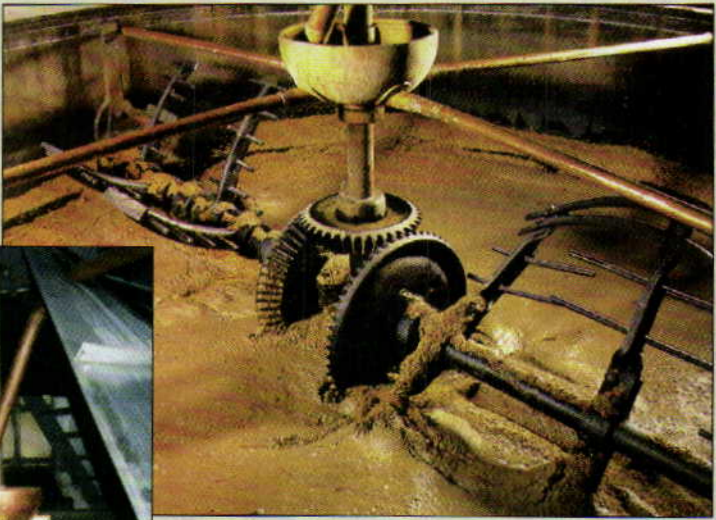
Pieces of equipment that are integral to the brewing process at Cantillon are considered museum pieces by many Belgian brewers.

verbal introduction on the history of the brewery.

Since I have visited other breweries and have a passable knowledge of brewing, I enjoyed giving myself a tour and lingering around the equipment. As several other tourists whizzed by probably thinking of the beer sample at the end of the tour (including a family that most likely broke a sweat because they moved so quickly), I stopped, stared, and took in the wonderful sights and scents. No one moved me along or blocked my view. At the end of the "tour," I had my questions answered by the person serving the beer. However, be aware that this may be dependent upon the server's English or your French.

Lambic is a wheat beer with straightforward ingredients. Cantillon's lambic is composed of 65 percent malt and 35 percent unmalted wheat. Hops, aged for a least three years and in amounts greater than two to three times that of other breweries, are also added, but mainly for their preservative qualities rather than for flavor and aroma.

After the wheat and barley are crushed in a grain mill, they are turned into grist in a copper mash tun that looks as if it might take off at any moment due to its "propellers." Massive, intimidating "corkscrews" mash the grains with water, creating a turbid mash of about 72° C (162° F) in approximately two hours. Resembling something out of a Frankenstein movie, a rudimentary albeit utilitarian belt-and-pulley system is used to provide power to the brewery equipment including the mash tun. After mashing, the wort is extracted, pumped into copper hop boilers, and boiled with the hops for three hours. The wort is subsequently pumped into the coolship, or



Brewer Jean-Pierre Van Roy operates the same equipment his wife's grandfather, founder Paul Cantillon, did in the early 1900s. This original mash tun is still in use.

cooling tun, in the loft.

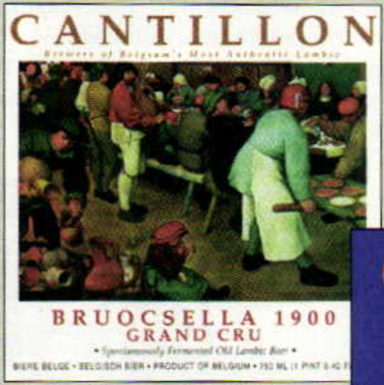
The room in the loft of the brewery that contains the coolship is the most fascinating for anyone who loves lambic or eccentric methods of brewing. Here it became evident how unusual lambic breweries are. The large, shallow, flat, rectangular, entirely riveted, red copper coolship takes up most of the loft and holds up to 7,500 liters of wort. The wort is cooled while the ambient yeasts (*Brettanomyces bruxelensis* and *Brettanomyces lambicus* along with several dozen other identified and unidentified types of yeast) and bacteria are beseeched to inoculate the wort and produce lambic's characteristic flavors and aromas. Louvers, or vents, on the sides of the room permit air flow and can be opened and closed depending upon weather conditions. The roof is also vented for air flow. Cooling the wort overnight permits the yeast to inoculate the wort, which is transferred to barrels when it has cooled to 20° C (68° F).

Gueuze, Cantillon's first beer, blends one-, two- and three-year-old lambics. Secondary fermentation in the bottle produces a complex flavor that is both fruity and sour.

A distinctive feature of the roof makes it particularly intriguing. Even though the roof was replaced in 1985, the original tiles, darkened by age and the environment, were retained under the new roofing tiles to maintain the "micro-organic fauna" of the brewery. Continued preservation of microflora in a lambic brewery is extremely important, since the beer's distinctive characteristics are partly due to the distinctive microflora of a particular brewery. Lambic breweries, as a result, are not nearly as sterile as other breweries. Bacteria adds to the flavor, so old roofing tiles and dusty rooms are not only acceptable, they are considered integral to producing good lambic beers.

After cooling, the wort is pumped into oak barrels. These barrels, originally used to ship wine, have been used for decades so their microflora contributes additional characteristics to the beer. In several days fermentation starts and bubbles pour from a bunghole in the barrel. The barrels are not secured for fear of explosion. After a few weeks the barrels are sealed and remain closed for as long as several years.

The barrel or cask storage area could have inspired Edgar Allan Poe. It is dimly lit and extremely dusty, with cobwebs for added effect. Dust accumulates on barrels that have had beer aging in them for several years. Mold grows undisturbed on the barrels, feeding on the beer left after the vigorous fermentation. Insects, attracted especially by the fruit beers, are counteracted by spiders, which are permitted to produce their works of art on the walls and barrels to reduce the insect population. Insecticides could be harmful to the maturing beer, so they are never used. According to the brewery handout, this atmosphere is all part of the "biological equilibrium" of the brewery and "a lambic brewer never destroys a cobweb" or kills a spider. Stains from fermentations past make patterns on the floor like modern art, and a faint, wonderful, somewhat sour odor drifts in the air. Although I would not recommend trying this type of brewing at home, this brewery illustrated that brewing is as much an art as a science.



Belgain art adorns labels that until recently were regarded by the ATF as indecent.

Wooden barrels used for fermentation and conditioning are part of the "biological equilibrium" of the brewery.

The lambic is aged in the same barrel for one to three years or possibly longer, depending upon its intended use. Up to 20 percent of the lambic is lost to evaporation during this time. Given the capriciousness of producing a beer that relies on bacteria, wild yeast, and wooden casks, maintaining consistent flavor and aroma is difficult.

The finishing touch is a cork with the name of the brewery and the bottling year, and a cap. Once bottled, corked, and stored horizontally in a cool cellar, the beer continues to age and ferment. It takes two years of bottle conditioning before gueuze, a blended combination of one-, two-, and three-year-old lambic, is ready to drink.

After the brewery tour, a visitor can sample Cantillon's beers. Large wooden casks in the entrance to the brewery serve as the bar. Since the beers are bottle conditioned, they are nestled in baskets and handled gently and with reverence. The brewers are obviously very proud of their product and, with little prodding, happy to let visitors try several kinds of their beer. I loitered near the tasting area long enough to try almost all of Cantillon's products, including a young, non-sparkling lambic aged for about a year.

Master Brewer Van Roy ardently supports maintaining the age-old practices involved in lambic brewing. Consequently, Cantillon prides itself on the authenticity and tradition that goes into the making of its beers. The beers are made the old-fashioned way and as a result are somewhat robust and more tart than other lambics.

Cantillon makes several beers in addition to gueuze. Cantillon's fruit beers, produced during the summer, contain cherries, raspberries, or grapes (which brings beer that much closer to wine). Two-year-old lambic is mixed with the fruits that are left to macerate in the lambic for five to six months. A young lambic is added (30 percent of final volume) just before bottling to aid with fermentation in the bottle. Kriek, flavored by schaarbeek cherries; Rose de Gambrinus, a framboise flavored by raspberries and a hint of cherries; and Gueuze Vigneronne, flavored by Italian muscat grapes, are all produced in this manner.

Some other lesser-known Cantillon products include Faro and Grand Cru Bruoscella 1900. Faro is a lambic with added candi sugar and caramel, a sweet beer that is definitely an acquired taste. Faro can only be kept for a few weeks, because the additional sugar causes fermentation in the bottle that might cause the bottles to explode. The Grand Cru is a non-sparkling, unblended lambic aged for three years.

Upon my return home, several friends tasted Cantillon's beers and had mixed reviews. It took me several tries to really appreciate their complex flavors. The considerable sourness and unique flavor of Cantillon's lambics are not what you might expect, even if you enjoy other distinctively flavored beers. The beers have been very highly rated and praised by Tim Webb in his *CAMRA Good Beer Guide to Belgium and Holland*, and Michael Jackson has given very high marks to the Rose de Gambrinus, Grand Cru, and Gueuze in current and past editions of his *Simon & Schuster Pocket Guide to Beer*.

The traditional beers of Cantillon are imported in the United States with great enthusiasm by three brothers, Joel, Daniel, and Will Shelton, who say they are not in it for the money but for love. Will Shelton would be "tickled pink" if they break even. Joel Shelton, a musician, met Jean-Pierre Van Roy while touring Europe and forged the relationship that resulted in this endeavor.

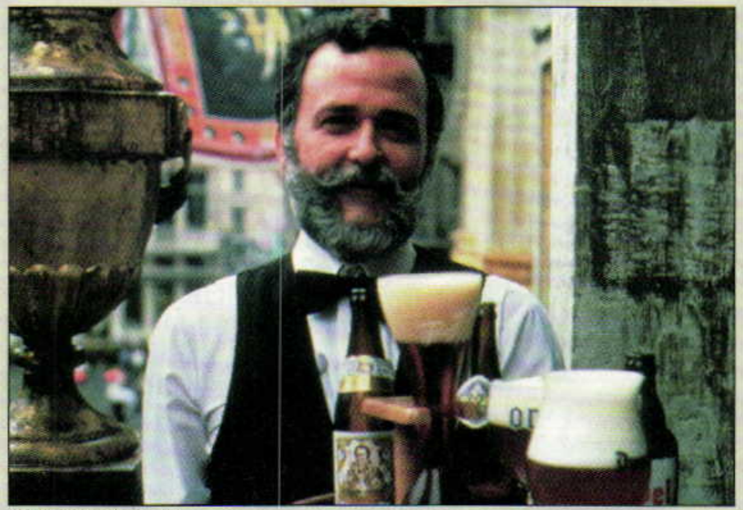
Faro is one of the many lambic-based beers Cantillon brews.

The Sheltons are importing Cantillon products under the name Shelton Broers. In late 1996 Shelton Broers began receiving shipments from the brewery in the United States. Five of Cantillon's beers are available in limited supply in the United States: Gueuze, Rose de Gambrinus, Kriek, Gueuze Vigneronne, and Bruoscella 1900 Grand Cru. The beer is being distributed in more than a dozen states including California, New York, Virginia, New Jersey, Oregon, and Illinois. Shelton Broers maintains a Web site, which, along with the history of the brewery, lists where Cantillon is available: www.cantillon.com.

Other Belgian lambic brands available in the United States include: Belle-Vue, Boon, De Troch, Lindemans, Mort Subite, and Timmermans.

Belgian brewers are famous for their artistic, unusual, risque, and colorful labels and Cantillon is no exception. In a "victory for art, beer, and freedom of expression," Shelton Broers recently had two of Cantillon's well known labels approved by the Bureau of Alcohol Tobacco and Firearms (ATF). The ATF previously rejected the labels for the Gueuze for an undisclosed reason and the Rose de Gambrinus as "indecent." The Gueuze label depicts the Manneken Pis, a famous Brussels bronze statuette of a little boy urinating, with a glass of Gueuze in his hand. The Rose de Gambrinus label portrays Gambrinus, the mythic king of beer, fully clothed in black, with a voluptuous, nude woman perched on his lap holding up a glass of framboise.

In previous shipments, to mollify the ATF's concerns about American sensibilities, the young woman on the Rose de Gambrinus label was depicted demurely with a long blue dress (a previous importer suggested that the woman wear a bikini). Rather than clothe the Manneken Pis, the American version of the Gueuze label abandoned the original label design for an Art



BELGIAN TOURIST OFFICE

Belgium is a land rich with opportunity for the beer lover.

Nouveau-style graphic.

In its effort to use the "indecent" labels in the United States, Shelton Broers argued to the ATF that the labels are original works of art rather than an attempt to appeal to beer drinkers' prurient interests. Famed Belgian artist Raymond Coumans painted the Rose de Gambrinus label. Shelton Broers maintained that the Manneken Pis is a symbol of Brussels and that Cantillon, the only brewery still operating in Brussels proper, should be permitted to use its rendering on the labels. The label for the Grand Cru, which shows a detail from Bruegel's painting The Wedding Feast, was also approved.

Although the Cantillon labels have been approved by the federal authorities, some states are not as willing to recognize their artistic merit. Pennsylvania rejected two of the labels, Washington rejected one, and other states are expected to follow suit.

Large wooden casks serve as a bar where guests are invited by the brewmaster's daughter to try several of the house beers.

Other Stops

After the Brasserie Cantillon, the next stop on my itinerary was the CBB (Confederation of Belgian Breweries) Museum in Brussels. The museum is located in one of the premier tourist attractions in Belgium, the Grand Place. The Grand Place in Brussels is a very impressive, even awe-inspiring square composed of ornate buildings dating from the 14th century. Gold statues and elaborate stone masonry decorate the buildings, making for a majestic view when you enter the square from a side street. Built in the late 16th century, the Brewers' House in the Grand Place houses the CBB Museum.

The CBB museum seeks to educate rather than fascinate, which makes it a good place to start a Belgian beer tour. The museum is small and requires only a short time to tour. Located in the lower level of the building, it juxtaposes

18th century and 20th century brewing equipment in adjacent rooms. The main room of the museum contains a microcosm of a modern brewery with shiny, technologically advanced examples of where the Belgian brewing industry is headed. Displays and videos enhance the experience. Interactive computer terminals permit visitors to "tour" Belgian breweries and find out about their beers. Of course a glass of beer is available at the end of the tour.

My third and final beer stop was the Straffe Hendrik brewery in Bruges. The brewery, which opened in 1856, maintains a "museum" of brewing equipment that is no longer in use. Straffe Hendrik now uses modern brewing equipment, most of it located outside of the city of Bruges.

My visit to Straffe Hendrik made it all too clear why Van Roy is fighting to preserve Belgian brewing traditions. The tour of this museum was a history lesson that emphasized differing perspectives in the brewing industry as to whether newer is necessarily better.

During the tour, the "old stirring vessel" that the guide pointed to happened to be the same type of mash tun I saw at Cantillon. The wooden barrels on display "are not used much nowadays," noted the tour guide and the tour group walked across the highly polished coolship (there was a mat) to get to the roof for a panoramic view of the city. This was particularly unsettling to me since I had seen how the coolship was treated as so integral to brewing at Cantillon. The guide also declared that a fear of "infections" meant that beer was only cooled for 20 minutes in the coolship. At Straffe Hendrik, as is the case with the vast majority of breweries, "bad" bacteria translated into bad beer.

This tour, like the others, ended with a glass of beer. The tour was pleasant and interesting. Straffe Hendrik, which is situated in a lovely part of the city adjacent to a picturesque canal, has an attractive indoor bar and restaurant as well as a courtyard.

A trip to beer paradise requires a certain amount of planning and research. Keep in mind that summer, especially June and July, is vacation time for many Belgians, so some breweries and bars may not be open. Unfortunately, I experienced this first hand when I tried to visit some well-known pubs in Bruges and Brussels. Brewery tours, although sometimes available generally, may need to be reserved in advance for some breweries and may not be available at all for others. Finally, if you want to see a lambic brewery in operation, do not visit between March and October.

The CBB Museum touts Belgium as the "hub of the latest brewing technology," but Cantillon proves there is more to great beer than the shiny, sparkling, stainless steel brewing equipment of the modern age. The beer, the brewery, the brewing equipment, and brewer all made for a memorable experience. Another vistor to the Brasserie Cantillon stated it best: "That was a revelation, it really was."

BREWING WITH SUGAR

Most beginning homebrewers are told the same thing, in one way or another. It may be by the experienced friend who gets them started or by the salesperson in the shop where they purchase their first kit, but the message is the same: Don't use sugar.

They hear horror stories about "Grandad's day," when beer was brewed from 10 pounds of sugar, some raisins, and a cake of yeast kept in a crock behind the kitchen stove, or something like that. Modern brewers, they're told, know better now and brew with malt. All malt. The more malt the better. Homebrewers tend to look down on the big commercial brewers for using adjuncts, unmalted cereal grain, and non-malt fermentable ingredients that produce fermentable sugars.

Well, it's all a big lie. Or at least in part. For every rule, there's always an exception or two. You've heard of the Reinheitsgebot, right? The Bavarian Purity law of 1516 states that only hops, malt, and water may go into the making of beer. (Note that not even yeast is mentioned.) But to be realistic, a relatively small percentage of the world's beer production is brewed according to that law. Now, this is not putting down the German brewers. On the contrary. There are very few better-made beers in the world than the real Bavarian lagers, bohemian pilsners, weizenbiers, and so on. If Germans can brew all that with just hops, malt, and water, then that should be good enough for the rest of us too, right?

Well, that would mean no more Belgian beers of any kind, pretty much. No more English bitters, most of which have some kind of adjunct added to them. No more specialty beers, fruit beers, beers with unusual grains or spices. In short the world of beer would be a less diverse, less interesting, and truly poorer place.

Sweetening the Pot

First a question: What is sugar? Without getting into a review of your college molecular biology class, sugars are nature's energy source.

They are what seeds (such as barley and wheat grains, for instance) contain in order to feed the new, growing plant until it can get outside its

by Scott R. Russell

CHRISTINE KELL


CORN SUGAR
TREACLE • MALT SUGARS
SUGAR • BROWN
MOLASSES • HONEY • GOLDEN SYRUP • MAPLE SYRUP

shell into the soil and find more. Every kind of plant life contains something similar. The sugars we've been able to tap into have become a processed product for our table: cane sugar, beet sugar, maple sugar, corn syrup, and fruit juice can be found in one form or another in virtually every home.

All of these and more have their place in the homebrewer's arsenal. Add to these the closely related (non-fermentable) carbohydrates such as malto-dextrin and lactose, and you put into the homebrewer's hands a gazillion (or so) different ways to add uniqueness to his or her brew.

Here are several sugars and some of their traditional and/or possible brewing uses:

Corn sugar (dextrose): Derived from corn. Used primarily for bottle priming but also for increasing gravity of beer without changing color or flavor.

Rice syrup or solids: Same uses as corn. Also used as an adjunct in many American-style lagers.

Table sugar (cane sugar): Highly processed, refined (as are corn sugar and rice syrup). Not used all that often in brewing, except as an emergency substitute for corn sugar. Occasionally used for priming. The stuff of "Grandad's" legends.

Brown sugar (cane sugar): Processed white table sugar with a little molasses added back in. Some use in British (bitters, particularly in the Yorkshire area) and Scottish brewing. Useful for priming where a richer butterscotch flavor is desired.

Molasses (cane sugar): Strong, dark byproduct of the refining process. Often found in porters, occasionally in old ales, brown ales, and so forth. Easy to overdo.

Treacle (cane sugar): Special dark molasses, even richer and darker. Best used in strong black ales, such as old ales and stouts.

Malt sugars (malted grains such as barley, wheat): The malting process (partial sprouting and then drying of the grain, which is part of the process for corn and rice sugars as well, incidentally) creates enzymes that later convert starches to sugars. Several types of sugar compounds are created, depending on temperature and moisture conditions and other factors. These are the goodies. The vast majority of beers (and other stronger alcoholic beverages) from around the world are dependent on these sugars.

Candi sugar: Made almost exclusively in Belgium. It is merely crystallized beet sugar, ranging from light to dark in color (depending on the degree of caramelization). It is one of the secrets of the Belgian brewing industry.

Maple syrup and sugar: Production is concentrated in the Northeastern United States and Southeastern Canada (Maine, New Hampshire, Vermont, and Quebec). Derived from the sap of the sugar maple tree, boiled to concentrate. It takes 35 to 40 gallons of sap to produce one gallon of syrup. A recent rediscovery in brewing circles (old-timers in Vermont and elsewhere have always made sap beer, but they won't usually admit it or give you the recipe) now being found in porters, wheat beers, blond ales, and so forth.

Honey: Bees do the work of converting starches in flower pollen to a type of sugar, then store it as a food source for their offspring. Honey ferments slowly compared with malt and other sugars but can be used in almost any type of beer. Or use it exclusively and make mead.

Golden syrup (invert sugar, cane sugar): a syrup made by processing cane sugar so as to break the bond between sugar molecules, allowing a cleaner fermentation. It is useful for strong ales because it adds fermentables without influencing color or flavor (much).

There are other sugars available, such as coconut sugar, fruit sugars, and date sugar, but their use is not yet widespread in brewing, at least in the English-speaking part of the world. If you should find something that intrigues you, try it!

The most important rule of thumb is to use a light hand. Don't brew with too much of the wrong sugar. It's true that excessive amounts of highly and quickly fermentable sugars (such as rice or corn) can lead to off-flavors. It's also true that strong-flavored sugars such as molasses and treacle can overwhelm any other flavors in your brew. Honey and maple may take so long to ferment that you get cloyingly sweet beer or way overcarbonated bottles. So be cautious but not rigid.

Here are six recipes in which it is perfectly acceptable, even *de rigueur*, to use some non-malt form of sugar. Some are classic, old-world beers, some new-fangled American styles, but each has its place in brewing lore and tradition, past or future.

Molasses Licorice Porter

(5 gallons, grain, extract, and adjuncts)

There is reason to believe that a recipe like this was brewed frequently in colonial and revolutionary times by such luminaries as Thomas Jefferson and George Washington. Good enough? Well, we won, didn't we?

Ingredients:

- 3 lbs. pale malt
- 0.5 lb. dark crystal malt, 90° to 120° Lovibond
- 0.25 lb. chocolate malt
- 0.25 lb. black patent malt
- 5 lbs. dark malt extract syrup
- 2 cups unsulphured molasses
- 8-12 AAUs of your favorite bittering hop (1-1.5 oz. Brewer's Gold, 8% alpha acid, for example), for 45 min.
- 1 stick brewer's licorice (broken small) or 2 oz. shredded dry licorice root
- 10-14 g. dry ale yeast
- 3/4 cup corn sugar and 4 Tbsp. molasses for priming

Step by Step:

Heat 1 gal. of water to 165° F and mix in the crushed grains. Hold for 75 min. around 153° F, then run off and sparge with 2 gal. of water at 168° F. You should have about 2.5 gal. of sweet wort. Add malt extract and molasses, bring to a boil. Boil 15 min. and add hops. Boil 45 min., add licorice, and turn off heat. Steep for 30 min., then pour into fermenter along with enough pre-boiled cold water to make 5.25 gal. When cooled to 70° F, add yeast.

Ferment at 65° F for 10 days. Rack to secondary and age at 55° F for two weeks. Prime with corn sugar and molasses. Bottle age for six weeks.

Belgian Dubbel

(5 gallons, grain and adjunct)

How do the Belgian brewers get such high alcohol contents without cloyingly sweet flavors? The answer is candi sugar. This is a very big beer. Use a good, tolerant yeast.

Ingredients:

- 10 lbs. pale malt (preferably Belgian)
- 1 lb. malted wheat
- 0.5 lb. Belgian cara-Vienne malt
- 0.5 lb. light Munich malt
- 1 lb. brewer's corn sugar
- 1 lb. light candi sugar

- 1.5 oz. Hallertauer hops (4% alpha acid), for about 45 min.
- 0.5 oz. Brewer's Gold hops (6% alpha acid), for 5 min.
- Belgian strong ale yeast slurry (such as recultured Chimay, Rochefort, or other Trappist yeast, or Wyeast 1388)
- 2/3 cup corn sugar for priming

Step by Step:

In 4 gal. of water heated to 163° F, mash in crushed grains. Mash should settle to about 151° F. Hold for 90 min. Run off to kettle, sparge with 3 gal. water at 169° F.

Add corn and candi sugar, stir in well. Bring kettle to a boil for about 20 to 30 min. Add Hallertauer hops. Boil about 40 min. Total boil will reduce wort to 5.25 gal. (approx. 60 to 90 min.). Add Brewer's Gold hops 5 min. before the end of boil. Remove from heat, chill quickly, and pitch yeast when wort is 70° F or so.

Ferment at 70° to 75° F for two weeks. Rack to secondary and condition at 50° F for one week, then raise temperature to 70° F for two weeks. (This temperature variation method is used by Orval, among others.) Prime with corn sugar and bottle. Age well (10 to 15 weeks) and sip slowly.

Smoked Maple Amber Ale

(5 gallons, extract with specialty grains and adjuncts)

A Vermont specialty, especially if you can get real sap! If not, don't worry. Instead of boiling with sap, use 3 gal. of water and double the amount of maple syrup. "Reverse-hopped" (lighter hop used for bittering, higher alpha hop for aroma) for a little extra zing.

Ingredients:

- 8 gal. maple sap boiled down to 3 gal.
- 1 lb. medium crystal malt, 50° to 60° Lovibond
- 0.25 lb. German rauch malt (or home-smoked cara-pils malt)
- 6 lbs. unhopped amber dry malt extract
- 1 pint real Vermont maple syrup
- 1 oz. Cascade hops (4% alpha acid), for 60 min.
- 1 oz. Northern Brewer hops (8% alpha acid), for steeping
- 10-14 g. dry ale yeast
- 1/3 cup corn sugar and 2/3 cup maple syrup for priming

Step by Step:

Boil maple sap down and cool to 155° F. (If you can't get maple sap, just heat water to 155° F). Steep malts with the heat off for 30 min., then remove. Turn on heat and add DME and syrup. Bring to boil. Add Cascade hops, boil 60 min. Add Northern Brewer hops, remove from heat, and steep 30 min. Cool, add to fermenter along with enough pre-boiled cold water to make 5.25 gal. At 70° F, add yeast.

Ferment warm, 68° to 70° F, for two weeks. Rack to secondary. Check gravity. If it has not come down to 1.020 or lower yet, repitch a little dry yeast. Condition three to four weeks at

65° F, then prime with corn sugar and maple syrup. Bottle and be patient. Try one in four weeks.

Yorkshire Bitter

(5 gallons, grain, extract, and adjunct)

Many classic breweries in the Yorkshire area brew with brown sugar to achieve a different snap to what would otherwise be just another bitter.

Ingredients:

- 2 lbs. pale malt
- 1 lb. light crystal malt, 20° Lovibond
- 0.5 lb. wheat malt
- 0.5 lb. toasted malt (toast 0.5 lb. cara-pils malt on a cookie sheet at 350° F for 15 min.)
- 3 lbs. light unhopped dry malt extract
- 1 lb. light brown sugar
- 1 oz. Bullion hops (7% alpha acid), for 75 min.
- 1 oz. whole Fuggles hops, at end boil
- British ale yeast slurry (such as Wyeast 1318 or 1098)
- 7/8 cup corn sugar

Step by Step:

Heat 1.5 gal. water to 164° F, mix in crushed grains, and hold at 152° F for 90 min. Sparge with 2.5 gal. and collect run-off in kettle.

Add dry malt extract and brown sugar. Heat to a boil. Add bullion hops, boil 75 min. Add Fuggles as you remove from the heat, proceed to chill immediately. At 70° F, pitch yeast.

Ferment at 62° to 64° F for about two weeks. Rack to secondary and condition at 65° F for three to four weeks. Prime with corn sugar and bottle age two to three weeks. This is a great brew to experiment with mini-keg systems and nitrogen taps.

Honeyweizen

(5 gallons, grain and adjunct)

There have been several commercial tries at this style over the last couple of years. This version uses fresh, local organic honey. Get the best malted wheat you can. German wheat, if available, seems to give a nuttier character, which complements the honey and the yeast. Honey malt is a proprietary malt made by Gambrinus Malting Co. and can be replaced (sort of) by cara-pils or cara-Vienne, if honey malt is unavailable.

Ingredients:

- 3 lbs. pilsner malt
- 3 lbs. malted wheat
- 0.5 lb. light German crystal malt, 20° Lovibond
- 1 lb. honey malt
- 1 lb. Vienna malt
- 2 lbs. light honey (alfalfa or dandelion is great!)
- 8 AAUs Spalt hops (2 oz., 4% alpha acid, for example), 1/2 hops for about 90 min., 1/2 hops for about 30 min.
- 1/4 tsp. gypsum
- German weizenbier yeast slurry (some prefer the more neutral, tart Wyeast 3333, but 3056 and 3068 give more traditional phenolics to the aroma of this brew...your call!)

- 7/8 cup corn sugar (or save 0.5 gal. of the unfermented wort, or "speise," with which to prime)

Step by Step:

Heat 3 gal. of water, treated with gypsum, to 162° F. Mix in cracked grains (careful not to crush the wheat too finely, or your runoff will definitely get stuck), aiming for a mash temperature of 151° F. Hold this for 90 min., begin runoff, and sparge with 4.5 gal. water at 170° F.

Bring collected wort to a boil, add honey and half the hops at the onset of boiling. Boil 60 min., add the rest of the hops, and continue until reduced to 5.25 gal. (approximately 30 min. more). Cool to 70° F and pitch yeast (if you are going to prime with speise, don't forget to save some here; see Eric Warner's book in the AHA Style Series, *German Wheat Beers*, Brewers Publications, for more on this technique).

Ferment at 65° to 68° F for two weeks, then rack to secondary. Condition at 60° F or so for three weeks, prime, and bottle. Age two weeks.

Old Pellicula Ale

(4 gallons, grain, extract, and adjunct)

This recipe is a dark strong ale. The use of real treacle (as opposed to mere molasses) lends such a rich, toffeeish flavor to the beer that I'm not even going to suggest that you can brew it with anything else.

Ingredients:

- 2 lbs. pale malt
- 1 lb. dark crystal malt, 120° Lovibond
- 1 lb. roasted barley
- 1 lb. biscuit malt (or amber malt)
- 5 lbs. dark, unhopped dry malt extract
- 1 tin (10 oz.) Lyle's English treacle
- 1 oz. Northern Brewer hops (8% alpha acid), for 75 min.
- 2 oz. Styrian Goldings hops (4% alpha acid), 1 oz. for 30 min., 1 oz. for steeping
- English ale yeast slurry (Wyeast 1275 or 1335)
- 1/3 cup corn sugar and 1/3 cup brown sugar for priming

Step by Step:

Heat 1.5 gal. water to 168° F, mix in cracked grains. Hold at 157° F for 60 min., run off, and sparge with 2.5 gal. at 168° F.

Mix in dry malt and treacle. Bring to a boil. After 15 min. add Northern Brewer hops. Boil 45 min. more, add 1 oz. Styrian Goldings, boil 30 min. Remove from heat and add remaining 1 oz. Styrian Goldings hops. Steep at least 15 min., then chill. Top off in fermenter with pre-boiled cold water to make 4.25 gal. At 68° F, pitch yeast.

Ferment at about 68° F for three weeks. Rack to secondary, condition four weeks at 55° F. Prime with combination of corn sugar and brown sugar, bottle, and arm yourself with the patience to let it bottle condition for eight to 10 weeks. This beer has, on occasion, been saved for two years at my house.

Mashing and the Balanced Diet

by Alex Fodor

How mashing creates the perfect health food — for yeast! (Who did you think we meant?)

Beer as we know it was first discovered by Sir Francis James Beer III in 1873. Beer (the man) was the court scientist to the Queen of England. After first accidentally inventing diet cola and then wine coolers, Beer succeeded on his third attempt to create the official royal beverage when he modified barley into malt, mashed it, and fermented the resulting sweet, brown liquid into beer.

Ah, if only the invention of beer had a nice, neat little story like that to accompany it. Why couldn't it have been like the famous story of the Earl of Sandwich, Thomas Edison, or even John Crapper? Instead beer historians and writers have a muddled tale of evolution that begins with the spoiled barley of ancient Egypt, which somehow becomes the safest drink of medieval Europe, and then Louis Pasteur gets involved and suddenly we have Budweiser.

Although brewing developed over a fairly long period for a beverage, it was the Industrial Revolution that made beer into the sparkling clear, clean-tasting, consistent drink we know and love. Modern scientists now have many explanations as to why brewing works. One brewing process that scientists have elucidated for the brewers is the mashing of malt. Though the aim of mashing is the same today as it was hundreds of years ago, now chemistry and biology are used to explain how malt is made into food for yeast and ultimately beer for people.

The mash is made up of two ingredients: crushed malted barley and

STEPHANIE GAGE ILLUSTRATIONS

warm water. Adding the malt to water then heating the water creates an important biochemical reaction. How much and what types of malt (and adjuncts) you use, how much heat you add, and even the chemical make-up of the water create variations in the mash, but the essential goal is always the same.

The primary aim of mashing is to break down two types of large, complex molecules contained in barley: starches and proteins. These molecules are too big to be consumed by yeast. But their components provide essential yeast nutrients.

Starches are broken down into maltose, a type of fermentable sugar. Maltose provides the energy necessary for fermentation to occur. Proteins are broken down into organic acids called amino acids.

In any biochemical reaction the important work of breaking down molecules into their components is done by enzymes. The enzymes most important to brewers are called alpha-amylase and beta-amylase.

Starch

About 65 to 70 percent of the malted barley kernel is composed of starch. Starch is the primary energy storage mechanism of the barley seed. When the seed germinates, it draws energy from the starch for seedling growth by releasing enzymes to degrade the starch into its simplest component, sugar. Imagine starch as a long chain. Each link in the chain is a molecule of glucose (a simple sugar). However, as starch chains become larger they take on the shape of a tree limb, with many branching points from which other chains emerge. Starch molecules in the raw barley are large and reside in tightly structured units called starch granules. Brewing articles and texts often refer to the gelatinization of starch. This is the point at which a starch granule looses its ordered structure due to heat, making it accessible for enzymatic conversion.

A primary purpose of malting and mashing is to turn the barley's large reservoir of starch into fermentable sugars. Yeast cannot consume a large starchy molecule. Like cutting a piece

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Like cutting a piece of meat into small pieces so a young child can eat it, the brewer must make the energy of the starch accessible to the yeast.

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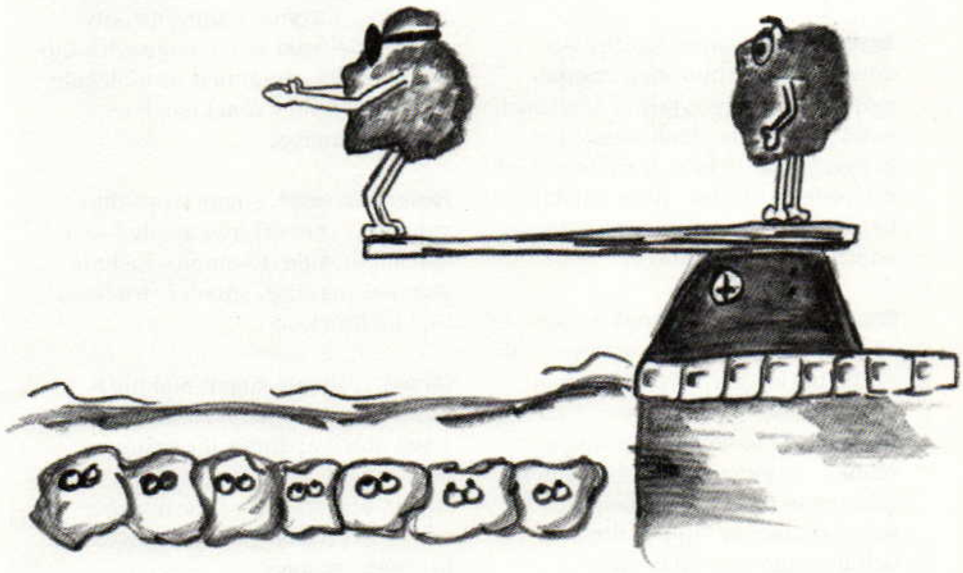
of meat into small pieces so a young child can eat it, the brewer must make the energy of the starch accessible to the yeast. The knife in this analogy is the group of enzymes known as the amylases. The two most important amylases are beta-amylase and alpha-amylase.

Taking It to the Limit

Beta-amylase can attack only the end of the starch chain. It clips off maltose, a sugar usable to yeast, from the starch chain. Beta-amylase is therefore responsible for producing the bulk of fermentable sugar.

Maltose is called a disaccharide because it is composed of two glucose molecules linked together (*di-* means two, *-saccharide* sugar). Beta-amylase is unable to cleave off a maltose disaccharide that is near a branching point on a starch molecule. If you start with a large, branched starch molecule and allow beta-amylase to fully react with it, the resulting starch molecule will be stripped down to the branching points. This is called a beta-limit dextrin, because beta-amylase cannot attack it any further. Since most starch molecules are large and complex, it appears that not very much sugar would be produced if beta-amylase were the only enzyme present in the mash.

In fact another enzyme called alpha-amylase can cut beta-limit dextrins, thereby yielding new ends for beta-amylase to attack. Alpha-amylase simply cuts starch molecules at a point anywhere within the chain, randomly



Mash Words

Amino acid. A simple organic acid. Amino acids are the basic compents of proteins. Sometimes, brewers use a protein rest to help break down proteins into amino acids.

Amylase. An enzyme that breaks down starches into their components parts. Two types of amylases work in tandem. Alpha-amylase converts starch into dextrins, which are unfermentable. Beta-amylase breaks down dextrins into maltose, which is fermentable.

Beta-glucan. Large molecule composed of glucose units. In the storage cells of the barley kernel that contain starches and proteins, about 70 percent of the cell wall is made up of beta-glucans. The more beta-glucans in the finished beer, the more viscous or "thick" the beer will be. Commercial brewers generally try to eliminate beta-glucans, which tend to gum up beer filters.

Beta-glucanase. Enzyme that degrades beta-glucans. Most beta-glucanase activity occurs during malting. Kilning (the final step in making brewer's malt) denatures beta-glucanase. Some beta-glucanase remains in lightly kilned malts.

Beta-glucan solubilase. Beta-glucans are joined together by peptides, which are strings of amino acids. Beta-glucan solubilase is an enzyme that separates beta-glucans from the peptides, thus making beta-glucans more soluble.

Dextrin. An unfermentable, complex carbohydrate created when amylase enzymes break down starch. Dextrins add to body and mouthfeel in beer. They can be broken down into fermentable sugars by the enzyme beta-amylase.

Enzyme. Enzymes are the catalysts that promote biochemical reactions. Enzymes are, by definition, proteins. Each enzyme type acts on a specific molecule or compound to create a specific reaction. Enzyme names usually end in *-ase* and often begin with the name of the compound or molecule with which they react (such as beta-glucanase).

Fermentable sugar. Sugar types that yeast can convert into alcohol and carbon dioxide. Examples include glucose, maltose, sucrose, fructose, and maltotriose.

Glucose. A simple sugar, making it easily fermentable. It is an important yeast nutrient and is the primary building block for longer chain sugars and starches. For instance, two glucose molecules join together to create maltose.

Maltose. The main fermentable sugar used by brewers. It's formed when enzymes break starch molecules and dextrins into maltose. Maltose consists of two glucose molecules.

Peptide. Peptides are strings of amino acids, the basic components of protein.

Protein. Complex molecule formed from groups of amino acids. Proteins can cause haze in beer, and they also affect head retention.

Starch. Complex molecules formed from strings of glucose. A main objective of mashing is to break starch (unfermentable) into its component simple sugars, which are fermentable.

Saccharification. Conversion of malt starch into fermentable sugars. The step during which the mash is held at a specific temperature to allow enzymes to break down starches into simple sugars. Also called conversion rest.

producing two smaller starch molecules. It also can break down trisaccharides (three glucose molecules), something beta-glucans cannot do. While yeast can consume maltose, not all yeast can consume trisaccharides. Alpha-amylase makes trisaccharides available to yeast.

Both alpha- and beta-amylase enzymes are needed to conduct a successful mash. Naturally the balance of these enzymes will affect the composition and fermentability of the wort. The more beta-amylase is at work, the more fermentable the wort becomes. A lower percentage of beta-amylase results in a more dextrinous wort. (Dextrins are unfermentable complex chains. They add body to beer and affect mouthfeel.)

Beta-amylase is heat sensitive and generally functions best at 140° to 149° F. In contrast alpha-amylase can resist temperatures as high as 158° to 160° F. It makes sense then that brewers can control wort composition by effectively favoring an enzyme through mash temperature. Note that the optimum temperature of enzymes is also the point at which they are quickly deactivated. At the typical mashing temperature of 152° F, beta-amylase is almost completely inactivated within a half hour. For this reason many brewing texts don't recommend extended conversion rests, especially ones that last more than an hour. A mash temperature of 155° F will favor alpha-amylase while beta-amylase is quickly denatured. The result is a less fermentable and more dextrinous wort.

There are many practical implications related to the heat stability of enzymes. The first among them is the importance of measuring temperature accurately. A temperature change as small as five degrees can impact the fermentability of the wort and, therefore, the flavor profile of the finished beer. Since thermometers often fall out of calibration, it is worth keeping a few reference thermometers to make sure their readings agree. If one is more than two degrees off, it should be replaced.

The brewer should alter the mash temperature to suit the style of beer being brewed. A temperature of 150° F should yield a more fermentable wort such as that desired for an English bitter, whereas a temperature of 155° F would better suit a sweeter beer like a Scotch ale.

Proteins

Proteins surround the starch granules in raw barley. Protein degradation during malting frees up the starch granules, making them more available for attack by amylases. Like starches, proteins are large, complex molecules composed of simple subunits. Proteins, however, can be composed of as many as 20 different amino acids (organic acids that are the basic component of protein). A peptide is a small chain of amino acids. A protein is a fairly large molecule made of a complex arrangement of peptides.

Although starch provides the energy needed for fermentation, yeast still need other nutrients to complete a fermentation. These nutrients include a large selection of amino acids. One of the goals of malting and mashing is to provide for yeast a wort that contains all the amino acids they need in an adequate supply. Malting breaks down proteins to suply these amino acids. Protein degradation is also important to beer clarity, since proteins can cause haze problems in finished beer.

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The majority of large-protein degradation occurs in the malting process rather than the mash. Endopeptidases, the enzymes responsible for degrading proteins, attack the large molecules randomly in the chains (much like alpha-amylase and starch) and produce peptides and polypeptides. During malting, the barley kernel has an extensive arsenal of these protein-munching enzymes. In the kiln they become denatured. By the time the brewer mashes in, they are no longer active. However, exo-peptidases, enzymes that degrade peptides by cleaving single amino acids off the ends of the chain, do survive kilning and are active in the mash. The protein rest during mashing is probably not responsible for very much protein degradation. At best, some peptides will be broken down into their amino acids.

Protein decomposition is therefore more of a maltster's responsibility than a brewer's. Still, brewers can create worts with insufficient amino acids by using large amounts of low-protein adjuncts such as corn. To deal with this, brewers of high-adjunct beers such as American lager typically use six-row barley. Six-row's high protein content makes up for the addition of low-protein adjuncts.

Beta-glucans

In the barley kernel, storage cells contain the proteins and starches. To make these materials available to enzymatic attack, the wall of the storage cells must be broken down. About 70 percent of the cell wall material of these storage cells is composed of beta-glucans. Like starches, beta-glucans are composed of glucose units. However, because these units are bonded together in a different manner, beta-glucans have different properties than starch.

Beta-glucans are hefty molecules that form a very viscous solution in warm water, much like combining hot water and wheat flour makes a gooey mixture. Consequently, beta-glucans play a large part in determining the viscosity of wort and beer (how "thick" or "thin" it is).

Raw barley has a large amount of beta-glucans. It is not surprising then that Irish stout, a beer renown for being "thick," should have a dose of raw barley among its ingredients. For professional brewers who usually filter their beers, a high beta-glucan content in the beer means extended filtration times and added cost. Furthermore, it tends to slow the lauter. Consequently, most professional brewers would like to carefully control beta-glucans.

In barley, beta-glucans are held together by peptides (chains of amino acids). To break down the cell walls where beta-glucans reside, an enzyme that breaks the links between beta-glucans and peptides is needed. This enzyme is called beta-glucan solubilase, since it helps release beta-glucans into solution, making them soluble. However, the enzyme that actually breaks apart the molecule is beta-glucanase. The majority of the beta-glucanase activity must take place in the malthouse prior to kilning, since the heat of the kiln denatures this enzyme. Once again, the brewer should let out a sigh of relief, since the problem of beta-glucans is primarily dealt with during malting.

This is a benefit brewers enjoy because of advancements in malting technology. Although many brewers still practice the traditional protein rests and beta-glucan rests at lower temperatures, the benefits of the rests are in contention. Still, many brewers swear by them and site evidence of shorter lauter times to back up their case. If you really want to settle the matter of whether these rests are beneficial, then take the role of the brewing scientist yourself. Try brewing two batches of the same beer, one with a protein rest and one without or one with a beta-glucan rest and one without. Observe the difference in the final beers and decide on a mash regimen that makes the best beer. ■

A Tale From Middle Ages

by Stan Hieronymus and Daria Labinsky

A marketing guru would probably charge a king's ransom to create what has come naturally for Middle Ages Brewery in Syracuse, N.Y. A birthday card inspired the brewery's name, while love of the British comedy troupe Monty Python helped the brewers name their flagship beer and provided a theme for those that followed.

Of course a marketing guru also would have told the brewery not to mess with that archaic beer style from across the Atlantic Ocean — the one the British call "real ale."

Owners Marc and Mary Rubenstein demonstrate a commitment to real ale at Middle Ages Brewery in Syracuse, N.Y.

Although cask-conditioned ales make up a relatively small percentage of Middle Ages' overall beer sales, the brewery qualifies as one of the major distributing real ale producers in the United States. Six accounts move between 50 and 60 firkins (British casks, each of which holds 10.8 American gallons) a month.

About half of Middle Ages' beer sales are draft, and only 10 percent of those are cask beer. But the commitment to real ale is an example of why owners Mary and Marc Rubenstein consider it a compliment when they hear their business called "medieval." The theme replays daily in the brewery, where Marc skims the yeast from open fermenters to be used in the next batch, as well as in the marketplace, where each of the distinctive labels recalls the days of King Arthur.

"I gave Marc a card on his 40th birthday that said, 'Welcome to the middle ages,'" says Mary Rubenstein, the company president. Long before, the Rubensteins had called their first really tasty homebrew Holy Grail Pale Ale, in tribute to the movie "Monty Python and the Holy Grail."

The Rubensteins began homebrewing together in the mid-1980s. "I really liked beer; she liked wine," Marc says. "The appeal was doing something together. She's a wonderful cook, so it came easy to her." Marc brews on his own these days. "Mary can brew, but she can't get out of the office," he says.

They got serious about opening a brewery in 1992. "It was something we had a passion to do and something we could do together," Marc says. He was running his family's scrap metal business, and Mary was a medical technologist. They spent three weeks at Alan Pugsley's brewing school at Kennebunkport Brewing Co. in

Kennebunk, Maine, then toured about 25 breweries in the West. "At that time everybody was really accessible, willing to trade information," Marc says.

Back in Syracuse they went shopping for a building, looking at more than 100 before ending up in a former Sealtest ice cream factory. The 9,000-square-foot plant had some of the required floor drains but needed about 4,000 square feet of new concrete. They installed a 30-barrel Peter Austin system with four open fermenters. Current capacity is 6,200 barrels per year, and there's room to expand.

The building sits in a former industrial area of Syracuse, where city officials are offering tax incentives, utility price breaks, and other inducements to attract new businesses. The Rubensteins, obviously, were not just homebrewers with dreams of entrepreneurship. They used funds from the sale of Marc's family business and borrowed money from a bank with which they already had a relationship because of the business. "Syracuse is a small town, really," Marc says. "I've been going to the same car dealer for 25 years."

They sold their first draft beer at the end of May 1995 and had bottles on shelves only a few weeks later.

Grail Ale is the brewery's flagship beer. It's tamer now than when it was the homebrew called Holy Grail Pale Ale. "In the first six months (of homebrewing) I tended to overhop beers," Marc says. He calls Holy Grail "more of a dark amber," although it remains relatively hoppy at 38 International Bittering Units and packs a punch (1.050 original gravity, 5 percent alcohol by volume). Pale, crystal, chocolate, and cara-pils malts go into a wort hopped with Cascade, Northern Brewer, and Tettnanger.

Rubenstein uses British Muntons' malts but American hops in the four beers sold in bottles: Grail Ale, White Knight (a golden ale), Beast Bitter (1.053 OG, 45 IBUs), and the seasonal Winter Wizard (a winter warmer, 1.060 OG and 6.3 ABV). "The British hops are twice as expensive," he says, "and getting them fresh can be a real problem."

The brewery launched a Family Jewels series in 1996 — draft-only beers intended to be available on a limited basis, though some proved so popular they were held over. Rubenstein sometimes uses British hops in the seasonal beers, such as Old Marcus, a strong bitter. "I'm such a Goldings fan, and I missed them so much, I had to do it," he says.

Middle Ages beers are fermented with Ringwood yeast, which is common to the dozens of Austin breweries Alan Pugsley helped open in the Mid-Atlantic and Northeast. The distinctive yeast is easily recognized and often receives either very positive or quite negative reviews. Of course Rubenstein is a fan. "The mistake a lot of breweries make is in the water treatment, and the beers come out tasting really dry," he says. He softens his local water to avoid that.

The yeast, which quickly drops bright in a firkin, works particularly well in cask beers. Middle Ages began shipping cask beer within months after it opened. William Taggert, who had just opened the Rose & Crown in Rochester, N.Y., after working at another Rochester British pub, The Old Toad, was the first customer. Those Rochester pubs are rare because they have separate "cellars" for British firkins, where the casks are put in stillage and conditioned at the proper temperature for the correct amount of time.

"Cask beer is really for the people who care a lot," Rubenstein says. "I do it more for myself."

The brewery owned 10 firkins when the Rose & Crown started selling cask beer. Today it has 90. Two Syracuse bars, Clark's Ale House and the Blue Tusk, sell cask beer, along with the two in Rochester, one in Buffalo, and one in New York City.

The Rubensteins have been very careful about who they'll let serve such a fragile product. "We only sell it to somebody who begs," Mary says. "If the beer is off, the only people who look bad are us."

Each of the six cask accounts usually drains a firkin in less than three days. The beer was moving even more quickly in 1996 when the Highlander Brewery was operating in New York City. The Highlander originally opened as a brewpub-in-waiting, serving mostly cask-conditioned beer brewed at Middle Ages. "We were going through nearly 100 casks a month," Mary says. Despite moving that much beer, the quasi-brewpub quit selling the Highlander beers only months after opening. Middle Ages now owns the brand names, and Highlander 80 is one of its seasonal beers.

Although Middle Ages ships beer to New York City, Connecticut, and parts of New Jersey and Pennsylvania, most of its accounts are in upstate New York. "We've stretched out a little more because we weren't able to sell as much in our town as we wanted," Marc says. "Hopefully we'll be able to pull back a little as we sell more beer here."

They knew going in that Genesee brewed beer with a strong regional following just up the road in Rochester and that Coors Light, Labatt's, Budweiser, and Pabst were the top-selling beers in Syracuse. They didn't realize, however, how much trouble they would have getting beers distributed. "We've ended up self-distributing through most of the state, and that wasn't in our business plan," Marc says.

Getting shelf space in chain stores has been particularly challenging, but bar owners have been supportive. "Having two great beer bars (Clark's and the Blue Tusk) in your town really helps word-of-mouth."

One of Peter Austin's classic statements is that a brewery shouldn't sell beer farther from its door than a horse can walk in a day. The Rubensteins might amend that to allow the use of a truck, but otherwise they agree.

"Our personal preference is cask," Mary says. "Then it would be draft, but you get a lot more exposure with the bottles."

Even those are better close to home. "We just want to make good beer for our region," Marc says. "I come from a small family business and that's what this is, too."

Middle Ages Brewing Co., is located at 120 Wilkinson St., Syracuse, N.Y. For information call (315) 476-4250. ■

Stan Hieronymus and Daria Labinsky are authors of the Beer Travelers Guide, *which lists more than 1,700 brewpubs, bars, and restaurants in the United States that serve flavorful beer.*

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BREWER'S MARKETPLACE

Attack of the Anti-Stress Homebrewer

by Gerry Studzinski

In recent years homebrewing has become "user friendly," with an emphasis on keeping things lighthearted and relaxed. In a much-needed departure from this easygoing attitude, the International Society of Brewing Neo-Fascists has released *Homebrewing Made Hard* by noted expert Donald Schlachtfest, DDT. Subtitled "At-Home Microbrewing," this hefty tome is a *tour de force* of homebrewing knowledge, weighing in at 2,379 pages.

The reader immediately knows he is in for a treat perusing the introduction, forward, and preface, which make the critical point that homebrewing is not some mere imprecise hobby but rather a glorious technological quest for perfection entailing rigorous methodology, laboratory analysis, and replicable results. What follows does not disappoint: turgid prose replete with scientific jargon, perfect for those who believe homebrewing deserves a place in the forefront of academia or at least a category for the Nobel Prize.

The opening chapters on brewing water are exhaustive. There is important information on the latest geological advances in water exploration, as well as lengthy and abstruse instructions for digging an artesian well.

Barley and malt are very well handled, with sound advice on growing barley from scratch. Experienced brewers know achieving professional brewery quality at home begins with growing one's own barley. Comparative analysis of anthocyanogen levels in winter, spring, and summer is provided, as well as in-depth discussion of hybrid three-row barley, which combines the greater enzymatic power of six-row barley with the lower polyphenol levels of two-row barley. Dr. Schlachtfest explains convincingly why the best malt flavor can only be obtained by turning each germinating barleycorn by hand with chopsticks during malting.

The role of yeast is thoroughly explored, and ground-breaking research on recombinant DNA technique in the context of homebrewing is presented for the first time. Dr. Schlachtfest makes clear that with a modicum of perseverance — and an advanced degree in molecular biology — manipulating the metabolic pathways of yeast through cloning and gene splicing is within the serious homebrewer's grasp. The only blight on this otherwise flawless section appears on page 1,284, where the author mentions fermenting Weisenheimer 6654 at 51° F in the primary. Extensive tests at the Diesel Beer Institute in Cleveland have conclusively established 49° F as the proper temperature for this yeast.

Gerry Studzinski bites back with a book review he'd like to see.

The subject of hops is given surprisingly little space, only 457 pages, but the information contained therein is solid and trustworthy. The reader is ordered to segregate his harvest according to height and position on the pole to minimize variations in resins and oils. As the author correctly points out, variations in caryophyllene as small as 5 units can result in wildly erratic flavor profiles. This is why he demands that the serious brewer purchase a super-critical fluid extractor (SCFE). An SCFE can measure hop constituents down to nanograms and is required equipment for precision brewing. While the price tag on one of these machines is not for the average pocket book, the inaccessibility of such tools helps weed out technologically deficient brewers, thus helping preserve the purity of the upper echelons of homebrewing.

The book is full of other useful information such as tips on determining nuances between natural gas vs. propane firing in the final product and step-by-step directions for the grueling, 14-hour quadruple decoction mash. Also included are instructions, with complete schematic diagrams, for building the MIRV zero-gravity osmotic mashing system designed by Jet Propulsion Laboratory and Martin Marietta. (Note: Full security clearance is required to purchase certain components.)

All in all, this book is a tremendous achievement. Veteran grain brewers who think they know a thing or two will be given a healthy jolt of gnawing doubt, while pot-knocking extract brewers will be lucky if they ever brew again. The text is recondite, the references are impeccable, and the author's disdain for unsophisticated techniques, not to mention the reader, is maintained throughout. *Homebrewing Made Hard* is sure to be the last word on homebrewing for a long, long time. ■

Do you have a 750-word story for Last Call? Mail it with a color photo to Last Call, c/o Brew Your Own, 216 F St., #160, Davis, CA 95616.