



**116th MBAA Convention  
October 4–7, 2003  
Milwaukee, Wisconsin**





## 116th MBAA Convention

# Table of Contents

MBAA Information .....4  
Hours .....6  
Schedule .....9  
Poster Program .....16  
Abstracts .....17  
Supplier Presentations and Poster Sessions .....53  
Advertiser Index .....58  
Hyatt Regency Milwaukee Floorplan .....60

# MBAA 2003 Sponsors

**MBAA extends its sincere appreciation to the following organizations for their generous contributions to the MBAA 2003 Convention:**

- BASF Corp.
- 
- Briess Malting Co.
- 
- The Brewers Bulletin Inc.
- 
- Cargill Malt
- 
- domnick hunter
- 
- Froedert Malt Corp.
- 
- MeadWestvaco
- 
- S.S. Steiner Inc.
- 
- Shops of Grand Avenue
- 
- Sprecher Brewing Co.
- 
- Tuchenhagen North America LLC
- 
- World Minerals Inc.





# MBAA Information

## MBAA Executive Committee

President	Frank Kirner, <i>St. Louis, MO</i>
First Vice President	Inge Russell, <i>London, ON, Canada</i>
Second Vice President	Paul L. Kramer, <i>Rahr Malting Co., Shakopee, MN</i>
Past President	Kathy Kinton, <i>Miller Brewing Co., Irwindale, CA</i>
Secretary/Treasurer	Larry L. Sidor, <i>S.S. Steiner Inc., Yakima, WA</i>
Technical Director	Ray Klimovitz, <i>Klimovitz Brewing Consultants, Inc., Chippewa Falls, WI</i>

## District Wisconsin Officers

District President	Jim Olen, <i>The Milwaukee Ale House, Milwaukee, WI</i>
District Board of Governors Representative and 2003 Convention Co-Chair	Gil Sanchez, <i>Menomonee Falls, WI</i>
District Vice President and Technical Chair	Bradley A. Rush, <i>Briess Industries, Chilton, WI</i>
District Secretary	David Newell, <i>Miller Brewing Company, Milwaukee, WI</i>
District Past President	Tim Stover, <i>Gurnee, IL</i>
District Treasurer and Condolences Chair	Thomas Volke, <i>The Brewers Bulletin Inc., Mequon, WI</i>
District Public Relations Chair and 2003 Convention Chair	Jerrold Hilton, <i>S.S. Steiner, Inc., Butler, WI</i>
District Arrangements and Convention Co-Chair	John R. Kretsch, <i>Ace Chemical Products, Milwaukee, WI</i>
District Membership Chair	Penny Pickart, <i>Briess Malting Company, Chilton, WI</i>
District Finance Chair	Tom Eplett, <i>Miller Brewing Company, Milwaukee, WI</i>
District Website Chair	Bernardo Alatorre, <i>Miller Brewing Company, Milwaukee, WI</i>

## 116th Convention Planning Team

<b>General Chairman:</b>	Jerrold Hilton, <i>S.S. Steiner, Inc., Butler, WI</i>
<b>Co-Chair, Technical Program:</b>	Gil Sanchez, <i>Menomonee Falls, WI</i>
<b>Co-Chair, Arrangements:</b>	John R. Kretsch, <i>Ace Chemical Products, Milwaukee, WI</i>

## General Planning Committee

<b>Beer</b>	<b>Chair:</b> Jim Olen, <i>The Milwaukee Ale House, Milwaukee, WI</i> David Newell, <i>Miller Brewing Company, Milwaukee, WI</i> Bradley A. Rush, <i>Briess Industries, Chilton, WI</i> Randy Sprecher, <i>Sprecher Brewing</i>
<b>Sponsorships</b>	<b>Chair:</b> David Newell, <i>Miller Brewing Company, Milwaukee, WI</i> Tracy Thompson, <i>Miller Brewing Company, Milwaukee, WI</i>
<b>Spouse/Guest Program</b>	<b>Chair:</b> Betty Hilton Mary Ann Bromeisl, Judi Huige, Diane Kretsch, Marianna Luther, Kath Radzanowski, Barbara Sanchez, Jean Schmidt, Marge Volke, Geri Zappa.
<b>Membership</b>	Denny Pickart, <i>Briess Malting Company</i>

## MBAA Technical Committee

### Technical Committee Chair

Mike Sutton, *Coors Brewing Company, Memphis, TN*

### Technical Committee Members

Barry Axcell, *South African Breweries, Sandton, Republic of South Africa*  
Rick Brundage, *Nalco Chemical Co., Moon Township, PA*  
John Harris, *Full Sail Brewing Company, Portland, OR*  
Frederik Y. Havel, *Molson Breweries, Richelieu, PQ, Canada*  
KáOtia Jorge, *Brewtech Servicios Ltda., Rio de Janeiro, Brazil*  
Terry Kavanagh, *Carlton & United Breweries Ltd., Melbourne, Australia*  
Mark Kierstan, *Brewing Research International, Surrey, United Kingdom*  
Bill Ladish, *Cargill Malt, Jefferson, WI*  
Motoo Ohkochi, *Kirin Brewery Co., Ltd., Yokohama, Japan*  
George Reisch, *Anheuser-Busch, Inc., St. Louis, MO*  
Gil Sanchez, *Menomonee Falls, WI*  
Richard Sharpe, *Brewing Research International, Surrey, United Kingdom*  
J. Antolin Sierra Benavides, *Cerveceria Cuauhtemoc Moctezuma, Monterrey, Mexico*



## Hours

### Registration

#### Regency Preconvene

Friday, October 3	2:00 – 4:30 p.m.
Saturday, October 4	8:00 a.m. – 6:00 p.m.
Sunday, October 5	8:00 a.m. – 6:00 p.m.
Monday, October 6	8:00 a.m. – 6:00 p.m.
Tuesday, October 7	8:00 a.m. – 6:00 p.m.

### Technical Posters

#### Executive Ballroom

Sunday, October 5	Poster Set Up 2:00 – 5:00 p.m.
Monday, October 6	Posters Available for Viewing 8:00 a.m. – 5:00 p.m. Authors Present 9:30 – 10:30 a.m.
Tuesday, October 7	Posters Available for Viewing 8:00 a.m. – 5:00 p.m. Authors Present 11:15 a.m. – 12:15 p.m.

### Supplier Poster Sessions and Lunch

#### Regency CD

Monday, October 6	Supplier Poster Set Up 9:30 – 10:30 a.m. Supplier Poster Session and Buffet Lunch 11:45 a.m. – 1:15 p.m.
Tuesday, October 7	Supplier Poster Session and Buffet Lunch 12:00 – 1:30 p.m. Supplier Poster Take Down 2:30 – 4:00 p.m.

### Bierstube

#### Crystal and Milwaukee AB

Friday, October 3	2:00 p.m. – Midnight
Saturday, October 4	3:00 p.m. – Midnight
Sunday, October 5	11:00 a.m. – 7:00 p.m.
Monday, October 6	9:30 a.m. – 10:00 p.m.
Tuesday, October 7	9:30 a.m. – 6:00 p.m.

### MBAA Interactive Demonstrations

#### Regency Convene

Monday, October 6	7:30 – 7:45 a.m. 10:00 – 10:15 a.m. 12:45 – 1:00 p.m. 3:15 – 3:30 p.m.
-------------------	---

**SAVE BIG**  
on books at the MBAA Convention!



**SAVE  
\$25**

When you buy  
at the MBAA  
Convention!

List Price: \$100

**Convention  
SALE Price:  
\$75**

## The Practical Brewer, Third Edition

Edited by John T. McCabe



**Now Available in Spanish!**

¡Una Célebre y Renombrada  
Referencia Cervecera, Ahora  
Disponibile en Español!

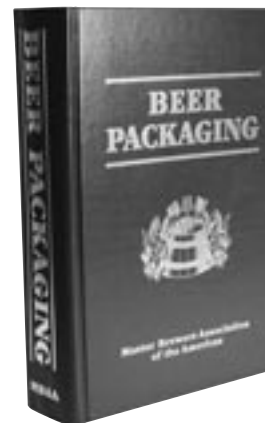
See page 38 for more information.

**SAVE  
\$30**

When you buy  
at the MBAA  
Convention!

List Price: \$75

**Convention  
SALE Price:  
\$45**



## Beer Packaging

**A Manual for the Brewing and  
Beverage Industries**

Edited by Harold M. Broderick



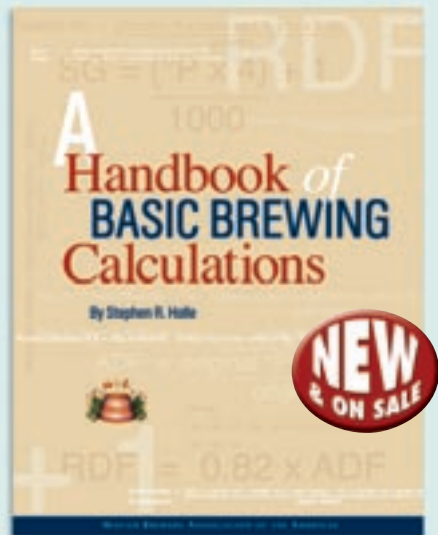
#1-8/03

www.mbaa.com • Toll-Free 1.800.328.7560





**SAVE BIG** when you buy at the MBAA Convention!



2003; 8 1/2" x 11" softcover; spiral binding;  
96 pages; ISBN: 0-9718255-0-5  
Item number: 25505

List Price: \$49

**Convention Sale Price: \$39**

### Learn to translate theory into practical applications in the brewhouse!

- Explore step-by-step calculations from malt through dispense for increased control over brewing variables and improved consistency
- Understand the science establishing each equation and its applicability to brewing to ensure correct variables are used in equations
- Learn each mathematical step in solving equations to thoroughly comprehend how solutions are reached



## A Handbook of Basic Brewing Calculations

By Stephen R. Holle

Foreword by Ray Klimovitz, Technical Director,  
Master Brewers Association of the Americas

*A Handbook of Basic Brewing Calculations* is a survey of authoritative textbooks that use quantitative methods to show the brewer how to translate the “what’s and why’s” of brewing science into practical brewing applications that result in more consistent and higher quality beer. Equations and procedures that would receive short treatment in other texts are thoroughly explained through numerous examples of practical brewing applications.

*A Handbook of Basic Brewing Calculations* clearly illustrates how to apply sound science in the brewhouse. A typical textbook might explain why it is important to have a certain level of calcium in the brewing water, a specific mash temperature, the correct yeast pitching rate, or a certain carbonation level, but may not explain how to achieve these results. This handbook shows the brewer how to determine what weight of gypsum will provide the desired ppm of calcium in the brewing water, what mash water temperature will achieve the desired mash temperature, what volume of yeast slurry will provide the desired yeast cell pitching rate, and what weight of priming will provide the desired carbonation level.

Peer-reviewed and endorsed by the Master Brewers Association of the Americas, *A Handbook of Brewing Calculations* is the rare combination of a scientifically accurate and practical reference written for sophisticated brewing professionals, educators, students, craft brewers, and home brewers.

### CHAPTER HEADINGS

Preface; Malt; Volume; Water Treatment; Mixing; Mashing; Wort Boiling; Hops; Yeast Pitching Rates; Carbonation; Draught Beer Dispense; Conversion Factors; Abbreviations and Metric Prefixes; Congress Mash; References

Order Online [www.mbaa.com](http://www.mbaa.com)

OR

Toll-Free **1.800.328.7560** in the U.S. and Canada

+1.651.454.7250 elsewhere

Fax **+1.651.454.0766**

#4COL-9/03

# Schedule

## Friday, October 3

2:00 – 4:30 p.m.	Registration	Regency Preconvene
2:00 p.m. – Midnight	Bierstube	Crystal and Milwaukee AB
6:30 – 8:00 p.m.	MBAA Microsoft Excel for Brewers Workshop Computer Set-up	Milwaukee

## Friday, October 3, and Saturday, October 4

8:00 a.m. – 5:00 p.m.	Basic Sanitation and Pest Control Workshop for the Brewing and Beverage Industries <i>(sponsored by MBAA, Siebel Institute of Technology, and the American Institute of Baking)</i>	Lakeshore Ballroom
-----------------------	---	--------------------

## Saturday, October 4

8:00 – 10:00 a.m.	Education Committee Meeting	Gilpatrick AB
8:00 – 11:00 a.m.	Technical Committee Meeting	Executive AB
8:00 a.m. – 6:00 p.m.	Registration	Regency Preconvene
8:30 a.m. – 4:30 p.m.	MBAA Microsoft Excel for Brewers Workshop	Milwaukee Room
9:00 – 10:30 a.m.	<i>Technical Quarterly</i> Editorial Committee Meeting	Executive Ballroom CD
10:00 a.m. – 4:30 p.m.	Executive Committee Meeting	Pere Marquette
3:00 p.m. – Midnight	Bierstube	Crystal and Milwaukee AB
6:00 – 11:00 p.m.	Pub Crawl	Offsite

## Sunday, October 5

8:00 a.m. – 6:00 p.m.	Registration	Regency Preconvene
9:00 a.m. – 4:00 p.m.	Board of Governors Meeting	Lakeshore Ballroom
11:00 a.m. – 7:00 p.m.	Bierstube	Crystal and Milwaukee AB
11:00 a.m. – 7:00 p.m.	Historical Exhibits	Milwaukee Foyer
1:00 – 5:00 p.m.	Maintenance: The Myths and Realities Workshop <i>(sponsored by MBAA and Siebel Institute of Technology)</i>	Regency CD
1:00 – 5:00 p.m.	MBAA Flavor Workshop	Regency AB
1:00 – 5:00 p.m.	Milwaukee Art Museum Optional Tour, <i>open to all attendees</i>	Offsite
2:00 – 5:00 p.m.	Poster Set Up	Executive Ballroom
2:00 – 5:00 p.m.	Speaker Ready Room	Pere Marquette
4:30 – 5:00 p.m.	First-Timers Orientation	Gilpatrick ABC
5:00 – 6:00 p.m.	District Officer Orientation	Gilpatrick ABC
6:00 – 7:00 p.m.	President's Night Reception	Atrium and Regency Preconvene
7:00 – 11:00 p.m.	President's Night Dinner <i>Entertainment by Wisconsin Saengerbezirk, Milwaukee Liedertafel</i>	Regency Ballroom

## Monday, October 6

7:00 – 7:45 a.m.	Speaker and Poster Presenters' Breakfast	Gilpatrick ABC
7:00 – 8:00 a.m.	Past Presidents Breakfast	Solomon Juneau
7:00 a.m. – 4:00 p.m.	Speaker Ready Room	Pere Marquette
7:30 – 7:45 a.m.	MBAA Interactive Demonstration	Regency Preconvene
8:00 – 11:00 a.m.	Spouse/Guest Breakfast and Presentation by Shops of Grand Avenue	Lakeshore Ballroom
8:00 a.m. – 5:00 p.m.	Technical Posters Available for Viewing Authors present 9:30 – 10:30 a.m.	Executive Ballroom
8:00 a.m. – 6:00 p.m.	Registration	Regency Preconvene
8:00 – 8:05 a.m.	Welcome and Announcements. Jerry Hilton, <i>S.S. Steiner, Inc., Butler, WI</i>	
	Opening of Technical Sessions. Mike Sutton, <i>Coors Brewing Company, Memphis, TN</i>	Regency AB
8:05 – 9:30 a.m.	<b>Technical Session I: New Crop Barley Quality Panel Discussion.</b> <b>Moderator:</b> Bill Ladish, <i>Cargill Malt, Brookfield, WI</i>	Regency AB
	Agricultural Problems with the 2002 Crop in the United States and Canada. <i>Steve Gorst, Canada Malting Co., Calgary, AB, Canada</i>	
	Dealing with the 2002 Crop in the Brewery. <i>Joe Hertrich, Anheuser-Busch, Inc., St. Louis, MO</i>	
	Dealing with the 2002 Crop in the Malthouse. <i>Paul Kramer, Rahr Malting Co., Shakopee, MN</i>	

	Outlook for the 2003 Crop in Canada. <i>Jim Ringo, Cargill Malt, Wayzata, MN</i>	
	Outlook for the 2003 Crop in the Midwest. <i>Scott Heisel, American Malting Barley Association, Inc., Milwaukee, WI</i>	
	Outlook for the 2003 Crop in the Western United States. <i>Alain Caekaert, Froedtert Malt, Milwaukee, WI</i>	
9:30 – 10:30 a.m.	<b>Authors at Posters</b>	
	<b>Co-Moderators:</b> Gil Sanchez, <i>Milwaukee, WI</i> and John Harris, <i>Full Sail Brewing Company, Portland, OR</i>	Executive Ballroom
9:30 – 10:30 a.m.	Supplier Poster Session Set Up	Regency CD
9:30 a.m. – 10:00 p.m.	Bierstube	Crystal and Milwaukee AB
9:30 a.m. – 10:00 p.m.	Historical Exhibits	Milwaukee Foyer
10:00 – 10:15 a.m.	MBAA Interactive Demonstration	Regency Preconvene
10:30 – 11:45 a.m.	<b>Technical Session II: Raw Materials.</b>	
	<b>Moderator:</b> Bill Ladish, <i>Cargill Malt, Brookfield, WI</i>	Regency A
10:30 a.m.	II-01 Charting the Synergistic Effect of Alpha- and Beta-Amylase on Starch. <i>Michael Lewis, University of California, Davis</i>	
10:55 a.m.	II-02 The Interaction Between Brewing Conditions and Malt Protein Quality and Their Impact on Beer Colloidal Stability. <i>Louise Robinson, University of Adelaide, Glen Osmond, SA, Australia</i>	
11:20 a.m.	II-03 The Influence of Malt Acrospires on Beer Taste and Foam Quality. <i>Nobuo Tada, Institute for Liquor Products, Suntory Ltd., Mishima-gun, Osaka, Japan</i>	
10:30 – 11:45 a.m.	<b>Technical Session III: Beer and Health.</b>	
	<b>Moderator:</b> Rick Brundage, <i>Nalco Chemical Co., Moon Township, PA</i>	Regency B
10:30 a.m.	III-04 Development of New Beers and Happou-Shu for Health-Conscious Consumers. <i>Shunichi Fujino, Kirin Brewery Co., Yokohama, Kanagawa, Japan</i>	
10:55 a.m.	III-05 Isolation from Beer of Potent Stimulants of Gastrointestinal Motility. <i>Katsu Kondo, Suntory Limited, Fuchu City, Tokyo, Japan</i>	
11:20 a.m.	III-06 Responsible Drinking by Adults. <i>John Kaestner, Anheuser-Busch, St. Louis, MO</i>	
11:15 a.m.	Spouses/Guests Board Buses for Edelweiss Boat	East Entrance of the Hyatt
11:30 a.m. – 3:00 p.m.	Spouse/Guest Lunch and Harbor Tour Aboard the Edelweiss Boat	
11:45 a.m. – 1:15 p.m.	Supplier Poster Session and Buffet Lunch	Regency CD
12:45 – 1:00 p.m.	MBAA Interactive Demonstration	Regency Preconvene
1:15 – 2:55 p.m.	<b>Technical Session IV: Wort Production.</b>	
	<b>Moderator:</b> Fred Havel, <i>Molson Breweries, Richelieu, PQ, Canada</i>	Regency A
1:15 p.m.	IV-07 Wort Clarity: Effects on Fermentation. <i>Graham Stewart, Heriot-Watt University, Edinburgh, Scotland</i>	
1:40 p.m.	IV-08 Improvements on Brewhouse Efficiency—First Results from a Lauter Tun Modification. <i>Thomas Buehler, Heinrich Huppmann GmbH, Kitzingen, Bavaria, Germany</i>	
2:05 p.m.	IV-09 A Review of Progress in Mash Separation Technology. <i>John Andrews, Briggs of Burton plc, Burton-on-Trent, Staffordshire, U.K.</i>	
2:30 p.m.	IV-10 Ziemann Vacuum Evaporation Plant: Wort Boiling System for Improvement of the Wort Quality and Simultaneous Energy Saving. <i>Joachim Gunkel, A. Ziemann GmbH, Ludwigsburg, Germany</i>	



1:15 – 2:55 p.m.	<b>Technical Session V: Packaging.</b> <b>Moderator:</b> Kátia Jorge, <i>Brewtech Servicos Ltda., Rio de Janeiro, Brazil</i>	Regency B
1:15 p.m.	V-11 Hygienic Design, Installation, and Maintenance in Draft Beer Dispense. <i>Jaime Jurado, The Gambrinus Company, San Antonio, TX</i>	
1:40 p.m.	V-12 How RevTech Helped Labatt Create New Decorating Technology for the Industry Standard Beer Bottle. <i>Anthony Georges, RevTech Inc., Edison, NJ</i>	
2:05 p.m.	V-13 Basic Requirements for Good Decision-Making. <i>Felix Seitz, International Food &amp; Beverages Services Ltd., Auckland, New Zealand</i>	
2:30 p.m.	V-14 Package Quality/Pasteurizer Conditions: Avoiding Staining, Spotting, and Rusting. <i>Thomas Soukup, ChemTreat, Inc., Glen Allen, VA</i>	
2:55 – 3:10 p.m.	Break	Regency Preconvene
3:15 – 3:30 p.m.	MBAA Interactive Demonstration	Regency Preconvene
3:30 – 5:15 p.m.	New and Exciting Industry Developments...presentations by our suppliers. (See listing on page 53). Beer will be served and prize drawings will be held. <b>Moderator:</b> Rick Brundage, <i>Nalco Chemical Co., Moon Township, PA</i>	Regency AB
3:30 – 4:40 p.m.	Spouse/Guest Coffee, Tea, and Dessert	Polaris Revolving Restaurant, top of the Hyatt Check onsite signs for location
5:30 – 6:30 p.m. Dinner Hour Open	Women in Brewing Networking Session Suppliers' dinners, hospitality rooms or restaurants of your choice.	
7:00 – 10:00 p.m. 9:00 p.m. – Midnight	Briess Malting Company's Reception, open to all Froedert Malt Irish Coffee Reception	Milwaukee Ale House Lakeshore Ballroom
<b>Tuesday, October 7</b>		
7:00 – 7:45 a.m.	Presenters' Breakfast	Gilpatrick ABC
7:00 a.m. – 4:00 p.m.	Speaker Ready Room	Pere Marquette
7:30 – 9:15 a.m.	Spouse/Guest Breakfast and Guest Speaker: Milwaukee Historian John Gurda	Lakeshore Ballroom
8:00 – 9:15 a.m.	<b>Technical Session VI: Beer Filtration.</b> <b>Moderator:</b> Richard Sharpe, <i>Brewing Research International, Surrey, UK</i>	Regency A
8:00 a.m.	VI-15 SWS Process for DE Replacement. <i>Joseph Snyder, Pall Corporation, Northborough, MA</i>	
8:25 a.m.	VI-16 The Effect of Microporous Membrane Filtration on Beer Foam Stability. <i>Peter Riddell, domnick hunter limited, Birtley, County Durham, England</i>	
8:50 a.m.	VI-17 Back to Basics—Pre-Coat Filtration with Diatomite. <i>Niels Mastrup, World Minerals Inc., Lompoc, CA</i>	
8:00 – 9:15 a.m.	<b>Technical Session VII: Test Methods and Sanitation.</b> <b>Moderator:</b> J. Antolin Sierre-Benavides, <i>Cerveceria Cuahtemoc Moctezuma, Monterrey, Mexico</i>	Regency B
8:00 a.m.	VII-18 New Development for Measuring Hydrogen Sulfide in Brewing. <i>Seung Park, Kyung Hee University, Yongin-Si, South Korea</i>	
8:25 a.m.	VII-19 VIT-Bier—The Rapid and Easy Detection Method for Beer-Spoiling Bacteria. <i>Jiri Snaidr, vermicon AG, Munich, Germany</i>	
8:50 a.m.	VII-20 Acid Cleaning: Your Future to Greater Savings, Higher Productivity, Increased Safety, and a Better Environment. <i>Mauricio Colosía, Eurochem International Corp., Atlanta, GA</i>	
8:00 a.m. – 5:00 p.m.	Posters Available for Viewing Authors Present 11:15 a.m. – 12:15 p.m.	Executive Ballroom
8:00 a.m. – 6:00 p.m.	Registration	Regency Preconvene
9:15 – 9:45 a.m.	Break	Regency Preconvene
9:30 a.m.	Spouses/Guests Board Buses for Tour of Milwaukee, includes tour of <i>Pabst Mansion</i>	
9:30 a.m. – 6:00 p.m.	Bierstube	Crystal and Milwaukee AB

9:30 a.m. – 6:00 p.m.	Historical Exhibits	Milwaukee Foyer
9:45 – 11:00 a.m.	<b>Technical Session VIII: Yeast and Fermentation.</b> <b>Moderator:</b> Luigi Mengoli, <i>Heineken International B. V., France</i>	Regency A
9:45 a.m.	VIII-21 Analysis of Foam Behavior During Fermentation in a Cylindroconical Tank. <i>Tatsufumi Kakui, Suntory Limited, Chiyoda-machi, Ohra-gun, Gunma, Japan</i>	
10:10 a.m.	VIII-22 Evaluation of Oxygen Requirement of Bottom and Lager Yeast Strains by Preoxygenation. <i>Sofie Depraetere, Katholieke Universiteit, Leuven, Belgium</i>	
10:35 a.m.	VIII-23 Brewers Yeast Management, Benchmark of Propagation Processes, and Beer Quality Best-Practice Bitburger Brauerei. <i>Christian Abel, Heinrich Frings GmbH &amp; Co. KG, Bonn, Germany</i>	
9:45 – 11:00 a.m.	<b>Technical Session IX: Craft Brewing.</b> <b>Moderator:</b> George Reisch, <i>Anheuser-Busch, Inc., St. Louis, MO</i>	Regency B
9:45 a.m.	IX-24 Beer Styles—Origins and Classifications. <i>Charlie Papazian, Association of Brewers, Boulder, CO</i>	
10:10 a.m.	IX-25 Back-to-Basics Yeast Management for Micro and Pub Brewers. <i>Hugh Burns, Williamsburg Brewing Co., Williamsburg, VA</i>	
10:35 a.m.	IX-26 The Effect of Wheat Malting on the Colloidal Haze of White Beers. <i>Filip Delvaux, Katholieke Universiteit, Leuven, Belgium</i>	
11:15 a.m. – 12:15 p.m.	<b>Authors at Posters.</b> <b>Co-Moderators:</b> Gil Sanchez, <i>Milwaukee, WI</i> and John Harris, <i>Full Sail Brewing Company, Portland, OR</i>	Executive Ballroom
12:00 – 1:30 p.m.	Supplier Poster Session and Buffet Lunch	Regency CD
12:45 – 2:15 p.m.	Spouse/Guest Lunch at Milwaukee Ale House	Offsite

1:30 – 2:45 p.m.	<b>Technical Session X: Flavor Stability.</b> <b>Moderator:</b> Barry Axcell, <i>South African Breweries, Sandton, Republic of South Africa</i>	Regency AB
1:30 p.m.	X-27 A Critical Control Point Analysis for Flavor Stability of Beer. <i>Charles Bamforth, University of California, Davis</i>	
1:55 p.m.	X-28 The Influence of Weak Wort for the Quality of Beer. <i>Klaus Wasmuht, Anton Steinecker, Freising, Germany</i>	
2:20 p.m.	X-29 Performance of the “Anaerobic” Mashing Process of Suntory for Improvement of Beer Flavor Stability. <i>Shingo Kawasaki, Suntory Ltd., Nagaokakyo, Kyoto, Japan</i>	
2:15 – 4:30 p.m.	Spouse/Guest Tour of Milwaukee continues, <i>includes tour of Basilica of St. Josaphat</i>	Offsite
2:30 – 4:00 p.m.	Supplier Session Poster Take Down	Regency CD
2:45 – 3:15 p.m.	Break	Regency Preconvene
3:15 – 4:05 p.m.	<b>Technical Session XI: Yeast Genetics.</b> <b>Moderator:</b> Mike Sutton, <i>Coors Brewing Co., Memphis, TN</i>	Regency AB
3:15 p.m.	XI-30 Cone Yeast Heterogeneity and Serial Repitching. <i>Katherine Smart, Oxford Brookes University, Oxford, U.K.</i>	
3:40 p.m.	XI-31 Enzymatic Generation of Factors from Malt Responsible for Premature Yeast Flocculation. <i>Sandra Van Nierop, The South African Breweries Ltd., Sandton, South Africa</i>	
3:55 p.m.	Questions and Answers	
4:05 – 4:30 p.m.	<b>Technical Session XII: Award of Merit Lecture.</b> Chemical Engineering for Quality Brewing <i>Nick Huige, Miller Brewing Company, Milwaukee, WI</i>	Regency AB
4:30 p.m.	Spouse/Guest Buses Return to Hyatt	Hyatt Lobby
6:00 – 7:00 p.m.	Social	Atrium and Regency Preconvene
7:00 p.m. – Midnight	Installation of Officers and Awards Night Dinner. <i>Entertainment by Airmen of Swing Dance Band</i>	Regency Ballroom
<b>Wednesday, October 8</b>		
10:00 a.m. - 1:00 p.m.	Sprecher Brewing Co. Open House, Tours and Hospitality	Sprecher Brewing Co. 701 W. Glendale Avenue

**The Sprecher Brewing Company invites all attendees to an open house with tours, snacks and their craft-brewed beers and sodas.**

From downtown Milwaukee, take I-43 north to Hampton Avenue East exit (77A). At the end of the ramp, turn right, go south to the traffic lights at Glendale, turn right. Go under the freeway and you will be at the brewery, 701 W. Glendale Avenue.



## Bring the Meeting Home with You!

### 2003 MBAA Convention Proceedings on CD-Rom

- Easy to Use
- Full Color Graphics
- Includes Abstracts, Author Bios, Posters, and Technical Session Presentations

#### Personal Use Version

**Only \$40** (\$65 plus S&H after the meeting)  
When you purchase during the Convention at the MBAA Registration Desk

**Multiple-User Version \$150**



#6PART-9/03

MASTER BREWERS ASSOCIATION OF THE AMERICAS





# Poster Program

Posters are on display in the Executive Ballroom during the following hours:

**Monday, October 6** 8:00 a.m. – 5:00 p.m.; authors present 9:30 – 10:30 a.m.

**Tuesday, October 7** 8:00 a.m. – 5:00 p.m.; authors present 11:15 a.m. – 12:15 p.m.

- P-1** Benefits from the Use of Chlorine Dioxide as an Alternate to Hot Water Sanitation. George Agius, *JohnsonDiversey Inc., Oakville, ON, Canada*
- P-2** Investigation of Material Characteristics and Influence on Sterile Beer Filtration. John Brantley, *Pall Corporation, Cortland, NY*
- P-3** Using In-Line Concentration Measurement to Reduce Variability. Wayne R. Brinkman, *Micro Motion, Inc., Boulder, CO*
- P-4** A Comparison of Monitoring Yeast Fermentations by RF Impedance with Traditional Methods of Biomass Estimation. John Carvell, *Aber Instruments Ltd., Science Park, Aberystwyth, U.K.*
- P-5** Servomyces—A Biological Nutrient. Tobias Fischborn, *Lallemand Inc., Montreal, QC, Canada*
- P-6** Incorporating Hygienic Matrix Manifolds into Older Brewery Systems. Edward Hall, *Coors Brewing Co. (retired), Golden, CO*
- P-7** The Effect of a Simulated Kilning Regime on the Profile and Antioxidant Activity of the Free Phenolics Extracted from Green Malt. Elizabeth Inns, *University of Reading, Whiteknights, Reading, U.K.*
- P-8** Production of Hydrogen Sulfide by Six Lager and Ale Yeast Strains. Ji-Yoon Kim, *Kyung Hee University, Yongin-Si, South Korea*
- P-9** The Importance of Free Amino Nitrogen in Wort and Beer. Christoforos Lekkas, *Heriot-Watt University, Riccarton, Edinburgh, U.K.*
- P-10** Fine Grinding in Water and Proteolysis. Laurent Marle, *Meura Technologies, Louvain-la-Neuve, Belgium*
- P-11** Control of Hydrogen Sulfide in Beer with a Copper Electrolysis System. Egbert Pfisterer, *First Key Corp., Richmond, BC, Canada*
- P-12** Life Cycle Assessment for a Beer Production Process. Yuji Takamoto, *Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan*
- P-13** Control of Malt Color. Curt Traina, *University of California, Davis*
- P-14** The Impact of Fermentation Temperature on Yeast Reductase Activity. Lance Lusk, *Miller Brewing Company, Milwaukee, WI*
- P-15** † Evaluation of the Addition of Gallotannins to the Brewing Liquor for the Improvement of the Flavor Stability of Beer. David Logsdon, *Wyeast Laboratories, Odell, OR*
- P-16** Lucilite TR—Structure and Performance. M. J. Thompson, *International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland*
- P-17** † Influence of Wort Boiling and Wort Clarification Conditions on Cardboard Flavor in Beer. Masaaki Yano, *Kirin Brewery Co. Ltd., Research Laboratory for Brewing, Yokohama, Japan*
- P-18** † Variability in the Malt Performance of the New Hull-less Barley Lines. Katerina Vaculova, *Agricultural Research Institute Kromeriz, Ltd., Kromeriz, Czech Republic*
- P-19** † Controlling the Level of Hydrogen Sulfide Production in Lager Brewing Yeast by the Introduction of Heterologous Enzymatic Pathways for Cysteine Biosynthesis. Britt Bramsted, *Carlsberg Research Laboratory, Copenhagen/Valby, Denmark*
- P-20** † The Influence of Isomerized Pellets on Beer Quality. Martin Ketterer, *Hopfenveredlung St. Johann GmbH & Co. KG, St. Johann/Hallertau, Germany*
- P-21** † The Physical Mechanism Responsible for the Destabilization of Beer Foam by Fatty Acids. Peter J. Wilde, *Institute of Food Research - Food Materials and Science Division, Norwich Research Park, Norwich, U.K.*

† Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.

# Abstracts

## Technical Session I – New Crop Barley Quality Panel Discussion

Monday, October 6 • 8:05 – 9:30 a.m. • Regency AB

**Moderator:** Bill Ladish, *Cargill Malt, Brookfield, WI*

*Bill Ladish received a bachelors degree in chemical engineering from the University of Wisconsin at Madison in 1972 and an M.B.A. degree from the Stanford University Graduate School of Business in 1974. Subsequently, he has held several management and technical positions with Ladish Malting Co. and its successor, Cargill Malt. Bill is currently an account executive for the Specialty Products Group.*

### Panelists:

#### **Agricultural Problems with the 2002 Crop in the United States and Canada**

Steve Gorst, *Canada Malting Co., Calgary, AB, Canada*

*Biography not available.*

#### **Dealing with the 2002 Crop in the Brewery**

Joe Hertrich, *Anheuser-Busch, Inc., St. Louis, MO*

*Joseph D. Hertrich is currently senior director, brewing raw materials in the Corporate Brewing Group for Anheuser-Busch, Inc., St. Louis, MO. His responsibilities include the development of all raw material selection criteria, raw material processing procedures and specifications, finished raw material specifications, and the supervision and inspection of facilities that produce and handle brewing raw materials that are used for the brewing of Anheuser-Busch products worldwide. Prior to joining Anheuser-Busch, Joe held various corporate and plant positions in brewing and malting with The Stroh Brewery Company, the Pabst Brewing Company, and the Christian Schmidt Brewing Company. He holds a B.Sc. degree in commerce and engineering from Drexel University in Philadelphia. He has attended brewing courses at the U.S. Brewers Academy, the Wallerstein Seminar, and the Center for Brewing Studies. Joe is an active member of both MBAA and ASBC. He has authored and coauthored technical papers on brewing processing, has been a guest lecturer at the U.S. Brewers Academy Executive Course, has been a visiting instructor at Michigan State University, and is a regular instructor at various MBAA educational courses. He has served as the MBAA international president during 1993–1994. He is a past member of the American Malting Barley Association Technical Committee and the MBAA National Technical Committee. He has also served as a member of the American Malting Barley Association Board of Directors and as a member of the Hop Research Council.*

#### **Dealing with the 2002 Crop in the Malthouse**

Paul Kramer, *Rahr Malting Co., Shakopee, MN*

*Paul Kramer is vice president of malt operations at Rahr Malting Co. Paul has been an employee of Rahr Malting Co. since 1979. He has held a variety of positions there including process engineering, assistant plant manager, and director of malt operations. He was the project manager responsible for the design and construction of Rahr Malting Co.'s tower malt production facility built in 1994 and he was part of the design team responsible for malting facility in Alberta Canada. Prior to joining Rahr Malting Co., Paul worked as a research specialist at the University of Minnesota. Paul has a B.S. degree in food science and technology from the University of Minnesota.*

#### **Outlook for the 2003 Crop in Canada**

Jim Ringo, *Cargill Malt, Wayzata, MN*

*Jim Ringo was named commercial manager of Cargill's Malt Americas business in December 1999. He is responsible for sales and marketing of malt and purchasing of malting barley. Jim joined Cargill in 1989 as a commodity merchant for North American Corn Milling in Dayton, OH. He was named Illinois rail merchant for the Cargill Grain Division in 1992, and in 1994, he was named merchandising manager at Blair, NE. He moved to Minneapolis, MN, in 1996, as a customer risk merchant, and in 1998, he was named business analyst for strategy and business development. Jim graduated from Washington State University in 1989 with a B.S. degree in agricultural economics. He resides in Wayzata, MN, with his wife, Stefanie, and sons Nathan and Alexander.*

#### **Outlook for the 2003 Crop in the Midwest**

Scott Heisel, *American Malting Barley Association, Inc., Milwaukee, WI*

*Scott E. Heisel is the vice president and technical director of the American Malting Barley Association, Inc., Milwaukee, WI. He received a B.S. degree in biochemistry and a B.S. degree in agronomy from the University of Wisconsin, Madison, in 1982. In 1986, Scott received his M.S. degree in agronomy. He worked for several years at the USDA-ARS Barley and Malt Laboratory and has published several papers on characterizing various enzymes of germinated barley and the use of biochemical techniques to identify barley varieties. Scott joined AMBA in April of 1987. He is a member of ASBC, MBAA, and the American Association of Cereal Chemists.*

#### **Outlook for the 2003 Crop in the Western United States**

Alain Caekaert, *Froedtert Malt, Milwaukee, WI*

*Alain Caekaert received his Master's degree in agronomy in 1988. He spent his military period (1988–1990) in Africa (Gabon) for a French company. From 1990 to 1993, he was an ingredient purchaser for Ralston-Purina France. From 1993 to 2002, he was director of barley procurement for IMC France (Grandes Malteries Modernes). From 1995 to 2002, he was a member of different technical committees of the French Malting, Brewing, and Breeding Association, recommending new varieties' registration. From 1996 to 2002, he was a referee for the Paris Grain Arbitration Chamber. From 2002 to the present, Alain has been director of barley procurement and logistic for Froedtert Malt-USA and Dominion Malting-Canada. Alain lives in Mequon, WI, with his wife and three children*

## Technical Session II – Raw Materials

Monday, October 6 • 10:30 – 11:45 a.m. • Regency

**Moderator:** Bill Ladish, *Cargill Malt, Brookfield, WI*

*Bill Ladish received a bachelors degree in chemical engineering from the University of Wisconsin at Madison in 1972 and an M.B.A. degree from the Stanford University Graduate School of Business in 1974. Subsequently, he has held several management and technical positions with Ladish Malting Co. and its successor, Cargill Malt. Bill is currently an account executive for the Specialty Products Group.*

### II-01

#### **Charting the Synergistic Effect of Alpha- and Beta-Amylase on Starch**

**10:30 a.m.**

Michael Lewis, *University of California, Davis*

The action of malt alpha-amylase and barley beta-amylase on Lintner starch, amylopectin, and amylose in model systems and on malt starch in practical mashes was monitored using reverse-phase high-performance liquid chromatography. Reducing the molecular weight of amylose by alpha-amylase action before beta-amylase activity markedly reduced the fermentability of the wort so produced, but this effect was less obvious with amylopectin or starch itself as a substrate. In all cases, however, pre-treatment of a starchy substrate with alpha-amylase before beta-amylase markedly increased the proportion of maltotriose in the fermentable sugar fraction. Beta-amylase hydrolyzed larger dextrans before attacking smaller ones. In general, factors that favored beta-amylase action in the presence of alpha-amylase resulted in lower yields of maltotriose and higher yields of maltose, as well as an overall increase in fermentability. In contrast, factors favoring alpha-amylase action yielded lower fermentability and the fermentable sugars were dominated by maltotriose. In practical mashes, extending low-temperature holds resulted in more total fermentable sugar, especially maltose, not so much by promoting beta-amylase activity but by minimizing alpha-amylase action.

*Professor Michael J. Lewis, professor emeritus of brewing science at the University of California at Davis, has been responsible for education, research, and public service at the University since 1962. Lewis has been honored with the Award of Merit of the Master Brewers Association of the Americas and has been elected as a fellow of the Institute of Brewing and a senior member of the International Brewers Guild.*

### II-02

#### **The Interaction Between Brewing Conditions and Malt Protein Quality and Their Impact on Beer Colloidal Stability**

**10:55 a.m.**

Louise Robinson, *University of Adelaide, Glen Osmond, SA, Australia*

Coauthors: A. Vilpola, S. Pöyri, E. Evans, and S. Home

In bright beers, the formation of permanent haze is a serious quality problem, which places limitations on the storage life of the product. From silica gel, used for the colloidal stabilization of beer, a silica eluent (SE) protein fraction was isolated and an antibody raised against this fraction. SDS-PAGE immunoblot analysis using the SE antiserum has detected a range of protein bands in barley, malt, beer, and haze. Interestingly, a polymorphism was observed in some barley varieties which contained an ~12-kDa band (SE +ve), while in other varieties, this band was absent (SE -ve). Pilot brewing trials have found that beer brewed from SE -ve varieties formed less haze in haze force testing trials than beer produced from SE +ve varieties. The interaction between the presence/absence of the SE protein and controlled atmosphere brewing by brewing under nitrogen or air was also investigated. Combined, these investigations are discussed in terms of brewers' options for extending the colloidal stability of their beer without the inclusion of "chemical" additives.

*Louise Robinson graduated from Deakin University in 2000 with a Bachelor of Science degree (Hons) in plant pathology. Louise is currently completing a Ph.D. degree at the University of Adelaide in collaboration with Lion Nathan Australia and Joe White Maltings Ltd. The project is looking into the influence of malt quality on the colloidal stability of beer. Recently, Louise completed 4 months of the project with Dr. Silja Home's group at VTT Biotechnology (Finland), and currently, Louise is undertaking a 3-month internship with the Miller Brewing Company.*

## II-03

### The Influence of Malt Acrospires on Beer Taste and Foam Quality

11:20 a.m.

Nobuo Tada, *Institute for Liquor Products, Suntory Ltd., Mishima-gun, Osaka, Japan*

Coauthors: Takako Inui, Norihiko Kageyama, Seisuke Takaoka, and Yasutsugu Kawasaki

In the past, it has been reported that acrospires of malt have an unfavorable influence on beer flavor stability. However, there are few reports which mentioned an influence on total quality of beer. We evaluated the influence on the total quality of beer by separating the acrospires from the malt. The results showed that they had an unfavorable influence on the beer taste, especially aftertaste quality, and on the foam quality and the flavor stability. Also, the results showed that the ingredient which deteriorates, causing an aftertaste, was specifically more abundant in the acrospires. The foam quality was aggravated by adding acrospires as a raw material. The reason was that they were considered to increase the basic amino acid level in beer. From these results, it was suggested that removing acrospires from malt before the mashing process led to improvement in beer quality and reduction of aftertaste.

*Nobuo Tada is a researcher in the Institute for Liquor Products of Suntory Ltd. The main subject of his work is development of wort production. He majored in agricultural chemistry at the University of Tokyo and was engaged in the study of chloroplast DNA. He graduated from the university with master's degree and joined Suntory Ltd. in 1998. He is now studying the influence of raw materials on the beer taste, foam quality, and flavor stability.*

## Technical Session III – Beer and Health

Monday, October 6 • 10:30 – 11:45 a.m. • Regency B

**Moderator:** Rick Brundage, *Nalco Chemical Co., Moon Township, PA*

*Rick Brundage received his B.S. degree in chemical engineering in 1981 from Bucknell University in Lewisburg, PA. After a brief period in a steel mill, Rick began his water treatment career with Nalco 20 years ago. With Nalco, he has been in sales, marketing, and consulting. For the past 15 years, Rick has spent his time exclusively with water treatment in the food and beverage industry, with his major efforts being in the brewing industry. Rick is currently a food and beverage industry technical consultant for Nalco and travels worldwide to work with Ondeo Nalco representatives in breweries. Rick joined the MBAA in 1990. He has served in several district positions in Districts Milwaukee and Philadelphia and is currently the BOG Rep for District Philadelphia and is on the MBAA Technical Committee.*

### III-04

#### Development of New Beers and Happou-Shu for Health-Conscious Consumers

10:30 a.m.

Shunichi Fujino, *Kirin Brewery Co., Yokohama, Kanagawa, Japan*

Coauthor: M. Ohkochi

In recent years, the Japanese consumers have paid attention to health and, as a result, the level of interest related with the nutritional quality of food items is growing. Under such circumstances, we have investigated and presented the preventive effects of dietary beer on lifestyle-related diseases (International Congress of the European Brewery Convention, 2003).

Furthermore, the results of consumer surveys have shown that, from the standpoint of nutrition, consumers demand low-calorie beers and happou-shu. Consequently, we developed a new product having 70% less carbohydrates than that of the conventional products last year. At the same time, the fact that consumers demand beers and happou-shu with reduced purine contents and the fact that there are about ten million people with hyperuricemia and about six hundred thousand people with gout in Japan was also indicated. Then, we have developed a new technique to eliminate purines specifically from beers and happou-shu. It enables us to remove more than 90% of purines by an adsorption method without markedly affecting the flavor (patent pending). The changes in the level of plasma uric acid after drinking low-purine happou-shu and consumers' response after launch are discussed.

*Editor's note: Beer sold in Japan is taxed on the amount of malt it contains. Happou-shu, which has a lower malt content than regular beer, was created so that the brewers could avoid the higher tax rate of regular beer and, thus, sell it more cheaply.*

*Shunichi Fujino received an M.S. degree in agricultural chemistry from Kyoto University in 1970 and then joined Kirin Brewery Company. During the first 23 years, he was engaged in the development of the utilization of brewery by-products and the development of new soft drinks in the R&D sections. He received a Ph.D. degree in microbiology from Tokyo University in 1990. From 1993, he was in charge of quality assurance and then packaging at a brewery as a manager. Since 2000, he has developed a beer foam quality and a new beer product in the Research Laboratory for Brewing.*

### III-05

#### Isolation from Beer of Potent Stimulants of Gastrointestinal Motility

10:55 a.m.

Katsu Kondo, *Suntory Limited, Fuchu City, Tokyo, Japan*

Coauthors: Y. Yokoo, W. Fujii, H. Hori, K. Nagao, Y. Suwa, K. Taniyama, K. Tsuji, and H. Nukaya

People have a habit of drinking before and during a meal. Recent work has revealed that beer is the most powerful of the alcoholic beverages in stimulating gastric emptying and gastrointestinal transit in humans. Our earlier work has shown that beer congener stimulates gastrointestinal motility via the muscarinic M3 receptor. In this work, we isolated two active compounds from beer by using the muscarinic M3 receptor binding assay. Active fraction including these two compounds induced the contraction of the longitudinal muscle from guinea pig ileum in a dose-dependent manner and significantly enhanced gastric emptying in mice. For further investigation of these two compounds, the effects of an addition of an active fraction to beer on drinking, urination, and consumption of dishes were studied in humans. Although volume of drinking was not altered, urination and consumption of dishes were significantly increased. These results showed that these two isolated compounds were potent stimulants of gastrointestinal motility in beer.

*Katsu Kondo is a researcher at the Institute for Liquor Products of Suntory Ltd. He majored in neuroscience at Osaka University and engaged in the study of olfactory signal transduction. He graduated from the university with a master's degree and joined Suntory Ltd. in 2001. He is now engaged in development of new products of beer and happou-shu.*

### III-06

#### Responsible Drinking by Adults

11:20 a.m.

John Kaestner, *Anheuser-Busch, St. Louis, MO*

Anheuser-Busch and its team of distributors have invested more than \$400 million over the past 2 decades developing and implementing more than two dozen community-based programs and national advertising campaigns to fight alcohol abuse and promote responsible drinking by adults who choose to drink. Kaestner's presentation will review (i) his company's philosophy, approach, policies, and programs regarding alcohol abuse; (ii) the signs of significant progress over the last 2 decades; and (iii) current issues in the area of alcohol abuse, especially regarding efforts to restrict the marketing and distribution of alcohol beverages.

*As vice-president of consumer affairs for Anheuser-Busch Companies, Inc., John T. Kaestner is responsible for directing the company's alcohol awareness and education initiatives, especially the implementation of programs that promote personal responsibility among adults who choose to drink, fight abusive drinking and drunk driving, and help prevent underage drinking. In addition, he oversees the company's communications on government affairs and environmental and legal issues and he serves as the company's spokesperson on these issues with news media, government and health agencies, community groups, and international brewers and industry associations. Mr. Kaestner began his career with Anheuser-Busch in 1978 and has held a variety of positions in its beer marketing division, which included overseeing the company's distributor management development department and serving as a staff assistant to the executive vice-president of marketing. Prior to joining Anheuser-Busch, he was an educator in suburban St. Louis. Mr. Kaestner is active with a number of business, mental health, and educational organizations across the country. He serves on the board of directors of the BACCHUS/GAMMA Peer Education Network (since 1999–current) based in Denver, CO; the Eastern Missouri and Southern Illinois Chapter of the Better Business Bureau (2001–current); the National Academic League (1997–current) in Salt Lake City; and The Family and Relationship Center (1997–current) in La Jolla, CA. He is also a member of the National Business Advisory Board for the American School Counselor Association (1995–current) and serves on the CHARACTERplus Planning and Advisory Committee (1995–current) in St. Louis. He is listed in Who's Who in the World, the U.S., and the Midwest. A native of St. Louis, Mr. Kaestner holds a B.A. degree in elementary education from Harris Teachers' College and an M.A. degree in education from St. Louis University. In 1997, Harris honored him as a distinguished alumni. Mr. Kaestner and his wife JoAnn reside in St. Louis County and have three daughters and two sons.*

### Technical Session IV – Wort Production

Monday, October 6 • 1:15 – 2:55 p.m. • Regency A

**Moderator:** Fred Havel, *Molson Breweries, Richelieu, PQ, Canada*

*Fred Havel is development brewer at Molson's Global Quality and Innovation Department. He received an Hons. B.Sc.Agr. from Guelph in 1981 and has been working in the brewing industry throughout the northern hemisphere since 1983. Fred has held positions at Canada Malting, Carling O'Keefe, Molson, SUN Brewing, Carlsberg, and Unibroue and has worked for himself as a consultant. He returned to Molson in 2001 and works out of Montreal, Quebec.*

#### IV-07

##### Wort Clarity: Effects on Fermentation

1:15 p.m.

Graham Stewart, *Heriot-Watt University, Edinburgh, Scotland*

Coauthor: Stephen A. Martin

The positives and negatives of wort clarity have been the subject of considerable debate. Wort solids have been shown to confer nutritive value during fermentation in both the brewing and Scotch whisky industries. The rate of fermentation is faster in the presence of solid material. The presence of insoluble material in wort is associated with higher levels of lipid material, particularly unsaturated fatty acids (UFA) and sterols. Both of these materials are essential membrane components of industrial yeast strains and can only be synthesized in the presence of oxygen, but they can be obtained from the surrounding medium. In addition, in the presence of wort solid material, carbon dioxide removal can be enhanced because the insoluble material acts as a nucleator. Also, yeast cells can attach themselves to solid particles and can display enhanced growth patterns by being maintained more effectively in suspension. However, wort solids can impede beer filtration and cause flavor (particularly stability) problems. The influence of all these factors, in brewing and distilling, will be considered on fermented wort quality.

*Graham Stewart is the director and professor of the International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland. He received his B.Sc. degree (Hons) in microbiology and biochemistry from the University of Wales at Cardiff and his Ph.D. and D.Sc. degrees from Bath University. He was a lecturer in biochemistry in the School of Pharmacy at Portsmouth College of Technology (now Portsmouth University) from 1967 to 1969. From 1969 to 1994, he held a number of technical positions with Labatt's in Canada and, from 1986 to 1994, was director of brewing technical affairs for John Labatt Ltd. He became a member of the Institute of Brewing (now the Institute and Guild of Brewing) in 1969, was elected a fellow in 1987, and was the Institute's president in 1999 and 2000. He is also a member of the MBAA, the ASBC, and the Institute of Brewing Studies. He was the ASBC's international director from 2000 to 2002. He holds fellowships in the Institute of Biology and the American Academy of Microbiology. He is a 1983 and 1998 recipient of the MBAA Presidential Award. In addition to coauthoring and editing a number of books, he has published over 200 original papers, patents, and reviews.*

#### IV-08

##### Improvements on Brewhouse Efficiency—First Results from a Lauter Tun Modification

1:40 p.m.

Thomas Buehler, *Heinrich Huppmann GmbH, Kitzingen, Bavaria, Germany*

Coauthor: Bernhard Vollhals

Extract loss is one of the key figures when comparing different designs of brewhouses. In literature and in various acceptance tests of brewhouse equipment, a significant difference in brewhouse efficiency is reported when comparing installations. The aim of this industrial research has been to improve brewhouse efficiency through a modified design of the equipment of the process. Parallel to the analysis of the brewhouse yield, engineering work on the milling system, on the design of the lauter tun, on the design of the lautering process, and on powerful software tools has been carried out. A package of improvements in lautering is presented and the results from industrial application are discussed. The impact and the results of this set of modifications are discussed, as well as the influence of the grinding technology: dry milling and the wet milling system MILLSTAR are compared. The flexible application of this package will lead to a significantly smaller figure of the soluble and digestible extract in the spent grains. Based on analytical figures of the spent grains, an extract balance is developed. Parallel to the calculations on the extract balance, the method of the "overall brewhouse yield" has been critically analyzed. Systematic errors of this particular method are evaluated and discussed.

*Thomas Buehler started brewing with an apprenticeship as brewer and maltster. He studied brewing and beverage technology at the Technical University of Munich-Weihenstephan, where he graduated in 1992 as Diplom-Ingenieur. From 1992 to 1995, he was employed at BRI, Nutfield, as scientist/engineer in the Process Innovation Department. During his time at BRI, he worked on different brewhouse research topics and beer filtration. From 1995 to 1996, he was manager of training and technology at APV Beverage Sector, Dortmund, Germany, and was responsible for worldwide training and technological development. In 1997, Thomas graduated with a doctorate in chemical engineering from Loughborough University, England. Until May 2003, he was managing editor of Brauwelt and other technical and scientific journals at Fachverlag Hans Carl, Nuremberg, Germany. Today, he is director of marketing and R&D at the Huppmann Group, Kitzingen, Germany.*



#### IV-09

##### A Review of Progress in Mash Separation Technology

2:05 p.m.

John Andrews, *Briggs of Burton plc, Burton-on-Trent, Staffordshire, U.K.*

Over the last decade, the shape of the world beer market changed substantially. The early 1990s saw a new generation of mash filters and saw wide acceptance of this highly effective technology. Lautering systems continued a long evolution, but recent changes in lauter tun design have strongly impacted yields, turnaround times, and wort quality. This paper will examine the developments in mash separation over the decade and will compare the alternative technologies in terms of performance, flexibility, and cost—and look at what the future may hold. The paper will conclude with a comparison of results at two recently installed large-scale breweries.

*John Andrews was born in Germany in 1948 but was educated in England at Bristol University, where he was awarded a 1st Class Honours degree and Doctorate in mechanical engineering. After early management training in a variety of industries, he joined Briggs of Burton plc as managing director in 1979 and led the rationalization of the engineering supply base to the industry, first with the acquisition of the brewing divisions of Henry Balfour and Co. Limited of Scotland and Pfaunder in the U.S.A. in 1983 and then with the acquisition of RMDG in 1988. In 1987, he carried out a management buyout of Briggs. Today the group of companies employs 250 people in four continents and John is chairman and majority shareholder. He has given papers at the IOB Asia Pacific and Africa Conventions and at MBAA Conventions. He also lectures at the International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland, and at the Indian Brewing Technology Course in Mysore, India. He was elected a fellow of the Institute in 1995 and in 2002 was elected president. Since 1998, he has also been a director of Brewing Research International.*

#### IV-10

##### Ziemann Vacuum Evaporation Plant: Wort Boiling System for Improvement of the Wort Quality and Simultaneous Energy Saving

2:30 p.m.

Joachim Gunkel, *A. Ziemann GmbH, Ludwigsburg, Germany*

The dynamic wort boiling with an evaporation rate of 4%, in combination with an additional vacuum evaporation of 2%, results in considerably improved wort qualities; especially due to the reduction of the DMS value to less than 40 mg/L. Any DMS produced in the whirlpool is also reduced. The thermal load of the wort TBC is also drastically reduced, which results in better beer colors. The coagulation value, which determines the foam stability, can be adjusted between 18 and 25 mg/L. At the same time, up to 60% of the energy costs can be saved due to the reduction of the evaporation rate in the wort kettle and an additional energy storage system. The plant can be easily installed to upgrade existing brewing lines as well as large new plants. More than 12 brews per day can be achieved with it.

*Joachim Gunkel, with an education in process technology, has worked for the Ziemann group for 34 years. During that time, he passed through different fields of study, e.g., planning, technology, plant engineering, and sales. He played a decisive role in the planning and construction of the world's largest breweries, among other things, a huge project in Mexico with an annual output of 22 million hectoliters. Mr. Gunkel is married and has two children. At the moment, he is working as sales director.*

## Technical Session V - Packaging

Monday, October 6 • 1:15 – 2:55 p.m. • Regency B

**Moderator:** Kátia Jorge, *Brewtech Servicos Ltda., Rio de Janeiro, Brazil*

*Kátia Jorge is a chemist educated at the State University of Rio de Janeiro (UERJ) and she has a Masters degree in biochemistry from Federal University of Rio de Janeiro (UFRJ). She has 17 years of brewing experience and was active as a research fellow at VLB-Berlin. Kátia worked as a chemist at Cia Cervejaria Brahma, beginning at the corporate QC Laboratory and ending with the position of specialist chemist at Brahma's R&D Center. Currently, Kátia is one of the partners of BrewTech, is active as technical director, and is concluding her Doctorate degree in food science at UFRJ.*

## V-11

**Hygienic Design, Installation, and Maintenance in Draft Beer Dispense**

**1:15 p.m.**

Jaime Jurado, *The Gambrinus Company, San Antonio, TX*

In North America, draft beer dispensed from keg has been a decreasing portion of the volume sold by many breweries. There are contrasting parameters driving the decline. Brewers have a leadership role to play in supporting the quality of draft beer dispensed in the trade. Breweries offer different standards and requirements; we will explore some problematic areas which all brewers can agree are challenges. The recent launch of the Gesellschaft für Öffentlichkeitsarbeit der deutschen Brauwirtschaft e.V. framework of practical system-wide real world standards, and DIN 6650-1 (“beverage dispensing systems”) indicates that industry standards can be established and pursued by competing brewing companies. The objectives of the recently established Draught Beer Guild in North America also demonstrates acknowledgement that draft dispense has an opportunity for improvement. Field examples of installation and hygienic maintenance problems will be shared, as well as practical improvements...improvements based on what we already know inside our brewery walls but which have not successfully been embraced in the field.

*Jaime Jurado serves as director of brewing operations at The Gambrinus Company, a family-owned company that imports beer and operates its own breweries in the U.S.A. Draft beer, as a percentage of volume sold by their own breweries, represents a larger portion of sales than the average in the United States. Among other responsibilities, Jurado works on draft dispense technical issues for the company. He has worked at five other brewing companies and was a Brewing Praktikant in Bavaria in 1983. He has an undergraduate degree in chemical engineering and a master's degree in electrical engineering.*

## V-12

### How RevTech Helped Labatt Create New Decorating Technology for the Industry Standard Beer Bottle

1:40 p.m.

Anthony Georges, *RevTech Inc., Edison, NJ*

Labatt Breweries of Canada had been searching for years to find a way to achieve product differentiation in the highly competitive Canadian beer market where the industry label options is strictly regulated and the glass beer bottles had been limited to standard paper or foil labels. This quest for enhanced brand impact took Labatt to RevTech, the world's leading supplier of UV curable inks for direct printing on glass and its ENVIROGLUV brand of ink technology. Together with RevTech's scientific team, Labatt achieved its objective of obtaining a unique, directly screen-printed bottle for their Labatt 50 and Kokanee Gold brands. RevTech developed a specialized ink called "ONE WASH"<sup>TM</sup> which was able to meet all of Labatt's handling and filling requirements, including the pasteurization of the decorated beer bottle. The screen-printed decoration also met the industry standard agreement for 100% removal of the printing in the caustic soda bottle washing machine just like the paper label. The results have been impressive, for the breweries and the environment.

*Anthony S. Georges is vice-president of business development at RevTech, a world leader in the R&D and manufacturing of UV-cured inks and coatings for direct printing on glass. Georges conceptualized the development of the "One Wash"<sup>TM</sup> ink, being used by Labatt Breweries to replace paper labels on the refillable glass beer bottles, and is responsible for licensing RevTech's inks and coatings worldwide. Georges provides RevTech with extensive domestic and international experience in strategic planning, market development and penetration, and an extensive knowledge of printing machinery technology and application. Before joining Revlon Technology in 1996, Georges was vice-president of sales at Graphics International Group. Under Georges' direction, GIG developed international markets in the Far East, and Central and South America. Georges directed business expansion to include new product lines and developed distributors and sales support programs in each of the markets. Georges has been a speaker at conferences and seminars worldwide to discuss a variety of related topics to the beverage, packaging, and glass manufacturing industries. He has also written articles for glass and packaging magazines regarding the printing of UV-cured inks on glass. Georges is a member of the Master Brewers Association of American, ON, Canada. In 2000, Georges was part of the RevTech team that won the acclaimed U.S. Presidential Award for the EPA Green Chemistry Challenge. Georges earned his B.A. degree at York University in Toronto, complementing his degree with postgraduate studies at the University of Freiburg in Germany. He is fluent in English, French, and German.*

## V-13

### Basic Requirements for Good Decision-Making

2:05 p.m.

Felix Seitz, *International Food & Beverages Services Ltd., Auckland, New Zealand*

Coauthor: T. Pidgeon

Capacity analyses of breweries are essential for good financial decision-making. Brewery capacity analyses are typically carried out using electronic spreadsheets. Though results can be misleading due to the simplifications and limitations that are inherent in this approach. Such spreadsheets often do not allow for the dynamic interaction between the different process departments. An effective alternative is simulation, which can consider the behavior of each element in the process and show how the changes interact dynamically. This provides enhanced realism of the model and hence accuracy in the analysis. Combined with on-screen animation, a powerful visual diagnostic capability can be achieved. Data generated during the simulation run also produces statistics for reports. Brewery configuration and operational inputs are parameterized to allow rapid "what-if" investigations, analyzing the visions of key decision makers. When the interactions between all the process departments are included, a more balanced perspective is provided to the decision makers.

*Felix Seitz was born in 1959 in Caracas, Venezuela, and is a German citizen and New Zealand resident. He gained his B.Sc. degree in chemical/process and mechanical engineering at Technical University Munich-Weihenstephan and holds a Dipl. Ing. (FH) degree in brewing and beverage technology. Since June 2002, Seitz has been an international business development executive with the Beca Group in New Zealand. Prior to this, he worked for International Food and Beverage Services Ltd., New Zealand, a wholly Beca-owned company specializing in providing services to the brewing industry. Before joining the Beca Group, Seitz worked on brewery and beverage projects in over 40 countries, including Germany, France, Spain, Poland, Kingdom of Tonga, Samoa, The Gambia, Nigeria, Malaysia, Brazil, Argentina, and Venezuela. Seitz's areas of special competence are operational management and brewing processes, as well as design (malting and brewing, juices, mineral water, and carbonated soft drinks). His papers and publications have appeared across the globe, most recently in Scandinavian Brewers 2002, Denmark, 'Capacity analysis through Simulation'. He is a member of the MBAA.*

## V-14

### Package Quality/Pasteurizer Conditions: Avoiding Staining, Spotting, and Rusting

2:30 p.m.

Thomas Soukup, *ChemTreat, Inc., Glen Allen, VA*

Coauthor: Jack Bland

Recently, several U.S. breweries have experienced quality issues related to package appearance with a variety of aluminum cans and 12-ounce bottles not evidenced in the past. The efficiency of water conservation programs, changes in can coatings, standardization of pasteurizer treatments, and compliance with environmental standards are but a few of the issues that have increased the potential for can spotting and staining, crown rusting, and increased organic deposition in pasteurizers. This paper will discuss individual incidents, along with the corrective action taken. The systematic approach used to diagnose the problem and the causative agents, as well as the corrective action taken, will be thoroughly detailed. Valuable information, along with recommended changes in protocol, are summarized in order to avoid package appearance issues in future operations.

*Tom Soukup received his B.S. degree in geochemistry from the University of Pennsylvania in 1979. He has worked in brewery water treatment for 22 years, the last 11 with ChemTreat, where he is a brewery specialist. In this position, he is responsible for designing brewery chemical feed and reclaim systems and technical support troubleshooting. Tom has authored and presented papers at conferences and conventions. In 1997, he presented "Halogen Feed to Pasteurizers" at the MBAA regional conference and "Automation of Chemical Feed" at the MBAA national convention. Tom travels 80% of the time, which gives him the opportunity to become familiar with breweries across North America.*

## Technical Session VI – Beer Filtration

Tuesday, October 7 • 8:00 – 9:15 a.m. • Regency A

**Moderator:** Richard Sharpe, *Brewing Research International, Surrey, UK*

*Richard Sharpe obtained his first degree in chemistry. He then studied for his Ph.D. degree at the Brewing Research Foundation, where he investigated the chemistry of beer flavor, hop oil, and the extraction of hops with liquid carbon dioxide. He joined Whitbread plc in 1979 and, after a 20-year career in science and technology, left his position as director of beverage research and development to join Brewing Research International as their technical director. He is the author of 61 publications and two patents. He is a fellow of the Royal Society of Chemistry, the Institute of Food Science and Technology, and the Institute and Guild of Brewing. He is chair of the Institute and Guild of Brewing's Analysis Committee and a member of the Heriot-Watt Research Committee and the EBC Analysis Committee. Richard is a visiting professor of food and beverage safety at the University of Luton and his science interests are flavor, hop chemistry, biotechnology, and beer foam.*

## VI-15

### SWS Process for DE Replacement

8:00 a.m.

Joseph Snyder, *Pall Corporation, Northborough, MA*

Nothing has been more fundamental to beer filtration than the use of DE for clarification. For a number of reasons, that will be reviewed, brewers are seeking a better solution that is not dependent on any filter aid. Advances in filter materials and separation processing provides a solution that meets the brewer's needs for quality, economics, and environmental/health impact. Centrifuge and crossflow membrane technology combine to provide a practical way forward. This hybrid solution overcomes the limitations of each technology applied separately and positively impacts taste, energy consumption, quality, and production flexibility. Results, from 5 years of microbrewery operation and more recent validation through operation at a mid-sized brewery, will be presented. Benefits of the system include miniscule beer loss, low oxygen uptake, low energy consumption, continuous 24/7 operation, modular design, and no change in analytical or organoleptic parameters.

*Joe Snyder joined Miller Brewing Company's Fulton, NY, Quality Assurance Department in 1980. In 1983, he joined the Brewing, Research, and Quality Assurance Division to complete consumer research projects. He also spent some time in the pilot brewery and product innovation area. This exposure provided insights into new technologies and product formulation and their impact on consumer acceptance. The knowledge was applied to formulating new products and improving existing products. Moving to Pall Corporation in a sales and marketing position in 1997, he has assisted brewers in solving problems through the application of filtration technology.*

## VI-16

### The Effect of Microporous Membrane Filtration on Beer Foam Stability

8:25 a.m.

Peter Riddell, *domnick hunter limited, Birtley, County Durham, England*

Cold 'sterilization', the microbiological stabilization of beer using microporous filter media, is an alternative to pasteurization. Process economics have hindered its progress and adoption has been driven by the 'cleaner, fresher, more natural' perception that the technique conveys and by the option to incorporate critical control point monitoring in the form of nondestructive integrity testing of the filter. Such filters are designed to remove spoilage organisms, but their nature dictates that they will also remove other suspended particles. Additionally, they may remove dissolved species, often to the detriment of the product. New materials, coupled with improved cleaning techniques, have served to improve economic and decrease detrimental effects. This work studies the effect of membrane and protein interactions using three commonly available membranes—polyethersulphone, polyvinylidene difluoride, and nylon 6,6. Three beer styles were studied. The total protein content of each beer before and after filtration was measured using the Pyrogallol Red Molybdate (PRM) method of assay. Foam stability, an aesthetic quality more recognizable to the consumer, was measured using the Rudin method.

*Peter Riddell is product manager within the process filtration operation of domnick hunter limited. Based in the United Kingdom, he is responsible for the global development of applications within the food and beverage industry. After graduating with a B.Sc. degree in applied chemistry and chemical process engineering, Peter spent 7 years in product development at domnick hunter during their diversification into the liquid filtration market. He then moved on to project engineering in the dairy and biopharmaceutical industries. Peter returned to domnick hunter as product development manager with a specific remit to extend and improve the range of products for the beverage industry. After a brief spell looking after all liquid applications, he moved on to his current role of product manager.*

## VI-17

### Back to Basics—Pre-Coat Filtration with Diatomite

8:50 a.m.

Niels Mastrup, *World Minerals Inc., Lompoc, CA*

Pre-coat filtration with diatomite has been used in food and beverage applications for over 70 years. The longevity and worldwide acceptance of diatomite filtration technology can be attributed to the fact it offers the most complete and economic filtration option. Diatomite filtration continues to be the simplest and most flexible process available for the filtration of beer:

Reliability – Predictable and consistent filter performance;

Flexibility – A broad spectrum of suspended solids can be handled;

Simplicity – Pre-coat filtration with diatomite is based on simple principles of engineering and mechanics;

Optimization – Ability to optimize diatomite filtration resulting in the exclusion of only the solids that you want to remove;

Cost Effectiveness – Low initial capital cost, low maintenance cost, and optimization of use yield the lowest dollar cost per unit filtered.

Pre-coat filtration with diatomite is an established and proven technology for beer clarification.

*Niels Steffen Mastrup received an A.S. degree in marine technology from Santa Barbara City College, Santa Barbara, CA; an A.A. degree in business from Harbor College, Los Angeles, CA; and a B.S. degree in business from California State University, Dominguez Hills, Carson, CA. Niels has been an offshore commercial diver for SubSea International & Oceaneering in California and Louisiana. He has also worked with industrial minerals in technical service, sales, and sales management for World Minerals and GREFCO. Niels is currently a market segment director, beverage, for World Minerals Inc., Lompoc, California. Niels is married and has two daughters, ages 11 and 8.*

## Technical Session VII – Test Methods and Sanitation

Tuesday, October 7 • 8:00 – 9:15 a.m. • Regency B

**Moderator:** J. Antolin Sierre-Benavides, *Cerveceria Cuauhtemoc, Moctezuma, Monterrey, Mexico*

*J. Antolin Sierra Benavides was born in Monterrey, México. He received a bachelors degree in chemistry from the Instituto Tecnológico de Monterrey in 1969 and a Ph.D. degree in organic chemistry from the University of Detroit in 1975. Antolin joined Cerveceria Cuauhtemoc Moctezuma in 1975 as head of the quality control laboratory and has since held various positions in the areas of quality assurance, process development, and research. He is a member of the MBAA and the American Society of Brewing Chemists (ASBC). He has served on the ASBC Editorial Committee and the MBAA Technical Committee and was president of the MBAA District Mexico in 1986. His current position is director of research and development for Cerveceria Cuauhtemoc Moctezuma.*

## VII-18

### New Development for Measuring Hydrogen Sulfide in Brewing

8:00 a.m.

Seung Park, *Kyung Hee University, Yongin-Si, South Korea*

Coauthors: J. Y. Kim and Y. R. Kim

Hydrogen sulfide (H<sub>2</sub>S) is mainly produced by yeast during fermentation and is a well-known compound responsible for the rotten egg smell in beer. One of the problems in preventing H<sub>2</sub>S in brewing is a lack of appropriate methods to measure H<sub>2</sub>S in a simple, easy, fast, accurate, yet cost-effectiveness manner. We have developed a detection tube (DT) method to measure H<sub>2</sub>S produced by yeast during fermentation and in finished beer. The DT was prepared by homogeneously impregnating the support material with an H<sub>2</sub>S-reactive chemical, followed by drying and packing into a transparent plastic tube. The DT was precalibrated with a known amount of H<sub>2</sub>S, which was represented by the scale on the tube. The DT only responded to H<sub>2</sub>S and not other compounds. Reproducibility studies showed that the coefficient of variation for the DT method was 0–5%. Multiple tests could be performed using the DT, so various factors and sources responsible for overproduction of H<sub>2</sub>S in brewing could be investigated simultaneously under different fermentation conditions including yeast strains, wort composition, and fermentation temperatures. The detection tube is disposable.

*Seung Park is a professor of food chemistry at Kyung Hee University, Seoul, Korea. After graduating from Kyung Hee University in Seoul in 1981 with a degree in food science and technology, he joined General Foods Korea (now Kraft Foods) as a flavor chemist. After 5 years of working on coffee flavor chemistry and process engineering at General Foods Korea, he moved to California for further studies in flavor chemistry and to obtain his master's and Ph.D. degrees in food science at the University of California, Davis. In 1993, he did postdoctoral work at Ernest and Julio Gallo Winery Research Center in Modesto, CA, before joining the university. Besides teaching and research at the university, he has been actively working as a wine flavor technical consultant for major wineries in California. Professor Park's research is focused in the development and application of analytical chemistry techniques to study the flavor chemistry of foods, especially wine and beer.*

## VII-19

### VIT-Bier—The Rapid and Easy Detection Method for Beer-Spoiling Bacteria

8:25 a.m.

Jiri Snaidr, *vermicon AG, Munich, Germany*

Coauthors: K. Thelen and C. Beimfohr

A new rapid test to detect all viable beer-spoiling bacteria in every stage of the brewing process will be presented. This test is based on the VIT (vermicon identification technology) gene probe technique and enables the fast and specific detection of spoiling bacteria within 3 h after a short pre-enrichment (1–2 days). The technique is based on the principle that specific fluorescently labeled gene probes which were programmed to identify beer-spoiling bacteria penetrate into the bacteria of a given sample and bind to their target sites within the cells. By using a fluorescent microscope, the fluorescent dye now present in the cells will be excited and the bacteria start to shine. All beer-spoiling bacteria light up red and *Lactobacillus brevis* as the most common contaminant lights up green. VIT is characterized by very easy handling. All solutions provided with the kit are filled in dropping bottles so that no pipetting is required. Moreover, the equipment costs are pretty low. In summary, VIT-Bier meets all microbiological needs in modern breweries.

*Dr. Jiri Snaidr was born in 1966 in Brno, Czech Republic. In 1995, he received his Masters degree in biology from the Technical University of Munich, Germany. After undertaking studies at the Technical University of Munich as well as at the Max-Planck Institute in Bremen (Germany), he received his Ph.D. degree in 1997. His work dealt with the application of molecular biological methods for the detection of hitherto unknown microorganisms. In 1999, he started his studies at the Open University in England and received a degree in senior management in 2000. Since 1997, he has held the position of CEO/President at vermicon AG in Munich. Dr. Jiri Snaidr founded vermicon in 1997 with a focus on the development and distribution of test kits for rapid and specific detection of microorganisms. After receiving awards in the first two stages of the Munich business plan competition, his company won second prize in the final round in 1999. In 2000, Henkel KGaA acquired a minor share in the company. In 2001, the first product of a series of subsequent test kits for the detection of microorganisms was launched on the market. In 2003, RWE as well as the energy supplier MVV Energie acquired shares in vermicon. The company is today considered to be an internationally recognized supplier of microbiological rapid tests based on leading gene probes technologies.*

## VII-20

### **Acid Cleaning: Your Future to Greater Savings, Higher Productivity, Increased Safety, and a Better Environment**

**8:50 a.m.**

Mauricio Colosía, *Eurochem International Corp., Atlanta, GA*

Coauthor: D. Lee

High-productivity breweries have overcome several obstacles throughout their existence to maintain their high-productivity status: concentrate wort technology, post-fermentation centrifugation, and unitank process implementation, to name a few. And it is with the latter that a new opportunity to keep up with the referred status is discussed here. Present unitank and BBT cleaning procedures include the use of high-alkalinity cleaners which demand CO<sub>2</sub> ventilation prior to cleaning. This negatively impacts productivity due to

- Time needed to eliminate CO<sub>2</sub>.
- Time elapsed so tank can be filled again.
- Worker and facility safety.
- CO<sub>2</sub> loss.
- Pollution issues.

Special technology acid cleaners allow their use under CO<sub>2</sub> atmospheres, eliminating the need for venting, the CO<sub>2</sub> loss, and the environmental problems involved. Long from being a laboratory test report in which variables and scientific explanations are sought, this paper deals with facts and benefits obtained throughout real applications in high-productivity breweries. This paper is a compilation of more than 10 years of experience in successful acid cleaning of cold cellars' tanks and equipment.

*Mauricio Colosía was born December 20, 1969, in Mexico City, Mexico. Mauricio has been with EUROCHEM since 1985. He was in sales (1985–1988) and technical service (1989–1995). From 1995 to 2000, he was a brewery account manager. Since 2000, Mauricio has held various positions within EUROCHEM: board member and general manager (EUROCHEM Mexico); board member and CEO (EUROCHEM Brazil); board member (EUROCHEM U.S.A.); and head of research, development, and technology (EUROCHEM Group). Mauricio has attended training seminars on numerous topics, including sanitation, chemical formulation, water treatment, brewing process, packaging process, and product processing.*

## **Technical Session VIII – Yeast and Fermentation**

**Tuesday, October 7 • 9:45 – 11:00 a.m. • Regency A**

**Moderator:** Terry Kavanagh, *Carlton & United Breweries Ltd., Melbourne, Australia*

*Terry E. Kavanagh joined Carlton and United Breweries Ltd., Melbourne, Australia, in 1970 with a Ph.D. degree in organic chemistry from The University of Melbourne and 2 years of experience in food science at The Pennsylvania State University working on the flavor of both dairy products and chocolate. While his initial work was associated with beer flavor, he subsequently managed the Company's research activities. Later, he was responsible for the technical services, coordinating both research and quality assurance. He currently works in operations evaluation, Carlton and United's operations performance assessment group, with responsibility for quality and regulatory affairs. He chairs the Australian Associated Brewers Technical Committee and also the Institute of Brewing (Asia Pacific) Editorial Committee, which assembles the technical program for its biennial convention. He is a member of the MBAA Technical Committee.*



### VIII-21

#### Analysis of Foam Behavior During Fermentation in a Cylindroconical Tank

9:45 a.m.

Tatsufumi Kakui, *Suntory Limited, Chiyoda-machi, Ohra-gun, Gunma, Japan*

Coauthors: Y. Mano, T. Sekizuka, R. Watanabe, and A. Iose

During fermentation, CO<sub>2</sub> is evolved by extract consumption of yeast and foam head is formed in the fermenter. We observed the foam behavior in a cylindroconical tank by using a laser sensor and CCD camera during fermentation. We got the following results.

- (i) Foam grew and diminished with oscillations.
  - (ii) The cycle between foam up and down nearly coincided with DCO<sub>2</sub> change in fermentation.
  - (iii) The cooling on and off to adjust the target temperature had a close relationship with DCO<sub>2</sub> change and foam oscillations.
- In addition, it was suggested that the rate of CO<sub>2</sub> evolution was related to maximum foam height. We think that these foam-monitoring devices are useful to understand factors to control the foam behavior and could be applied to recognition of fermentation condition, control of hydrophobic compound yield, and utilization of free head space.

*Tatsufumi Kakui majored in biochemistry and obtained the master's degree from the Osaka University, Japan, in 1993. After joining the Suntory Ltd. the same year, he worked with colleague to develop the ELISA method for determining the content of foam proteins in beer and malt at a research center in Osaka. He also studied the several compounds related with the aftertaste of beer. After the first 6 years, in 1999, he moved to the Tonegawa brewery in Gunma. He currently has been working to keep and elevate the beer quality at the brewing section in Tonegawa brewery as assistant brewmaster.*

### VIII-22

#### Evaluation of Oxygen Requirement of Bottom and Lager Yeast Strains by Preoxygenation

10:10 a.m.

Sofie Depraetere, *Katholieke Universiteit, Leuven, Belgium*

Coauthors: J. Winderickx and F. R. Delvaux

An adequate cellular oxygen supply is critical for yeast growth and its fermentation performance, since oxygen is a necessary building block for the biosynthesis of essential membrane lipids. Traditionally, the cold wort is aerated before pitching. However, this technique has several drawbacks such as inconsistent fermentations and the oxidation of wort constituents, resulting in undesirable color and flavor changes. In order to avoid these shortcomings, yeast can be oxygenated (= preoxygenation) before its use in fermentation. The goals of this research were to gain insight in the oxygen requirement of different yeast strains during preoxygenation and to determine the physiological state of the yeast during preoxygenation and fermentation. Bottom-fermenting as well as top-fermenting yeast strains were evaluated for their preoxygenation ability. Yeast strains were preoxygenated in a membrane loop reactor and yeast characteristics were determined during preoxygenation and fermentation. Oxygen requirements as well as yeast vitality were shown to be yeast strain dependent. Furthermore, knowledge for application of the preoxygenation technique on an industrial scale has been established.

*Sofie Depraetere started her studies of applied biological sciences at the KU Leuven in 1996, where she obtained her M.Sc. degree (2001) in bioengineering, majoring in food technology. She is currently working as a Ph.D. student with an IWT grant in the Department of Food and Microbial Technology at the same university. In collaboration with the Centre for Malting and Brewing Science, she is carrying out a research project on pre-oxygenation of bottom- as well as top-fermenting yeast strains.*

### VIII-23

#### **Brewers Yeast Management, Benchmark of Propagation Processes, and Beer Quality Best-Practice Bitburger Brauerei 10:35 a.m.**

Christian Abel, *Heinrich Frings GmbH & Co. KG, Bonn, Germany*

Coauthors: Michael Quantz, Ulrich Peters, and Georg Stettner

The two common ways of yeast propagation from pure yeast cultures and yeast harvest are compared with regard to yeast management and beer quality issues. It is shown that Bitburgers strategic decision toward yeast propagation is based on remarkable improvements of beer quality. The Bitburger Brauerei and the R&D Research Brewery, Germany, are introduced as a best-practice case study. A benchmark is given between the repeated fed batch process, with continuous aeration, and the single batch process, with aeration intervals. The advantages of the repeated fed batch process are shown for yeast management and beer maturation, in which accelerated decay of diacetyl is achieved. The repeated fed batch yeast propagation process in a unit equipped with a high-efficient Frings dynamic aeration system and a mechanical defoamer enables Bitburger Brauerei to produce reliable pure pitch yeast with a high vitality in flexible, short cycles. An outlook on high cell density propagation and further development of the said units is given.

*Christian Abel was born in Essen, Germany, where he completed his university education. He received his master's degree in chemical engineering from the University of Essen in 1999. His principal areas of interest are bio- and food technology. He is currently product manager for the Brewery Systems Group of Heinrich Frings GmbH Bonn, Germany.*

### **Technical Session IX – Craft Brewing**

**Tuesday, October 7 • 9:45 – 11:00 a.m. • Regency B**

**Moderator:** George Reisch, *Anheuser-Busch, Inc., St. Louis, MO*

*George Reisch is a corporate brewing staff brewmaster in St. Louis. He is a fifth generation brewmaster. His family owned and operated the Reisch Brewing Co. of Springfield, Illinois, from 1849 till it ceased operations in 1966. George graduated in 1979 with a B.S. degree from the University of Wisconsin. He was hired by Anheuser Busch Inc. and was placed in their Corporate Management Training Program (1979–1980). In 1980, he was promoted to brewing supervisor and transferred to the Los Angeles Anheuser Busch brewery. At the Los Angeles brewery, he also held the positions of brewing technical coordinator, assistant brewmaster, and staff brewmaster before being moved into corporate brewing. George is an active member of the MBAA. He is a past president of MBAA District Southern California and is currently serving on the Education and Technical Committees for the national MBAA office. In addition, he is a member of the Board of Advisors for the North American Brewers Association (NABA). George's current duties include overseeing Budweiser production at several Labatt breweries in Canada. George and his wife Kathy have four children. They live west of St. Louis in Wildwood, Missouri.*

## IX-24

### Beer Styles—Origins and Classifications

9:45 a.m.

Charlie Papazian, *Association of Brewers, Boulder, CO*

Beer is an expression of the human spirit. We use technical sciences as a tool to create it, psychology to market and help sell it, but its essence is and always will be a form of art. Beer style is the art of combining hundreds of factors to create a consistent combination of beer characters. Beer's complexity and all of the diversity it offers expresses the variety of the world's lifestyles. There are an estimated 5,000 commercial breweries in the world today. We can arguably estimate that each brewery may, on average, produce eight different kinds of beer. That gives us 40,000 different beers available for sale around the world. While many beers may be similar in style, their individual creation and the culture surrounding its enjoyment and celebration help define each beer's individual uniqueness. This essay explores beer's stylistic diversity and how our knowledge of the factors influencing variety can be useful in beer formulation, brewhouse management, beer evaluation, tempering government regulation, beer competitions, and improving the image of beer in the marketplace. I have identified and detailed almost 100 different beer styles of British, German, Belgian, American, Irish, and Japanese origin, most of which are available in the contemporary American beer market. The American beer market is undoubtedly the world beer market that offers the most diversity. There are indeed dozens of other styles popular in various regions of the world that remain to be "cataloged" in this ongoing project. With the expansion of international trade and the increase in intercultural experiences, there will be more opportunities to access, enjoy, and introduce new varieties of beer to the world's marketplaces.

*Charlie Papazian, president and founder of the Association of Brewers (AOB), is a prominent and recognized name in the world of beer and brewing. He has published commentaries that provide insights into the industry, advice to home brewers, and beer reviews for consumers. Since founding the Association in 1978, Charlie has guided the development of its principal activities and two magazines Zymurgy and the New Brewer. He is author of four best-selling books, The New Complete Joy of Home Brewing, The Home Brewer's Companion, Home Brewer's Gold, and The Best of Zymurgy, and is a member of the Master Brewers Association of the Americas, the American Society of Brewing Chemists, the Institute and Guild of Brewing, Slow Food International, and Bier Convent International. He received his B.S. degree in nuclear engineering in 1972 from the University of Virginia. He lives in Boulder, CO, with his wife, Sandra, where he avidly brews lagers, ales, and honey meads.*

## IX-25

### Back-to-Basics Yeast Management for Micro and Pub Brewers

10:10 a.m.

Hugh Burns, *Williamsburg Brewing Co., Williamsburg, VA*

Small micro and pub brewers must constantly manage the problem of growing and maintaining clean, viable, pitchable yeast cultures for inoculating batch sizes in the range of 7 to 20 barrels. Yeast management techniques must be practical, reliable, and cost-effective for the small brewer. This paper addresses the problems and presents practical solutions for maintaining multiple yeast strains in a small brewery and for preparing pitchable amounts of a new yeast strain for seasonal or limited-run beers. Materials and equipment are chosen and presented that are both readily and affordably available to the small brewer and are easily used and managed in a small brewery environment. The yeast management techniques and recommended protocols presented are designed for practical use in a small brewery workplace.

*Hugh Burns is the brewer and founder of Williamsburg Brewing Company in Williamsburg, Virginia. Hugh earned a B.S. degree in biology from the University of Scranton in Scranton, Pennsylvania, in 1981. After a semester at Georgetown University Medical School, he changed gears, and in 1982, he joined the U.S. Air Force to become a fighter pilot. He served as a pilot and officer, flying F-4 "Phantoms" and F-117A "Nighthawks" until 1995. He is a graduate of the USAF Fighter Weapons Instructor Course (TOPGUN). He's authored and coauthored works on instructional techniques and on fighter weapons employment and tactics. In 1991, Hugh began home-brewing as a hobby and came full-circle with his microbiology and biochemistry education roots. He founded the Williamsburg Brewing Company in 1995 and has been its brewer until the present. Now his efforts are divided among making beer, managing a business, and handling the myriad legal issues involved with being a microbrewer. His first love remains his wife and six children. His second love is making hand-crafted beer.*

## IX-26

### The Effect of Wheat Malting on the Colloidal Haze of White Beers

10:35 a.m.

Filip Delvaux, *Katholieke Universiteit, Leuven, Belgium*

Coauthors: J. A. Delcour and F. R. Delvaux

Wheat and wheat malt are commonly used for white beer production. Although wheat and wheat malt characteristics can vary greatly depending on the variety and malting procedure, no strict specifications for wheat or wheat malt are set by the brewers. The literature about beer haze influencing properties of wheat is conflicting. It was previously shown that the wheat protein level and molecular weight profile strongly determine the final haze intensity of white beers. Therefore, the objective of this study was to investigate the influence of wheat malting on the haze. Wheat malts of variable degrees of modification were prepared industrially. Malt properties, including the soluble protein and protein degradation, were determined. Laboratory-scale wheat beers were brewed and standard beer analyses were carried out. Beer haze was determined nephelometrically. The results of this study showed an influence of wheat malting, and as a consequence of protein degradation, on the haze-forming potential of the malt and thus will help the brewer setting wheat malt specifications.

*Filip Delvaux started his studies on applied biological sciences at KU Leuven in 1992, where he obtained his B.Sc. (1994) and M.Sc. (1997) degrees in bio-engineering, majoring in food technology. This was followed with a Ph.D. degree in 2001 at the same university. In collaboration with the Laboratory of Food Chemistry and the Centre for Malting and Brewing Science, he investigated colloidal haze in Belgian white beers. He is currently employed as a postdoctoral fellow at the Centre For Malting and Brewing Science (KU Leuven).*

## Technical Session X – Flavor Stability

Tuesday, October 7 • 1:30 – 2:45 p.m. • Regency AB

**Moderator:** Barry Axcell, *South African Breweries, Sandton, Republic of South Africa*

*Barry Axcell started his career with Shell Research in the United Kingdom, where he worked for 9 years in the laboratories of Professor J. W. Cornforth, the 1975 Nobel Prize winner in chemistry. He immigrated to South Africa in 1975 and for 3 years was head of the Biochemistry Department of a large pharmaceutical company. Barry joined the South African Breweries in 1978, working initially in the Brewing Materials Department. Between 1985 and 1997, he was head of the SAB's research and development laboratories. In 1997, he became chief brewer for SAB Ltd., with responsibilities for corporate brewing, research, and development and technical services. Recently, his role has expanded to cover SABMiller interests. Barry is a chartered biologist, chartered chemist, and a fellow of the Institute of Brewing, The Institute of Biology, and the Royal Society of Chemistry. He is also a visiting professor in the Department of Microbiology at the University of Stellenbosch. Barry has authored or coauthored more than 70 papers relating to various aspects of the brewing industry and is actively involved with both the American Society of Brewing Chemists and the MBAA. He was elected the first international director of the ASBC.*

**X-27**

**A Critical Control Point Analysis for Flavor Stability of Beer**

**1:30 p.m.**

Charles Bamforth, *University of California, Davis*

There is a burgeoning amount of literature on flavor instability in beer and the factors that influence it. Many of these studies have shortcomings in one or more ways. Many rely on analytical measures that have not been proven to relate to perceived organoleptic characteristics of the beer. Others report sensory work that is ill-defined or flawed. Yet more present a passionate opinion that is not underpinned by very much analytical data at all. This paper seeks to plough through this morass and give an overview of what is either fact, supposition, or dogmatic belief with regard to critical control points from barley to beer for the achievement of long-flavor-life beer.

*Charlie Bamforth became the first Anheuser-Busch-endowed professor of malting and brewing sciences at the University of California, Davis, in February 1999. He has 25 years of experience in the brewing industry, previously holding senior positions with Brewing Research International and Bass. He is a fellow of the Institute of Brewing and of the Institute of Biology. He is editor-in-chief of the Journal of the American Society of Brewing Chemist. Charlie is also visiting professor of brewing at the International Center for Brewing & Distilling at Heriot-Watt University in Edinburgh, Scotland. His latest book, Standards of Brewing, was published in 2003, together with the second edition of Beer: Tap into the Art and Science of Brewing. He has also published on biotechnology and soccer goalkeepers.*

**X-28**

**The Influence of Weak Wort for the Quality of Beer**

**1:55 p.m.**

Klaus Wasmuht, *Anton Steinecker, Freising, Germany*

Wort consists in its majority of water, carbohydrates, and proteins. In addition, wort contains a lot of other organic and nonorganic substances. During the process of lautering and here especially at the point of the spargings, the relationship of the quantities of the individual substances of the wort is shifting. This is also valid for the composition of the individual fractions such as carbohydrates which are changing quite significantly. The part of the nonfermentable carbohydrates is increasing, while that of the original extract is decreasing. The practical process already showed that an extended exhaustion of the spent grains leads to a negative influence of the fermentation, e.g., propagation. We have to ask the question whether an intensive process to obtain the extract makes sense from an economic standpoint as well as from a technological standpoint.

*Klaus Wasmuht was born in Bamberg, Germany. He completed his apprenticeship in brewing in 1975. After military service, Klaus attended the Technical University of Munich, Weihenstephan, completing his certificates in brewmaster & malting master and brewing technician. From 1984, Klaus worked in technological development for Anton Steinecker Maschinenfabrik in technology, commissioning, and acceptance. Klaus was appointed deputy department manager in 1989 and, since 1999, has worked with Dr. Stippler on technological management.*

X-29

**Performance of the “Anaerobic” Mashing Process of Suntory for Improvement of Beer Flavor Stability**

**2:20 p.m.**

Shingo Kawasaki, *Suntory Ltd., Nagaokakyo, Kyoto, Japan*

Coauthors: A. Kogin, T. Inui, O. Takemura, E. Honno, and H. Ikeda

The new brewhouse in Suntory Kyoto brewery was in operation in 2000 and Mr. Takemura presented the outline of this brewhouse at WBC 2000. In this brewhouse, we tried to reduce the oxygen uptake to the minimum level possible in a commercial plant with today's technology in order to improve the beer flavor stability. In this presentation, we will show the performance of the “anaerobic” mashing process and its effect on the improvement of the beer flavor stability. We will show also the behavior of T2NP during the brewing process under different oxygen uptake conditions and consider additional mechanisms for influence on T2NP content. In the new brewhouse, all of our brands are produced by the “anaerobic” mashing process and the flavor stability has been remarkably improved.

*Shingo Kawasaki graduated from Tohoku University in 1992 with a bachelor's degree in agricultural chemistry. He majored in enzymatic chemistry and engaged in structural analysis for the sugar chain of protease. In 1992, he joined Suntory Limited and engaged in research and improvement in the area of yeast handling and fermentation performance for beer until 1995. He then was engaged in new product development of beer and happou-shu until 2001, and various types of beer and happou-shu were launched on the market. In 2001, he transferred to Kyoto Brewery as an assistant brewmaster and he has been engaged in a development of brewing technology not only for beer but also for happou-shu, including improvement of the flavor stability and yeast handling.*

**Technical Session XI – Yeast Genetics**

**Tuesday, October 7 • 3:15 – 4:05 p.m. • Regency AB**

**Moderator:** Mike Sutton, *Coors Brewing Company, Memphis TN*

*Mike Sutton is the director of brewing operations for Coors Brewing Company in Memphis, TN. In addition to brewing operations over the past 7 years, Mike has held other responsibilities at various times including powerhouse/utilities and brewing quality control. Prior to joining Coors, Mike worked in the brewing/malting industry for 17 years in various management operations and quality positions. These included 3 years with Froedtert Malt Corporation, Milwaukee, WI, as director of customer satisfaction/quality assurance and 14 years with Miller Brewing Company, Albany, GA, and Ft. Worth, TX, in brewing operations. Mike is a 1992 graduate of the Diploma Program in Brewing Technology - Siebel Institute of Technology, Chicago, IL, and holds a Bachelor of Science degree in chemistry from Salisbury State University, Salisbury, MD. Mike is an active member of the MBAA and is currently serving as the MBAA Technical Committee chair. Mike is also a member of the American Society of Quality (ASQ)—Memphis Chapter.*

**XI-30****Cone Yeast Heterogeneity and Serial Repitching****3:15 p.m.**Katherine Smart, *Oxford Brookes University, Oxford, U.K.*

At the end of cylindroconical fermentations, the yeast is usually harvested from the cone and reused. This recycling process permits the practice of serial repitching to occur without the necessity to propagate fresh slurry for each fermentation. However, it has long been recognized that the quality and fermentation performance of slurries that are reused in this manner deteriorates due to the stresses imposed during yeast handling. In this study, the importance of cone residence in the maintenance of yeast quality and potential to perform has been investigated for two lager yeast strains. The nature, magnitude, and localization of the stresses imposed during cone residence have been assessed. Furthermore, the heterogeneity of the crop based on its location during cone residence is discussed in terms of yeast viability, vitality, and potential to perform. In addition, the impact of crop generation number on this phenomenon is demonstrated. Biomarkers for the avoidance of poor slurry harvesting are proposed.

*Katherine Smart completed a B.Sc. degree (Hons) in biological sciences at Nottingham University and was awarded the Rainbow Research Scholarship to complete a Ph.D. degree in brewing yeast physiology at Bass Brewers, Burton-on-Trent. She then moved to Cambridge University to take up an appointment as research fellow in the Department of Plant Sciences, where she worked on bioactive surfaces, biofouling, and bacterial contamination of beverages. In 1992, at the age of 25, Katherine became a lecturer and then senior lecturer in microbiology and fermentation at Oxford Brookes University. Now the Scottish Courage Reader in brewing science and a fellow of the Institute and Guild of Brewing, Katherine holds a Royal Society Industrial Fellowship. Her research group currently comprises several post-doctoral researchers and Ph.D. students. Her main research interests include yeast cell biology, using yeast as a model system for the study of the molecular mechanism of aging, brewing yeast aging and resistance to stress, and the impact of stress on brewing yeast fermentation performance and final product quality. Katherine is a member of the several societies and has served on society committees and journal editorial boards. She is chair of the Institute and Guild of Brewing International Section and the international director of the American Society of Brewing Chemists.*

**XI-31****Enzymatic Generation of Factors from Malt Responsible for Premature Yeast Flocculation****3:40 p.m.**Sandra van Nierop, *The South African Breweries Ltd., Sandton, South Africa*

Coauthors: Anna Cameron-Clarke and Barry Axcell

Investigations over 3 decades, by a number of major international brewing groups, have implicated malt factors as being responsible for periodically causing premature flocculation of yeast during fermentation. The nature of these factors has remained elusive because of confounding intricacies between brewing raw materials, yeast strains, and differing brewing processes. Recent research has now allowed the production of these flocculating agents on a routine basis from malts not normally exhibiting premature flocculation. These results suggest a mechanism that could lead to a solution to this long-researched brewing issue.

*Sandra van Nierop is a research scientist in the R&D Cereals section at South African Breweries Ltd. in Johannesburg. She graduated from the University of the Witwatersrand with a B.Sc. degree in biochemistry (Hons) in 1993 receiving the Best Biological Science Student award sponsored by South African Breweries. She then joined them in 1995, after travelling the world and continuing with her studies. She obtained an M.Sc. degree in 1997, also at the University of the Witwatersrand, which investigated malt-related flavor stability of beer. Her current research focuses on the impact of barley/malt on premature yeast flocculation and the impact of barley antimicrobials on fermentation. She is currently working toward her Ph.D. degree through Stellenbosch University.*

**SAVE \$50**

When you buy at the  
MBAA Convention!

## ¡Una Célebre y Renombrada Referencia Cervecera, Ahora Disponible en Español!



© 2002; 6" x 9" pasta dura; 840 páginas;  
82 tablas; 313 Ilustraciones & Figuras

**Convention SALE Price \$125**  
Regular Price \$175

The popular *Practical Brewer, Third Edition* is now available in Spanish! Written by industry experts, this valuable reference is regarded as an outstanding basic training tool in the art and science of brewing.

### Capítulos

Historia Mundial Cervecera y su Desarrollo en las Américas; Agua; Cebada y Malteo; Adjuntos; Producción de Mosto; Composición del Mosto; Cocción del Mosto; Lúpulo; Enfriamiento del Lúpulo; Fermentación, Principios y Prácticas; Levadura – Cepas y su Manejo; Operaciones en Cavas; Envasado – Botellas; Llenado – Barriles; Calidad de la Cerveza y Métodos Sensoriales; Control Estadístico de Procesos en la Cervecería; Interpretación de Resultados de Laboratorio; Servicios de Ingeniería; Limpieza y Saneamiento; Sistemas de Control; Instrumentación; Cerveza de Baja Calorías; “Cervezas” No Alcohólicas y de Bajo Contenido de Alcohol; Temas Ambientales Afectando Operaciones Cerveceras; Técnicas Cerveceras Artesanas. Incluye los siguientes apéndices: Terminología Internacional para Pruebas de Degustación Cervecera, Tablas de Bengtsson, Tabla de Kramer, Metricación; Índice.



#3-8/03

### Technical Session XII – Award of Merit Lecture: “Chemical Engineering for Quality Brewing”

Tuesday, October 7 • 4:05 – 4:30 p.m. • Regency AB

Nick Huige, *Miller Brewing Co., Milwaukee, WI*

Abstract not available.

*Dr. Nick J. Huige started his brewing career at Schlitz Brewing Company in 1972. In 1978, he joined Miller Brewing Company, where he was manager of research engineering, planning, and packaging until his retirement in March 2002 with 30 years of experience in new process and product development in the brewing industry. A native of the Netherlands, Dr. Huige obtained an M.S. degree in chemical engineering from Northwestern University and a Ph.D. degree in chemical engineering from the Technical University of Eindhoven, the Netherlands. His doctoral work was done in the field of freeze concentration of liquid foods. Dr. Huige has been a member of MBAA since 1973, served as a past president of District Milwaukee, and been a valuable contributing member to the MBAA Technical Committee and its poster program for 8 years. Dr. Huige is currently involved in selected consulting assignments in the areas of new process technologies and plastic bottles. He has also been a member of the Institute of Brewing (now known as the Institute & Guild of Brewing following the merger with International Brewers' Guild), American Institute of Chemical Engineers, American Society of Brewing Chemist, and Institute of Packaging Professionals, and has served on the Brewing Research International Process Panel. Dr. Huige has contributed three books on brewing and has authored papers and patents in the areas of beer processing, beer flavor stability, preparation of nonalcoholic malt beverages, by-products, pasteurization, carbon dioxide, and plastic bottles for beer. In 1984, Dr. Huige received the MBAA Presidential Award for his paper on Measurement and Control of Oxygen in Carbon Dioxide. Dr. Huige has lectured for many years at the MBAA Brewing Course on the topics of flavor stability, physical stability, and foam stability. He also served as a member of the expert panel at that course. Most recently, he has lectured on plastic bottles for beer at the MBAA Packaging Technology course.*



# Thank You

MBAA volunteers tackle important issues, keep members informed, and basically make things happen.

Sincere thanks to everyone who has given his or her time and talents to make a difference in MBAA and in the technology of brewing!



MBAA especially thanks the following 2003 committee chairs who have volunteered their service to MBAA committees:

## **Bylaws Committee**

James Diamantis, *DiverseyLever, Inc.*

## **The MBAA Communicator Editorial Committee**

Jerry Hilton, *J.F. Hilton & Company*

## **2003 Milwaukee Convention Committee**

Jerry Hilton, *J.F. Hilton & Company*

## **TQ Editorial Board**

Jaime Jurado, *The Gambrinus Company*

## **Education Committee**

Warren R.D. Quilliam,  
*Coors Brewing Company*

## **Finance Committee**

Paul L. Kramer, *Rahr Malting Company*

## **Long Range Planning Committee**

Kathy M. Kinton, *Miller Brewing Company*

## **Membership Committee**

Travis L. Audet, *Redhook Ale Brewery*

## **Nomination Committee**

Kathy M. Kinton, *Miller Brewing Company*

## **Scholarship Committee**

Randy Hughes, *City Brewing Company*

## **Technical Committee**

Mike Sutton, *Coors Brewing Company*

## **Website Committee**

Ian Stanners

MBAA also thanks the member volunteers who serve on Districts. Thank you for keeping MBAA strong on the District level.

## Poster Program

Posters will be on display in the Executive Ballroom during the following hours:

### **Sunday, October 5**

Poster Set Up 2:00 – 5:00 p.m.

### **Monday, October 6**

Posters Available for Viewing 8:00 a.m. – 5:00 p.m.

Authors Present 9:30 – 10:30 a.m.

### **Tuesday, October 7**

Posters Available for Viewing 8:00 a.m. – 5:00 p.m.

Authors Present 11:15 a.m. – 12:15 p.m.

### **Co-Moderator:** Gil Sanchez, *Menomonee Falls, WI*

*Gil Sanchez completed over 20 years as a senior research engineer in the Brewing Research and Quality Assurance Division at Miller Brewing Company. During his 20 years at Miller, he has had various responsibilities in water treatment and purification, carbon dioxide recovery and purification, pasteurizer operation, corrosion control, by-products, new product development, filtration, adsorption, flavor recovery, membrane separation, product quality improvement, and environmental control. Gil received his B.S. degree in chemical engineering at the Massachusetts Institute of Technology and his M.S. degree in chemical engineering at the University of California at Berkeley. He is a member of the American Institute of Chemical Engineers and the North American Membrane Society and is active as a Milwaukee District national governor, Technical Committee member, and 2003 Convention cochair in the Master Brewers Association of the Americas.*

### **Co-Moderator:** John Harris, *Full Sail Brewing Company, Portland, OR*

*John Harris, brewmaster at Full Sail Brewing Company in Portland, OR, has 17 years of experience as a brewmaster of craft beers: 2 years with McMenamins Breweries, Portland, OR; 4 years with Deschutes Brewery, Bend, OR; and 11 years with Full Sail. John has a dual role—he manages the Riverplace Brewery in Portland, which does all the research and development of new products, and is an emissary of beer education, traveling throughout the country teaching Full Sail distributors and retailers about our beers. John has been a member of the MBAA since 1989 and is the current Board of Governors representative of District Northwestern. John has been a member of the MBAA National Technical Committee since 1995. John is also a technical editor for the New Brewer magazine and a member of the National Craft Brewers Conference Technical Committee. In 2001, John was awarded the Institute for Brewing Studies Russell Scherer Award for Innovation in Craft Brewing.*

### Poster No. 1

#### Benefits from the Use of Chlorine Dioxide as an Alternate to Hot Water Sanitation

George Agius, *JohnsonDiversey Inc., Oakville, ON, Canada*

Coauthors: Stacey Burkeen and Jim Mynatt

Chlorine dioxide solutions in the range of 5–7.5 ppm were used to replace a hot water (85°C, 185°F) sanitation regime, used for the CIP under carbon dioxide pressure, of the blending, finishing tanks, and process lines. The new CIP procedures produced a number of benefits, which include a much reduced equipment turnaround time from 2.25 h to 1.25 h and heat energy and water savings arising from the loss of the heated water used. Major remedial CIP clean breaks using hot caustic and acid were also successfully replaced with acidic cleaning at ambient temperatures under carbon dioxide counterpressure. The new program now in use for 3 years has maintained beer quality standards. The less intrusive nature of the new procedures allowed the plant to clean the tanks and lines in groups, without interrupting production. The tanks, lines, and associated valves are also no longer subjected to repeated heating and cooling stress, thereby resulting in reduced maintenance.

*George Agius, who received his master's degree in chemistry, was a lecturer on organic and physical chemistry. An MBAA member since 1987, George has contributed several technical presentations to MBAA district meetings. He has held several research positions since 1982, leading to technical director (1990) with JohnsonDiversey, and he is responsible for product development and customer support in North America. During this time, George directed the development of synthetic conveyor lubricants, new sanitizers, bottle scuff maskants, low environment impact CIP cleaners, bottlewashing new pasteurizer treatments, and accompanying engineering systems. In 2001, George became technical director for brewing and beverage applications for North America.*

### Poster No. 2

#### Investigation of Material Characteristics and Influence on Sterile Beer Filtration

John Brantley, *Pall Corporation, Cortland, NY*

Coauthors: M. Hurwitz and T. Thilert

The search for the best possible filter media for more economical sterile beer production continues. Various materials have particular advantages that will be reviewed. The overriding concern of microbiological safety dominates the brewer's requirements. The most commonly used media, nylon and PES, will be compared for mechanical stability, long-term microbiological efficiency, and ability to clean. Material characteristics and requisite processing requirements influence economy, filter recovery, and product quality. A review of materials and best practices are considered for optimizing filter life and biological safety.

*John D. Brantley, Ph.D., grew up in San Antonio, TX, and graduated from the University of Miami (Florida) in 1980 with a B.S. degree in chemistry and math (minor in physics) and an A.S. degree in biology (minor in English) and obtained his doctorate from The Johns Hopkins University Department of Biophysics in 1989. Brantley had a postdoctoral position in the Department of Agronomy at the University of Kentucky, joining the Scientific and Laboratory Department of the Pall Corporation in 1992. About that time, he began brewing beer at home. In 1996, he attended the 56th Short Course in Brewing Technology at the Siebel Institute in Chicago. Brantley currently lives in Cortland, NY, and primarily supports R&D efforts for the food and beverage market.*

**Poster No. 3****Using In-Line Concentration Measurement to Reduce Variability**

Wayne R. Brinkman, *Micro Motion, Inc., Boulder, CO*

Variation is introduced to the brewing process when assumption of concentrations is made. Changes in wort concentration can have a dramatic effect in the variability of the packaged product. Concentration of purchased products, such as liquid adjuncts, yeast nutrients, or acids used to reduce water alkalinity, can vary within the purchase specifications and also have an effect. Variation with mixtures made on site, such as DE for the filters, can have an effect on beer clarity. On-line concentration measurement of solutions and mixtures gives the brewer information to allow for dynamic compensation for changes that would normally upset the process and introduce variability. This poster will identify the benefit of using concentration over raw density, outline technology used to make concentration measurements, and discuss criteria for selection of a technology for several specific applications.

*Wayne Brinkman received a B.S. degree in mechanical engineering from the University of Washington in 1980. He has 23 years of experience in the process measurement and control industry. He has spent the last 11 years working for Micro Motion, Inc. and currently holds the position of senior sales representative. His daily responsibilities include application and sales of Coriolis technology in brewing and other industries.*

**Poster No. 4****A Comparison of Monitoring Yeast Fermentations by RF Impedance with Traditional Methods of Biomass Estimation**

John Carvell, *Aber Instruments Ltd., Science Park, Aberystwyth, U.K.*

Coauthor: R. Todd

On-line radio frequency measurements have traditionally been used in brewing to monitor the live cell concentrations being pitched into a fermenter or recovered during cone cropping at the end of fermentation. The method can, however, provide both valuable quantitative and qualitative information on the yeast biomass during fermentation. In this paper, we present a comparison for a range of pilot plant fermentations between using radio frequency to provide a measurement of viable yeast biovolume and alternative traditional methods for estimating biomass, including dry weight, microscopic counting incorporating a correction for cell viability, and the Coulter Counter. Data are also presented from production brewery fermenters using an on-line radio frequency biomass probe to track the viable cell biovolume throughout all the stages of seeding, cell growth, and flocculation. The radio frequency profiles reveal unique information at certain critical stages of the fermentation that cannot be detected by using traditional methods. We also reveal how additional real-time information on the quality of the yeast cell can be extracted in the future by using radio frequency probes.

*John Carvell is a graduate in biochemistry and received his Ph.D. degree at Newcastle University, U.K. He gained 4 years of experience in large-scale yeast fermentation as a production manager of the UK Bakers Yeast Division of Gist Brocades, Holland. After 10 years in both the Process Development and Biotechnology Sales divisions of APV and Alfa Laval, he joined Aber Instruments Ltd. of Wales in 1993 as a director. With the business over 90% export and split between both the biotechnology sector and the brewing industry, he spends a large proportion of time visiting key customers involved in a diverse range of applications areas in which the Aber technology has potential. As a member of the ASBC, the MBAA, the IOB, and the SIM (Society of Industrial Microbiology), John presented posters at the ASBC meetings in Boston and Phoenix and the IOB Symposium in Perth, Singapore, and Adelaide, and papers at the SIM Recent Advances in Fermentation Technology Symposium in Florida in 2001, ACS in 2002, and the ASBC and MBAA annual meetings in 1992. When time permits, John enjoys a number of activities including squash, fly fishing, and the occasional drop of quality warm real ale!*

**Poster No. 5****Servomyces—A Biological Nutrient**

Tobias Fischborn, *Lallemand Inc., Montreal, QC, Canada*

Coauthors: J. McLaren, E. Geiger, F. Briem, and K. Glas

Zinc deficiency in brewer's wort is a known and accepted problem in the brewing industry. Zinc is an essential mineral micronutrient for yeast which influences the stabilization of yeast proteins and membrane, activates enzymes, accelerates riboflavin synthesis, and stimulates sugar uptake. The most common practice to compensate for zinc deficiency in brewer's wort is the addition of mineral zinc. In this study, we compare the addition of Servomyces, a yeast-based nutrient, to mineral zinc and inactivated yeast with respect to their effect on fermentation kinetics, fermentation efficiency, and flavor profile. Lab fermentations have been conducted at Weihenstephan and Doemens and industrial fermentations have been conducted in commercial breweries. The results demonstrate that Servomyces shortens fermentation time and increases alcohol yield and biomass production significantly compared to a control or to mineral zinc addition. The profile of fermentation by-products determined by gas chromatography was only slightly different from the control, but the beers treated with Servomyces were described as cleaner and better balanced. Servomyces is a biological alternative to mineral zinc additions.

*Tobias Fischborn was appointed project manager for Lallemand Inc. in March 1998. He is now head of the brewing research and development group at Lallemand and is also responsible for quality control and quality assurance of all brewing-related products. With Lallemand's acquisition of the Siebel Institute of Technology in Chicago, Tobias oversees production and quality control of Siebel culture media and brewing yeast collection. He graduated from the Technical University Munich/Weihenstephan in 1993, where he obtained a degree in engineering in brewing and beverage technology. In 1993, Tobias started his Ph.D. degree at TU Munich/Weihenstephan to work with Prof. E. Geiger on "Research on behavior of lager yeast during drying". Prior to his studies in Weihenstephan, he worked as a brewer at Brewery Ph. & C. Andres in Kirn, Germany.*

**Poster No. 6****Incorporating Hygienic Matrix Manifolds into Older Brewery Systems**

Edward Hall, *Coors Brewing Co. (retired), Golden, CO*

When a brewer considers replacing outdated and worn out beer process systems, such as hose stations and valve manifolds, they can turn to utilizing matrix manifold design to accomplish the same service. Upgrading or replacing these systems with a matrix manifold presents opportunities well beyond the obvious automation and cleanliness of design. Optimized manifold design requires a disciplined approach that entails much more detail than designing a schematically identical replacement. By working with the brewer's operators and maintenance personnel, an optimized design can be developed which increases the functionality of the manifold as well as avoiding expensive post in-service changes. For optimized manifold design, considerations should involve fluid viscosities, valve pressure drops, thermal expansion of the manifold, elimination of dead legs, physical site, maintenance access (lifting and repair), manifold drainage, internal cleanability, and training aids for operations. Methodologies and examples for each of these will be presented on the poster.

*Edward Hall is currently a consultant in brewing and beverage engineering. In 2003, he retired from a 25-year career with Coors Brewing Company, where he completed engineering assignments on various brewing, fermentation, aging, and conditioning projects.*

**Poster No. 7****The Effect of a Simulated Kilning Regime on the Profile and Antioxidant Activity of the Free Phenolics Extracted from Green Malt**

Elizabeth Inns, *University of Reading, Whiteknights, Reading, U.K.*

Coauthors: J. M. Ames, H. E. Nusten, and L. Buggiey

This study evaluated the effect of a simulated kilning regime on the profile and antioxidant activity of free phenolics extracted from green malt. The free phenolics were subjected to a simulated kilning regime involving heating from 25 to 200°C over 27 h. Samples were taken at intervals throughout heating and assessed for antioxidant activity and color. Where possible, phenolics were identified and quantified. Individual peak areas, attributed to specific phenolics, changed with progressive heating during simulated kilning, as monitored by HPLC. Although there was a fall in the level of phenolics, overall there was an increase as heating increased from 80 to 100°C. Similarly, the antioxidant activity of the free phenolics decreased overall during heating, but there was an increase in activity as heating was increased from 80 to 100°C. The reasons for this temperature effect are currently being investigated.

*Elizabeth Inns received a B.Sc. degree in food science in 1979. She worked in the flour milling industry for several years. In 1998, she joined the School of Food Biosciences at The University of Reading, United Kingdom, applying capillary electrophoresis to various projects funded by the United Kingdom Food Standards Agency. Since 2001, she has been working at the University toward a Ph.D. degree, in collaboration with Brewing Research International in the United Kingdom. Her research deals with the maintenance of the redox potential in the brewing process, with a special interest in changes in the free phenolics during kilning.*

**Poster No. 8****Production of Hydrogen Sulfide by Six Lager and Ale Yeast Strains**

Ji-Yoon Kim, *Kyung Hee University, Yongin-Si, South Korea*

Coauthors: S. K. Park and Y. R. Kim

Production of hydrogen sulfide (H<sub>2</sub>S) during fermentation from six commercial lager and ale yeasts with two different worts was studied. H<sub>2</sub>S was measured by using a newly developed H<sub>2</sub>S detection tube method that could conveniently and accurately measure H<sub>2</sub>S produced by yeast during fermentation and H<sub>2</sub>S remaining in beer after fermentation. A large variation in H<sub>2</sub>S production was observed among yeast strains tested, indicating the genetic variation in H<sub>2</sub>S production. Except for the Hefeweizen ale yeast, which produced a large amount of H<sub>2</sub>S, the ale strains produced less H<sub>2</sub>S during fermentation than the lager strains. For high producers, the highest production was observed in early stages of fermentation when yeasts actively fermented worts, and such high producers also remained at high levels of H<sub>2</sub>S at the end of fermentation. However, low producers produced H<sub>2</sub>S sporadically throughout the course of fermentation and remained with only trace levels of H<sub>2</sub>S at the end of fermentation. The results also showed that wort composition did not influence the production of H<sub>2</sub>S much. From this study, yeast strains appeared to be the predominant factor for the overproduction of H<sub>2</sub>S in brewing.

*Ji-Yoon Kim is a master's student in the Food Science Department at Kyung Hee University in Korea. She received a B.S. degree in food science from the same university and has been working toward an M.S. degree under the supervision of Professor Seung Park. She is interested in studying analytical flavor chemistry, especially green tea and beer, and is currently working on the production of hydrogen sulfide in brewing. This is her first experience of presenting research data in the U.S.*

**Poster No. 9****The Importance of Free Amino Nitrogen in Wort and Beer**

Christoforos Lekkas, *Heriot-Watt University, Riccarton, Edinburgh, U.K.*

Coauthors: G. G. Stewart, A. Hill, B. Taidi, and J. Hodgson

There is a lack of knowledge as to how wort nitrogenous materials affect different yeast strains and their fermentation performance and on what levels are needed to produce high-quality beer. FAN and individual amino acid composition were examined and differences were observed between normal and various high-gravity worts, with and without adjuncts. The EBC-ninhydrin and gradient elution HPLC methods were used for measuring FAN and amino acids, respectively. For ammonia determination, a spectrophotometric assay was utilized. Different yeast strains exhibited different amino acid absorption rates and preferences. In anaerobic fermentations, adequate amino acid consumption occurred. It was determined that yeast amino acid uptake depends on an immense variety of factors, including percentage of total assimilable nitrogen, individual amino acid concentration, quality and absorption rate, amino acid competitive inhibition, yeast strain and generation, and yeast growth phase. It was also determined that FAN affects a great range of other fermentation factors such as cell growth, biomass, viability, pH, and attenuation rate. This information can be used to design a more meaningful malt specification and to adjust process parameters in the brewhouse.

*Christoforos Lekkas was born in 1977. He started his studies in 1996 in the University of Wolverhampton (U.K.) from where he received his B.Sc. degree (Hons) in biological sciences-biotechnology. His final year research project was based on the investigation of biofilm formation in water purification plant systems and the treatment of the infected water supplies by biofilms and their toxic by-products. Then, after finishing his first degree in 1999, he was accepted from Reading University (U.K.) to carry out an M.Sc. degree in food biotechnology. His postgraduate thesis work, which was a university-company (EPL Technologies Ltd) collaboration, involved the inhibition of enzymatic browning in avocados in order to extend their shelf life and also to improve their marketability. Currently, he is in his second year of his Ph.D. degree in the University of Heriot-Watt (ICBD) in Edinburgh, working under the supervision of Pr. G. G. Stewart and Scottish Courage Ltd. for a brewing project concerning the importance of free amino nitrogen in wort and beer.*

**Poster No. 10****Fine Grinding in Water and Proteolysis**

Laurent Marle, *Meura Technologies, Louvain-la-Neuve, Belgium*

Coauthor: R. Tigel

Fine grinding in water is a technique of particular interest because it can significantly reduce oxygen uptake during mashing-in. However, the grinding capacity of the mill needs to be high, since the mash-in must be accomplished in a short period of time, according to current practices. For this work, we assumed that the average grinding time can be considered as the first part of the proteolysis step, given that proteolysis reactions have a linear pattern. To demonstrate, we completed several trials with different grinding times, keeping the same total time (grinding plus proteolysis). We compared the analyses of the different worts obtained and observed that all worts were identical. This observation confirmed our assumption. Consequently, it was demonstrated that the proteolysis step after milling can be shortened by the average milling time.

*Laurent Marlé was graduated in 1999 as a brewing engineer from the Catholic University of Louvain-La-Neuve in Belgium. For his dissertation, he worked in the laboratory of Professor Collin on the topic of "Pathways of methionine degradation during the beer making process". In 2000, he spent a year in England to brush up on his English skills. Since 2001, he has been working for Meura as a research and development engineer.*

### Poster No. 11

#### Control of Hydrogen Sulfide in Beer with a Copper Electrolysis System

Egbert Pfisterer, *First Key Corp., Richmond, BC, Canada*

Coauthors: I. Richardson and A. Soti

Humans are very sensitive to hydrogen sulfide. Panelists may detect this off-flavor in beer at or below concentrations of 3 µg/L. Among the technological efforts to reduce hydrogen sulfide, the most effective approach is the dosing of minute amounts of copper ions into beer with the newly developed copper electrolysis system to precipitate it as copper sulfide. Exact control of copper treatment is crucial, since this ion has been implicated with beer staling. The traditional use of copper vessels, pipes, or copper plates does not allow such a precise control. The newly developed equipment can be installed into a beer line and consists of two unique copper electrodes. A specifically designed power supply provides the necessary voltage and current for the operation. In a typical application, the copper electrolysis system reduced hydrogen sulfide in beer from 3 µg/L to a nondetectable level while the copper content only increased from 32 to 69 µg/L. Hydrogen sulfide in beer was determined by headspace gas chromatography.

*Egbert Pfisterer has been a member of the MBAA since 1969 and contributed to the organization not only as a member of the Board of Governors but also by presenting numerous papers dealing with an array of brewing technological topics. In 1996, the Master Brewers Association of the Americas presented him with the Award of Merit. His career in brewing began in Vienna, Austria, where he studied at the University of Agriculture. He graduated with a degree in biochemical engineering and a doctorate. After coming to Canada, he worked 12 years for Labatt and then 17 years for Molson Breweries in a variety of managing positions. He is currently director of brewing technology with First Key Corporation, a consulting company, and is affiliated with Beverage Machinery Services Inc. and Beverage Engineering Inc.*

### Poster No. 12

#### Life Cycle Assessment for a Beer Production Process

Yuji Takamoto, *Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan*

Coauthors: Y. Mitani, M. Takashio, K. Itoi, and K. Muroyama

In making products, it is important to consider influences on environment. We have achieved 100% recycle of wastes and by-products generated in our brewery process. As an efficient tool to evaluate environmental impacts associated with a product, life cycle assessment (LCA) has received attention in Japanese industries since METI (Ministry of Economy, Trade and Industry) started a national LCA project in the beginning of 1998. On the basis of such a background, we have carried out LCA inventory analysis for CO<sub>2</sub> emissions in the beer production process of one of our breweries. The beer production process is composed of four processes: (i) brewing, (ii) fermentation, (iii) storage, and (iv) filtration and packaging. The LCA inventory analyses of each process were conducted by use of software, JEMAI-LCA, based on the ISO14040. The result gives useful information for the improvements of the production process in consideration of influences on environment. (JEMAI: Japan Environmental Management Association for Industry that is the secretariat of the National LCA project.)

*Yuji Takamoto received a Ph.D. degree from Tokyo Metropolitan University in 1983 and then joined Sapporo Breweries Ltd. His specialty is biophysics and he has researched various fields, e.g., thermal convection in a cylindroconical tank and the development of equipment that automatically measures a can seam with X-ray. He is currently working on environmental engineering at Frontier Laboratories of Value Creation as a senior research scientist. It is a pleasure to meet many people through science and technology.*

**Poster No. 13**  
**Control of Malt Color**

Curt Traina, *University of California, Davis*  
Coauthor: Charles W. Bamforth

The color of a beer is a key aspect of its quality, directly and indirectly impacting on the consumer's interpretation of beer style and flavor. Nonetheless, traditional methods for assessing beer color are imprecise and do not offer a good assessment of subtleties of hue and shade. The color in most beers arises from the malt complement, either the main grist pale malt (including that color developed in the wort boiling stage) or, in the case of darker beers, from a range of specialty malts. In this study, we have assessed the impact of germination, kilning, and roasting conditions on color, relying on both traditional and more sophisticated procedures for measuring color.

*Curt Traina is a native of Seattle, WA, and earned a B.A. degree in psychology from the University of Washington. He is completing a Masters degree in food science and technology at the University of California, Davis. Curt has held the positions of assistant brewmaster and brewmaster at Sudwerk Brewery and Grill in Sacramento, CA, and Sudwerk Privatbrauerei Hubsch in Davis, CA, respectively.*

**Poster No. 14**  
**The Impact of Fermentation Temperature on Yeast Reductase Activity**

Lance Lusk, *Miller Brewing Company, Milwaukee, WI*  
Coauthors: Duncombe Dick, Petr Vesely, Gabriela Basarova, John Seabrooks, and David Ryder

Yeast metabolism in brewing fermentations is responsible for the formation of and a flavor balance of desirable compounds such as higher alcohols and esters. Yeast metabolism is also responsible for the reduction of undesirable wort aldehydes. Yeast aldehyde reductase activity was measured during fermentations at 10 and 16°C using 3-methyl butanal and methional as substrates. At 16°C, both reductase activities reached maxima on the second day and then progressively decreased. At 10°C, the highest 3-methyl butanal and methional reductase activities were observed after 4 days of fermentation, followed by a slight decrease in both activities. For the lager yeast used in this work, the specific activity was higher for methional than for 3-methylbutanal. Aldehyde concentration changes were also measured. The levels of analyzed aldehydes at the end of fermentation were lower in the beer fermented at 10°C. This result shows that, by modifying the fermentation temperature, the level of aldehydes in the fresh beer can be reduced. It also suggests that the flavor stability of beer can be extended.

*Lance Lusk is group leader of flavor, foam, and hop chemistry at the Miller Brewing Company. He joined Miller in 1980 and has regularly published in the area of beer foam chemistry. Some of his other interests include hops, beer flavor, and flavor stability. He is a member of the American Society of Brewing Chemistry, the American Chemical Society, and The Protein Society. In 1996, Mr. Lusk was presented the American Society of Brewing Chemists' Eric Kneen Memorial Award for excellence in scientific publication. He studied biology at the University of Chicago and biochemistry at Roosevelt University (Chicago, IL), where he received A.B. and M.S. degrees, respectively.*



**Poster No. 15****Evaluation of the Addition of Gallotannins to the Brewing Liquor for the Improvement of the Flavor Stability of Beer**

David Logsdon, *Wyeast Laboratories, Odell, OR*

Coauthors: Guido Aerts, Luc De Cooman, Gert De Rouch, Zoltan Penzes, Annemie De Buck, Roger Mussche, and Joseph van Waesberghe

Flavor deterioration coincides with an increase in and a release of alkanals-alkenals as final products of auto-oxidation and enzymatic degradation of lipids, and with a rise in Strecker aldehydes. Oxidative reactions on iso-alpha acids, especially on the less-stable trans-isomers, result in a lower, less fine, and harsher bitterness. Next to the LOX content, the antioxidant power of the malt and the mashing-in conditions are important parameters affecting the flavor staling of beer. However, in most brewing trials, the reducing capacity of the malt and other raw materials seems insufficient to prevent these adverse effects. This work deals with the use of gallotannins to increase the antioxidant powers during the mash process. Gallotannins can act as metal-chelating, radical-scavenging, and reducing agents. They are also very effective in binding aldehydes and in coagulation/flocculation of thiol-containing proteins. The analytical data with regard to Strecker degradation of amino acids, oxidation of lipids and iso-alpha acids, and the sensory evaluation demonstrate that gallotannin addition seems promising to increase the flavor stability of the final beer.

*David Logsdon is president/director and cofounder of Wyeast Laboratories and Full Sail Brewing Company of Hood River, OR, in the United States. Wyeast is a leading supplier of fermentation cultures for brewing, winemaking, baking, and biotechnology applications. Full Sail is a U.S. western regional brewer of Ales and lager beers. David has worked in all aspects of the brewing and beverage industry from brewery start up, product formulation, brewmaster, laboratory manager, packaging development, and marketing. He lives with his family in Oregon, where he was an honor student and 1979 graduate with a degree in food science technology. David is a member of the MBAA, American Society of Brewing Chemists, and Institute of Brewing Studies, and he has served on the Board of Advisors for the American HomeBrewers Association and served on the Board of Directors of the Association of Brewers. David has served as group leader and judge on the Professional Panel of Blind Tasting for the Great American Beer Festival; judged the World Beer Cup Competition for the past several events; and served as chief judge of BrewNZ 2002 and 2003 in Wellington, New Zealand.*

*Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.*

**Poster No. 16****Lucilite TR—Structure and Performance**

M. J. Thompson, *International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland*

Coauthors: G. G. Stewart and I. P. McKeown

The structural analysis of Lucilite TR by infrared absorbance will show that polyvinylpyrrolidone (PVP) is bound to the silica carrier by hydrogen bonding. In continuation of the work presented at the last convention of this Association, the polyphenols absorbed by Lucilite TR and PVPP have been characterized using HPLC analysis. The study has employed both all-malt and corn adjunct lager beers brewed at both sales and high gravity. The beers were also tested for physical and foam stability, reducing power, color, and bitterness. It was found that both Lucilite TR and PVPP removed a proportion of the polyphenols in the beer, although to different extents. Both products served to improve the forced-aging physical stability of the beers without affecting other beer properties.

*Matthew J. Thompson graduated from the University of Aberdeen in 1998, where he obtained a B.Sc. degree (Hons) in biochemistry. In October 2000, he was awarded the M.Sc. degree in brewing and distilling from Heriot-Watt University in Edinburgh. His M.Sc. thesis was on "The effects of temperature on an ale yeast at low- and high-gravity fermentations". After this, Matthew spent a year working as a brewing operative with Shepherd Neame Brewers in Faversham, Kent. In October 2001, he returned to his native Scotland to undertake a Ph.D. degree under the supervision of Professor Graham Stewart. The research has been based around the role of polyphenols within beer and their selective removal by absorbants, namely PVPP and Lucilite TR.*

**Poster No. 17**

**Influence of Wort Boiling and Wort Clarification Conditions on Cardboard Flavor in Beer**

Masaaki Yano, *Kirin Brewery Co. Ltd., Research Laboratory for Brewing, Yokohama, Japan*

Coauthors: Tetsuji Yasui, Yutaka Ogawa, and Motoo Ohkochi

We investigated the influence of thermal load and pH during wort boiling and wort clarification processes on *trans*-2-nonenal in beer. Reduction of thermal load during wort boiling is generally considered to improve the beer flavor and stability. However, we found that the reduction of thermal load during these processes resulted in an increase in the nonenal potential of the cold wort. Regarding the pH, the lower the pH of the sweet and cast worts, the lower the nonenal potential of the cold wort. These results indicate that wort boiling and wort clarification conditions affect the development of *trans*-2-nonenal in beer.

*Masaaki Yano, born in 1973, received an M.S. degree in genetic and protein engineering from the University of Tokyo, Japan, in 1999. Since 1999, he has been employed by Kirin Brewery Co. Ltd., for 3 years as a technical supervisor for brewing at the Nagoya plant and for 1 year as a researcher at the Research Laboratory for Brewing.*

*Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.*

**Poster No. 18**

**Variability in the Malt Performance of the New Hull-less Barley Lines**

Katerina Vaculova, *Agricultural Research Institute Kromeriz, Ltd., Kromeriz, Czech Republic*

Coauthor: Vratislav Psota

Malting of hull-less barley enhances its final utilization, especially for healthy human consumption. Micromalting trials of seven hull-less barley lines using two different methods (144 and 168h) in comparison with the hulled variety Krona showed their higher extract content in malt (E) and beta-glucan content in wort (BGw); on the contrary, lower relative extract at 45°C, Kolbach number, apparent final attenuation, and friability. Differences were found for all sources of variability—years, genotypes, and malting time—that were highly correlated with BGw and friability. In the future, higher E and lower demands on the mash filter can represent advantages of hull-less barley.

*Katerina Vaculova is a senior research scientist for the Department of Breeding and Genetics at the Agricultural Research Institute Kromeriz, Ltd., Czech Republic (ARI). She received her Ing. degree from the Agricultural Academy in Moscow, her CSc. degree (= PhD) from Mendel University of Agriculture and Forestry Brno, and her diploma from a post-graduate course at Charles University Prague. Her research is focused on special barley genotypes (particularly hull-less genotypes) for different end uses (healthy human nutrition, feed for monogastrics, nonfood purposes, etc.). She is a member of the Czech Academy of Agricultural Sciences and the Research Council of the ARI.*

*Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.*

**Poster No. 19**

**Controlling the Level of Hydrogen Sulfide Production in Lager Brewing Yeast by the Introduction of Heterologous Enzymatic Pathways for Cysteine Biosynthesis**

Britt Bramsted, *Carlsberg Research Laboratory, Copenhagen/Valby, Denmark*

Coauthor: Jørgen Hansen

Brewer's yeast produces H<sub>2</sub>S which in large amounts leads to an unpleasant flavor. We have developed a system that potentially is able to reduce H<sub>2</sub>S formation two- to threefold. In yeast, H<sub>2</sub>S condenses with *O*-acetylhomoserine to produce sulfur-containing amino acids, whereas plants and bacteria condense H<sub>2</sub>S to activated serine. This pathway was expressed in two strains of brewing yeast. The effect in one strain was that the maximal H<sub>2</sub>S content decreased 2.5-fold, with the onset of H<sub>2</sub>S production delayed 1 day and ceasing 1 day earlier. In the other strain, H<sub>2</sub>S production was comparable but delayed a few hours by the pathway.

*Britt Bramsted received an M.Sc. degree in biochemistry specializing in molecular biology from the University of Copenhagen in 2000. He is currently finishing an industrial Ph.D. degree specializing in molecular biology from the Technical University of Denmark. The experimental work, which has been performed at Carlsberg Research Center, is on the sulfur metabolism of brewer's yeast and its impact on the beer flavor.*

*Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.*

**Poster No. 20**

**The Influence of Isomerized Pellets on Beer Quality**

Martin Ketterer, *Hopfenveredlung St. Johann GmbH & Co. KG, St. Johann/Hallertau, Germany*

Coauthors: Adrian Forster, Andreas Gahr, Barbara Beck, Sabine Massinger, and Roland Schmidt

Isomerized pellets are produced by adding magnesium oxide to hop powder and keeping them warm. The aim is to increase the yield of the iso-alpha-acids in the brewhouse. Less is known about the influence on beer quality. Reactions of all important components are examined. Alongside the isomerization of alpha-acids, chemical alterations to other substances also occur. In brewing trials, the effect of isomerized pellets on the composition and flavor of beer is studied. Iso-pellets are not suitable for every type of hopping and beer. Especially isomerized pellets dosed as aromatized hops have to be observed carefully.

*Martin Ketterer, born in 1964, studied brewing and beverage technology at the Technical University Munich-Weihenstephan from 1984 to 1989 and received his Ph.D. degree in 1994. From 1989 to 1995, Martin was a research assistant at the Chair for Brewing Technology I, Technical University Munich-Weihenstephan; from 1995 to 2001, he was a production manager at Privatbrauerei Ketterer, Pforzheim, Germany; and from 2001 to 2003, he was an assistant to the managing director at Hopfenveredlung St. Johann, St. Johann/Hallertau, Germany. Martin is currently the managing director at Hopfenveredlung St. Johann.*

*Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.*

**Poster No. 21**

**The Physical Mechanism Responsible for the Destabilization of Beer Foam by Fatty Acids**

Peter J. Wilde, *Institute of Food Research - Food Materials and Science Division, Norwich Research Park, Norwich, U.K.*

Coauthors: Fiona A. Husband, Daniel Cooper, Michael J. Ridout, Dominique M. Georget, and E. N. Clare Mills

Beer foam is sensitive to the presence of lipids, which can destroy the protein-stabilized foam. Foaming, surface rheology and light-scattering techniques were used to reveal the mechanism of lipid-induced destabilization of beer foam. C6 to C10 fatty acids had little impact. C12 to C14, C18:1, and C18:2 fatty acids destabilized the bubbles by weakening the protein surface, whereas C16 to C18 fatty acids formed hydrophobic aggregates that destroyed the foam by film bridging. A correlation between surface tension and foam stability of commercial beers was found. This knowledge should help develop predictive methods and production of beer with lipid resistance.

*Peter J. Wilde received a B.Sc. degree in biophysics from the University of East Anglia, Norwich, U.K., in 1985. He received his Ph.D. degree ("Interfacial mechanisms underlying the stability of protein stabilised foams and emulsions") from the Institute of Food Research and University of East Anglia in 2000. From 1985 to 1999, Peter was a research scientist at the Institute of Food Research, Norwich. He is currently a senior research scientist at the Institute of Food Research. Peter's research interests are the interfacial and molecular mechanisms underlying the stabilization of foams and emulsions by proteins and their destabilization by surfactants and lipids. Peter has been chair of the EBC foam sub-group since November 2001.*

*Previously presented at the 29th European Brewing Congress on May 17-22, 2003 at Dublin, Ireland.*

**SAVE \$10** on TQ CD-Roms at the MBAA Convention



**SAVE \$10**

When you buy at the MBAA Convention!

The *Technical Quarterly* CD-Rom is a fully-searchable, state-of-the-art CD-Rom that compiles all articles published in *Technical Quarterly* during a single year. Volume 39 covers all articles published in 2002. Volume 38 covers all articles published in 2001. Volume 37 covers all articles published in 2000.

Regular Price .....\$55

**Convention Price .....\$45**

Institutional Price .....\$295

Local Area Network (serving up to 100 computers)

[www.mbaa.com](http://www.mbaa.com) • Toll-Free 1.800.328.7560



MASTER BREWERS ASSOCIATION OF THE AMERICAS

#2PART-9/03

# Thank You Members!

## Membership matters.

*Without your continued support, MBAA would not be the leading brewing association it is today!*

MBAA membership offers a terrific opportunity to interact with other industry professionals as well as gain practical solutions, resourceful safeguards, and innovative technologies to strengthen your ability to succeed.

### MBAA members receive:

- Subscription to the MBAA *Technical Quarterly*, which includes the *MBAA Communicator*
- Opportunities to network with more than 2,500 members worldwide
- Participate in continuing education courses at a member rate
- Attend District meetings and technical conferences
- Consult MBAA for technical support
- Save on MBAA books and CD-Roms
- Receive consultant referrals from MBAA
- Keep up-to-date through monthly member e-mail newsletters
- Publish and present your research

### Not a member?

Join today!

### Already a member?

Tell a colleague.

With your help, we'll meet our 2003 new member goal! Visit the membership table during the convention or online at [www.mbaa.com](http://www.mbaa.com) for details and an application.



# Where will you strengthen your knowledge of brewery packaging operations



## 2004 Brewery Packaging Technology Course

March 8-20, 2004, University of Wisconsin - Madison, Wisconsin, U.S.A.

- ✓ Improve your understanding of the technical side of packaging operations
- ✓ Implement new and more efficient processes in your brewery
- ✓ Become a problem solver
- ✓ Increase productivity in your brewery

### Tuition Includes Practically Everything!

Educational materials; accommodations at the class site; two meals per day during instruction times; opening banquet and closing banquet; tours

### More than 35 topics covered in this two-week, in-depth training course:

- Barley and malt overview
- Hop growing and hop varieties
- Brewing overview
- Sterile filtration for the brewing process
- Keg packaging
- Bottle and can fillers and handling of beer in the filler
- Sterile filling/aseptic packaging
- Labellers, labeling operations, and adhesives
- Glass manufacturing
- Bottle closing unit operation
- Two piece aluminum can and end manufacturing
- Double seam technology
- Bottle washing / Pasteurization
- Pasteurizer water treatment
- Microbiology of packaged products
- Conveyors
- How to do operator training effectively
- Warehouse logistics
- Plastic packaging for beer PET
- Corrugated and fiberboard packaging materials
- Modern coding
- Online quality assurance equipment
- Principles of sanitation and cleaning
- Maintaining product quality and uniformity
- Packaging line project management
- Multiple packers
- Palletizers
- Bulk depalletization of cans and bottles
- Environmental issues affecting
- Packaging graphics
- Packaging plant maintenance
- Packaging line design
- Packaging line layouts
- HACCP
- Effects of packaging materials on beer flavor

**Class Size Limited to 50 - Register Today!**  
[www.mbaa.com](http://www.mbaa.com)



# Supplier Sessions Floor Plan

# 2003 MBAA Supplier Poster Sessions and Lunch

Monday, October 6 11:45 a.m. – 1:15 p.m.

Tuesday, October 7 12:00 – 1:30 p.m.

Come for information on the latest ingredients, instruments, equipment, and services to see how they impact your day-to-day work environment. Representatives from leading industry suppliers will be available to answer your questions and share the most up-to-date information on their products and services during two supplier poster sessions. A buffet lunch will be served during both sessions so plan to grab a bite to eat while visiting with the brewing industry's premier suppliers.

## New and Exciting Industry Developments

### Supplier Presentations

---

Monday, October 6 • 3:30 – 5:30 p.m. • Regency CD

**Moderator:** Rick Brundage, *Nalco Chemical Co., Moon Township, PA*

Get to know your industry suppliers at this informal and informative gathering. Enjoy MBAA hospitality while you learn more about the products and services that are available to the brewing industry.

Beer will be served, and prizes will be awarded at 3:30, 4:30, and 5:30 p.m. Must be present to win.

Presentations will be given in this order (see following pages for company description and poster location).

- |    |  |    |                                       |
|----|--|----|---------------------------------------|
| 1  | CENTEC LLC   | 26 | GE Water Technologies                 |
| 2  | Waste Management                                     | 27 | Coesi Inc.                            |
| 3  | Filtrox North America Co.                            | 28 | Buhler, Inc.                          |
| 4  | International Specialty Products                     | 29 | McCrometer, Inc.                      |
| 5  | Brewing Research International                       | 30 | S.S. Steiner, Inc.                    |
| 6  | MEURA (Brewery Equipment) Ltd.                       | 31 | Anton Steinecker Maschinenfabrik GmbH |
| 7  | Loeffler Chemical Corporation                        | 32 | Kalsec, Inc.                          |
| 8  | ENERFAB, Inc.  | 33 | A. ZIEMANN Ludwigsburg GmbH           |
| 9  | Aber Instruments Ltd.                                | 34 | Rockwell Automation                   |
| 10 | Novozymes North America                              | 35 | Tuchenhagen Flow Components, LLC      |
| 11 | Millipore Corporation – Food & Beverage              | 36 | EUROCHEM International Corporation    |
| 12 | Ponndorf   | 37 | FRINGS America Inc.                   |
| 13 | Schmidt-Seeger AG                                    | 38 | Alfa Laval Inc.                       |
| 14 | optek-Danulat, Inc.                                  | 39 | Sartorius Systems Engineering GmbH    |
| 15 | Gusmer <i>Cellulo</i>                                | 40 | Brewers                               |
| 16 | Haffmans   | 41 | INEOS Silicas                         |
| 17 | NORIT Beverage                                       | 42 | Westfalia Separator, Inc.             |
| 18 | Südmo North America Inc.                             | 43 | PALL Corporation                      |
| 19 | Ecolab Inc.  | 44 | Profamo Inc.                          |
| 20 | GKD – USA, Inc.                                      | 45 | Weyermann Specialty Malts             |
| 21 | Siebel Institute of Technology/World Brewing Academy |    |                                       |
| 22 | Briggs of Burton, Inc.                               |    |                                       |
| 23 | HDP/NERB   |    |                                       |
| 24 | USFilter   |    |                                       |
| 25 | CanongateTechnology, Inc.                            |    |                                       |

**A. ZIEMANN Ludwigsburg GmbH** **Poster 34**

Schwieberdinger Strasse 86, Ludwigsburg 71636, Germany; Phone: +49 7141 408-0; Fax: +49 7141 408-222; Website: [www.ziemann.com](http://www.ziemann.com). **Products or Services:** ZIEMANN—A powerful group. Today, the ZIEMANN-group employs at its three European locations in Germany and France more than 800 people. In 2002, these companies together supplied plants and brewery equipment for a total volume worth more than 350 Mio. Worldwide, ZIEMANN now enjoys being the largest manufacturer of brewhouse plants and tankfarms for the brewing industry. The main products and services of the ZIEMANN program for the brewing industry are turnkey brewery plants; silo-milling plants; brewhouse plants; cyl.-con. tank plants; yeast and yeast propagation plants; beer filtration plants; bright beer tank plants; sterile filtration plant; energy supply, steam, cooling, air, etc.; process automation systems (SCADA); and management information systems (MIS).

**Aber Instruments Ltd.** **Poster 14**

Represented by Gusmer*Cellulo*, 1165 Globe Ave., Mountainside, NJ 07092; Phone: +1.908.301.1811; Website: [www.gusmercellulo.com](http://www.gusmercellulo.com). **Products or Services:** Aber yeast monitors provide a rapid accurate cell count by measuring only viable yeast cells. Applications include inline measuring for cropping and pitching, as well as fermentation monitoring. Aber yeast monitors are available through Gusmer*Cellulo*.

**Alfa Laval Inc.** **Poster 39**

5400 International Trade Dr., Richmond, VA 23231; Phone: +1.804.232.5300; Fax: +1.804.236.3276; Website: [www.alfalaval.us](http://www.alfalaval.us). **Products or Services:** Alfa Laval is the leading global supplier of centrifugal separators, heat exchangers, flow and tank components, process modules, and yeast systems for the brewing industry. From design planning to production, Alfa Laval is committed to world-class service throughout the lifetime of your brewing processes. With worldwide installations and more than 400 employees dedicated to the industry, Alfa Laval brewery technology has the engineering experience and process expertise to keep your brewery running at the height of efficiency.

**Anton Steinecker Maschinenfabrik GmbH** **Poster 32**

Raiffeisenstrasse 30, Freising 85356, Germany; Phone: +49 8161 9530; Fax: +49 8161 953150; Website: [www.steinecker.com](http://www.steinecker.com). **Products or Services:** Anton Steinecker Maschinenfabrik GmbH, a subsidiary of Krones AG, is among the world's leading suppliers of brewing plants. The scope of services encompasses the planning, brewing technology, manufacturing, and commissioning of plant components, as well as turnkey projects. The range of products includes brewhouse and filter plants, fermenting and storage cellars, pasteurizing and CIP plants, and also CO<sub>2</sub> recovery systems. Our newest innovations are Merlin, Pegasus, our Twin-Flow-Filter system, and Stromboli.

**Brewers** **Poster 41**

312 Connell Highway, Newport, RI 02840-1037; Phone: +1.401.845.2072; Fax: +1.401.845.2073; Website: [www.brewerswholesale.com](http://www.brewerswholesale.com). **Products or Services:** Brewers Wholesale Supply, Inc. is an integrated approach to ingredient supply. It is a rapidly growing organization offering the brewing industry quality raw materials from around the globe: specialty malts, hops, enzymes, clarification agents, and stabilization agents. We offer comprehensive technical expertise for all our products, including full-service laboratory support; contact us at 1.800.816.8542.

**Brewing Research International** **Poster 18**

Lyttel Hall, Coopers Hill Rd., Nutfield, RH1 4HY, United Kingdom; Phone: +44 1737 822272; Fax: +44 1737 822747; Website: [www.brewingresearch.co.uk](http://www.brewingresearch.co.uk). **Products or Services:** BRi is the premier technology and information organization providing consultancy, market research, auditing, brand development, analysis, and knowledge management services to the global brewing, malting, and drinks industries. We've been at the forefront of beer research for over 50 years and our knowledge and expertise is recognized by all major international brewers.

**Briggs of Burton, Inc.** **Poster 1**

5 Marway Circle, Rochester, NY 14624; Phone: +1.585.426.2460; Fax: +1.585.426.0250; Website: [www.briggsplc.co.uk](http://www.briggsplc.co.uk). **Products or Services:** Dr. John Andrews, chair of Briggs of Burton, will address the conference on Monday, regarding developments in mash separation over the decade. The early 1990s saw wide acceptance of a new generation of highly effective mash filters. Recent design changes have strongly impacted lautering system yields, turnaround times, and wort quality.

**Buhler, Inc.** **Poster 29**

1100 Xenium Lane, Plymouth, MN 55441; Phone: +1.763.847.0231; Fax: +1.763.847.9911; Website: [www.buhlergroup.com](http://www.buhlergroup.com). **Products or Services:** Buhler provides complete solutions for grain handling and processing in the brewing and malting industry including raw material handling and storage, conveying, cleaning, grinding, weighing, and process automation. Buhler's Maltomat<sup>®</sup> gristmill has revolutionized malt grinding, setting new standards for mill performance and grist quality. Buhler is committed to helping its customers succeed by providing them with equipment and systems offering superior performance, quality, and value.

**Canongate Technology, Inc.** **Poster 26**

2045 S. Arlington Hts. Rd., Arlington Hts., IL 60005; Phone: +1.847.593.1832; Fax: +1.847.593.1629; Website: [www.canongatetechnology.com](http://www.canongatetechnology.com). **Products or Services:** Canongate Technology manufactures a range of instruments for the brewing and beverage industries. Best known for the CarboCheck inline dissolved CO<sub>2</sub> analyzer, the company also offers instruments to monitor dissolved CO<sub>2</sub>, %alcohol, Plato, calories, and Brix. Cost-effective multisensor instruments are now manufactured—choose from any of the above!



**CENTEC LLC** **Poster 22**

P.O. Box 820, Germantown, WI 53022; Phone: +1.262.251.8209; Fax: +1.262.251.8376; Website: www.centec.de. **Products or Services:** CENTEC manufactures systems for water deaeration, blending, carbonation, nitrogenation, flash pasteurization, product deaeration, and instruments to measure on-line alcohol, OG, Brix, CO<sub>2</sub>, extract, product/product/water interfaces, and represents Keofitt sampling valves and equipment.

**Coesi Inc.** **Poster 28**

2600 William-Tremblay, Suite 132, Montreal, PQ H1Y 3J2, Canada; Phone: +1.514.524.2522; Fax: +1.514.524.6699; Website: www.coesi.com. **Products or Services:** Coesi Inc. is pleased to introduce its Viscoline unit. The Viscoline can measure viscosity of fluids in a process pipe in real time. The Viscoline unit contains no moving parts and is supplied in various diameters. The Viscoline's unique features permit dilution control and dosing control and is ideal for separating yeast and beer in the waste/yeast line. Please feel free to visit our supplier poster to view our prototype unit and discuss our experiences in the beer industry.

**Ecolab Inc.** **Poster 4**

370 Wabasha St. N., St. Paul, MN 55102-1307; Phone: +1.651.293.2233; Fax: +1.651.293.2260; Website: www.ecolab.com. **Products or Services:** Ecolab is the industry leading provider of sanitation products, systems, and services for the beverage and brewing industry, including CIP and automated control systems, specialty conveyor lubricants, cleaners, sanitizers, and service expertise.

**ENERFAB, Inc.** **Poster 15**

4955 Spring Grove Ave., Cincinnati, OH 45232-1925; Phone: 1.800.966.7322 or +1.513.641.0500; Fax: +1.513.242.6833; Website: www.enerfab.com. **Products or Services:** Turnkey brewing process systems installations, shop- and field-fabricated process equipment, maintenance and renovation services, LASTIGLAS/MUNKADUR tank lining services, piping systems fabrication and installation, and Kieselmann valve/component product line.

**EUROCHEM International Corporation** **Poster 37**

600 Wendell Ct., Atlanta, GA 30336; Phone: +1.404.696.9867; Fax: +1.404.696.3367; Website: www.eurochem.com. **Products or Services:** EUROCHEM is Mexico's largest specialty chemical supplier of cleaners, sanitizers, and conveyor lubricants to the brewing industry. The same three important elements that continue to bring success in Latin America are now available in North America: superior product technology, outstanding service, and exceptional value. Don't miss our presentation on Tuesday at 8:00 a.m.

**Filtrox North America Co.** **Poster 20**

2585 S. Sarah Ave., Fresno, CA 93706; Phone: +1.559.495.3142; Fax: +1.559.495.3145; Website: www.filtrox.ch. **Products or Services:** A complete line of filtration equipment for beer filtration, beer/yeast recovery, filter media, and engineering.

**FRINGS America Inc.** **Poster 38**

1413 Sherman Rd., Ste. 30, Romeoville, IL 60446-4092; Phone: +1.630.783.1407; Fax: +1.630.783.1410; Website: www.fringsamerica.com. **Products or Services:** FRINGS America, a Chicago-based subsidiary of Heinrich Frings, Bonn, Germany, provides laboratory, pilot & production scale equipment, instrumentation, process controls, and turnkey plants for the brewing and bio-chemical industry. Featured will be Alcosens probe for real time process measurement and/or control of alcohol and temperature, Destens system for measurement and/or control of alcohol content in still bottoms, and Yeast propagators in standard sizes for R&D and production. The proprietary aerator design features high oxygen transfer, lower energy consumption, high cell densities, turnkey yeast and ethanol plants, and upgrades and retrofits. The Alcosens probe and sterile yeast aerator will be on display.

**GE Water Technologies** **Poster 27**

4636 Somerton Rd., Trevese, PA 19053-6742; Phone: +1.215.953.2396; Fax: +1.215.953.5524; Website: www.gewater.com. **Products or Services:** From boiler to the bottle, GE Water Technologies is the leader in protecting the brand image and equipment of the world's largest beverage makers. Our innovative and cost-saving chemical treatment programs for pasteurizers and bottle processing earned GEWT the reputation as the company that delivers proof, not promises, at the world's leading breweries. As the largest RO manufacturer in the world, we bring our filtration expertise to enable beverage producers to achieve global product consistency as well as product enhancements that lead to new markets and squeeze cost out of waste products.

**GKD-USA, Inc.** **Poster 3**

5469 Moose Lodge Rd., Cambridge, MD 21613-3424; Phone: +1.410.221.0542; Fax: +1.410.221.0544; Website: www.gkdusa.com. **Products or Services:** GKD Neverleak filters clearly out-perform ordinary filter leaves. Our unique frame construction and continuous seam process contribute to an even filter cake accumulation for maximum filtration. Our filter media cloth is woven on our own looms, and every filter leaf is inspected under magnification before and after polishing to ensure the highest quality filter element available.

**GusmerCellulo** **Poster 8**

1165 Globe Ave., Mountainside, NJ 07092; Phone: +1.908.301.1811; Website: www.gusmercellulo.com. **Products or Services:** For almost 80 years, GusmerCellulo has been dedicated to providing service with knowledge to the brewing industry. GusmerCellulo supplies the brewing, malting, and distilling industries with a wide variety of products. Instrumentation, malt mills, malting equipment, filtration media, and spent grain handling equipment make up a portion of our product line.

**Haffmans** **Poster 7**

6918 Forest Hills Rd., Rockford, IL 61111; Phone: +1.815.639-0322; Fax: +1.815.639.1135; Website: www.haffmans.nl. **Products or Services:** Haffmans, a member of the NORIT Group, is a leading supplier of CO<sub>2</sub> management systems and offers CO<sub>2</sub> recovery plants, CO<sub>2</sub> audits, CO<sub>2</sub> instrumentation, water deaeration, and blending and carbonation units.

**HDP/NERB****Poster 24**

200 Avenue Rd., Cambridge, ON N1R 8H5, Canada; Phone: +1.519.740.9399 or 1.800.563.8247; Fax: +1.519.740.3686; Website: [www.hdpcanada.com](http://www.hdpcanada.com) or [www.nerb.de](http://www.nerb.de). **Products or Services:** A unique partnership of European and North American engineering and manufacturing with advantages in price, technology, and quality. Brewhouse and tank fabrication, brewhouse and cellar automation, thin film vacuum wort production, process piping, malt mills, malt-grist-spent grain conveyance, and plants for CIP, yeast, pilot brewing and malting, and packaging.

**INEOS Silicas****Poster 42**

111 Ingalls Ave., Joliet, IL 60544; Phone: +1.815.727.3651; Fax: +1.815.727.5312; Website: [www.ineossilicas.com](http://www.ineossilicas.com). **Products or Services:** Global supplier of silica-based beer stabilizers, including the Lucilite and Chill-Garde product range. Please stop by to learn about our new Lucilite TR product and discuss how we can help reduce costs and improve beer quality.

**International Specialty Products****Poster 19**

1361 Alps Rd., Wayne, NJ 07470; Phone: +1.973.628.4000; Fax: +1.973.872.1583; Website: [www.ispcorp.com](http://www.ispcorp.com). **Products or Services:** ISP is recognized worldwide for its Polyclar® line of products (PVPP) used for the stabilization (longer shelf life and improved flavor) and clarification of beer, and Polyclar V & VT for wine clarification and removal of astringent flavors. The line also includes products to remove haze-causing polyphenols (Polyclar 10 and Polyclar Super R).

**Kalsec, Inc.****Poster 33**

P.O. Box 50511, Kalamazoo, MI 49006-0511; Phone: +1.269.349.9711; Fax: +1.269.382.3060; Website: [www.kalsec.com](http://www.kalsec.com). **Products or Services:** Kalsec® is the leading producer of specialty hop extracts such as isomerized and reduced hop acids, as well as distinct hop oils. These are the tools for precise bitterness control, light stability, foam enhancement, and flexibility in beer aroma and flavor.

**Loeffler Chemical Corporation****Poster 16**

5700 Bucknell Dr., Atlanta, GA 30336; Phone: +1.404.629.0999; Fax: +1.404.629.0690; Website: [www.loefflerchemical.com](http://www.loefflerchemical.com). **Products or Services:** The Loeffler Chemical Corporation is a premier provider of cleaning and sanitation products, specializing in breweries. Shown this year are new and innovative cleaning and sanitation concepts for medium- to large-size breweries. Also shown is automated foam cleaning equipment for fillers and rinsers as well as chemical control systems and allocation systems.

**McCrometer, Inc.****Poster 30**

3255 W. Stetson Ave., Hemet, CA 92545; Phone: +1.909.652.6811; Fax: +1.909.652.3078; Website: [www.mccrometer.com](http://www.mccrometer.com). **Products or Services:** McCrometer's revolutionary V-Cone differential pressure flowmeter for even the most difficult liquid and gas flow problems. Ideal for tight-fit and retrofit installations, it offers high accuracy and repeatability, extremely flexible installation, and no maintenance. It has been employed successfully in many applications including brewing, process, and facility control measurement.

**MEURA (Brewery Equipment) Ltd.****Poster 17**

1 Park Farm, Ermine St., Buntingford, Herts., SG9 9AZ, United Kingdom; Phone: +44 1763 272680; Fax: +44 1763 272321; Website: [www.meura.com](http://www.meura.com). **Products or Services:** Here at MEURA, founded in 1845, we are specialists in the design and engineering of equipment for the brewing, distilling, and associated process industries. With our in-house research and development facility, we are able to develop new equipment and processes, as well as carry out confidential research projects for our customers. Our expertise covers dry goods handling, dry and wet milling, brewhouse process vessels and mash filtration, yeast handling systems, spent grains handling, and storage systems. MEURA – Traditionally Pioneers Since 1845.

**Millipore Corporation—Food & Beverage****Poster 12**

900 Middlesex Tpk., Billerica, MA 01821; Phone: 1.800.645.5476; Fax: 1.800.645.5439; Website: [www.millipore.com](http://www.millipore.com). **Products or Services:** Properly designed filter systems and effective QA/QC monitoring improve beverage process economics, manufacturing consistency, taste, and stability. Millipore filters, test devices, services, and total quality commitment provides manufacturers with the microbial management tools to perfect clarification/pretreatment, stabilization, gas filtration, and microbial monitoring. Our expertise is your advantage.

**NORIT Beverage****Poster 6**

6918 Forest Hills Rd., Rockford, IL 61111; Phone: +1.815.639-0322; Fax: +1.815.639.1135; Website: [www.norit.info](http://www.norit.info). **Products or Services:** NORIT Beverage, a member of the NORIT Group, is a leading supplier of cross flow membrane filtration (replaces kieselguhr), nano filtration for water treatment, yeast propagation, wort aeration–yeast pitching, and flash pasteurization.

**Novozymes North America****Poster 13**

77 Perry Chapel Church Rd., Franklinton, NC 27525-0576; Phone: +1.919.494.3094; Website: [www.novozymes.com](http://www.novozymes.com). **Products or Services:** Novozymes: World leader in enzymes. With a few exceptions, Novozymes has introduced every new enzyme for the brewing industry since 1941. Breweries worldwide use Novozymes enzymes to ensure “smooth brewing operations”. From adjunct cooking through mashing, fermentation, and during maturation, our enzymes improve beer quality and increase brewhouse efficiency.

**optek-Danulat, Inc.****Poster 9**

N118 W18748 Bunsen Dr., Germantown, WI 53022; Phone: +1.262.437.3600; Fax: +1.262.437.3699; Website: [www.optek.com/brewing](http://www.optek.com/brewing). **Products or Services:** optek's inline instrumentation provides precise control of color, haze, and concentration. Our inline photometers and insertion probes control fermentation, filtration, separation, yeast pitching, wort color and clarity, DE and PVPP dosing, and more. Achieve uninterrupted processing of your best possible product with reduced product loss, improved profitability, and greater efficiency.

**PALL Corporation****Poster 44**

25 Harbor Park Dr., Port Washington, NY 11050; Phone: +1.516.484.3600; Fax: +1.516.484.5228; Website: [www.pall.com](http://www.pall.com). **Products or Services:** PALL Corporation is the global leader in the field of filtration, separation, and purification. The company provides leading-edge products to meet the demanding needs of customers in food & beverage, biotechnology, pharmaceuticals, medicine, semiconductors, municipal drinking water, and aerospace. Further information can be found on our website at <http://www.pall.com>.

**Ponndorf****Poster 11**

Represented by Gusmer*Cellulo*, 1165 Globe Ave., Mountainside, NJ 07092; Phone: +1.908.301.1811; Website: [www.gusmercellulo.com](http://www.gusmercellulo.com). **Products or Services:** Ponndorf specializes in the conveying, storage, and drying of spent grain. Their equipment also includes spent hop conveyors, as well as silos for storage of spent grain, and yeast dryers. Ponndorf products are available through Gusmer*Cellulo*.

**Profamo Inc.****Poster 45**

4933 Featherbed Ln., Sarasota, FL 34242-1560; Phone: +1.941.346.3527; Fax: +1.941.346.2807; Website: [www.profamo.com](http://www.profamo.com). **Products or Services:** Profamo Inc. has been actively involved in the brewing industry since 1976. We represent many well-known manufacturers of process and quality control equipment, including Dr. Thiedig (dissolved oxygen and inline CO<sub>2</sub> meters); Steinfurth (CO<sub>2</sub> and temperature/pressure loggers); Lg Automatic (hazemeter, foam tester, TPO accessories, and mash bath); Rotech (keg monitor); OxySense (nondestructive oxygen measurement); ACM (beer analyzer, density meters, conductivity, refractometer, and decarbonizer); Keofitt (sterile sampling); and Pfeuffer (Friabilimeter, Sortimat, Tannometer, and Viscomat). For more information e-mail us at [profamo@comcast.net](mailto:profamo@comcast.net).

**Rockwell Automation****Poster 35**

777 E. Wisconsin Ave., Milwaukee, WI 53202; Phone: +1.414.212.5200; Website: [www.rockwell.com](http://www.rockwell.com). **Products or Services:** Rockwell Automation is a leading industrial automation company focused on being the most valued global provider of power, control, and information solutions. Rockwell Automation offers solutions for brewers and OEMs that combine world-class application engineering, products, and optimization services for brewers to achieve new levels of brewery production throughput.

**S.S. Steiner, Inc.****Poster 31**

655 Madison Ave., New York, NY 10021; Phone: +1.212.838.8900; Fax: +1.212.593.4238; Website: [www.hopsteiner.com](http://www.hopsteiner.com). **Products or Services:** S.S. Steiner was started in 1845 as a small hop dealership and is today one of the largest international hops growing, trading, and processing firms. The success of the Steiner group is largely due to our continuity as a family-owned and -run business and to the hard work and innovation of present and past management and employees. We are a leading developer of innovations in hop technology and are one of the world's main producers of hop pellets, extracts, and refined hop products. The quality of our relationships in hop growing and brewing ensures quality in the entire hop chain. S.S. Steiner is "committed to the brewer".

**Sartorius Systems Engineering GmbH****Poster 40**

Weender Land Str. 94-108, Goettingen 37075, Germany; Phone: +49 551 3083700; Fax: +49 551 3083754; Website: [www.sartorius.com](http://www.sartorius.com). **Products or Services:** Sartorius AG is an internationally leading process technology supplier covering the biotechnology and mechatronics segments. Its biotechnology segment focuses on filtration and separation applications, fermenters, and proteomics. With its new crossflow system for beer clarification, as well as their range of products for cold filtration, Sartorius wants to become a leading supplier for the brewing industry.

**Schmidt-Seeger AG****Poster 10**

Represented by Gusmer*Cellulo*, 1165 Globe Ave., Mountainside, NJ 07092; Phone: +1.908.301.1811; Website: [www.gusmercellulo.com](http://www.gusmercellulo.com). **Products or Services:** Schmidt-Seeger is a manufacturer of malt mills, malting equipment, and grain-handling equipment. Internationally known for constant innovation and providing the highest quality equipment to the brewer and maltster. Schmidt-Seeger products are available through Gusmer*Cellulo*.

**Siebel Institute of Technology/World Brewing Academy****Poster 2**

Suite 2F, 1777 N. Clybourn Ave., Chicago, IL 60614-5520; Phone: +1.312.255.0705; Fax: +1.312.255.1312; Website: [www.siebelinstitute.com](http://www.siebelinstitute.com). **Products or Services:** Featuring information about World Brewing Academy and Siebel Institute courses, yeast services and laboratory media, Siebel Institute consultancy services, and Siebel Institute laboratory services. Contact us by e-mail at [info@siebelinstitute.com](mailto:info@siebelinstitute.com).

**Südmo North America Inc.****Poster 5**

6918 Forest Hills Rd., Rockford, IL 61111; Phone: +1.815.639.0322; Fax: +1.815.639.1135; Website: [www.sudmona.com](http://www.sudmona.com). **Products or Services:** Südmo, a member of the NORIT Group, is a leading supplier of high-quality stainless steel mix-proof (double seat) valves and of standard, long stroke, sampling, regulating, tank outlet, aseptic, butterfly, flow diversion, ball, and diaphragm valves. Südmo also supplies fittings, complete manifolds, and control tops that interface directly with simple I/O controls or ASI, DeviceNet, or Profibus.

**Tuchenhagen Flow Components, LLC****Poster 36**

1000 Riverside St., Portland, ME 04103; Phone: +1.207.797.9500; Fax: +1.207.878.7914; Website: [www.tuchenhagen-fc.com](http://www.tuchenhagen-fc.com). **Products or Services:** Tuchenhagen Flow Components, inventor and still the global leader in the supply of mix-proof valve and matrix piping technology, manufactures the world's largest range of sanitary rising stem valves, including modulating, pressure relief, and vacuum valves, as well as our range of pocketless inline instrumentation, cleaning devices, and the new Varitop vessel protection and cleaning system.

## USFilter

## Poster 25

10 Technology Dr., Lowell, MA 01851; Phone: +1.518.758.2179; Fax: +1.518.758.2182; Website: [www.usfilter.com](http://www.usfilter.com). **Products or Services:** USFilter offers the most comprehensive selection of water and wastewater treatment equipment and technologies available for the food and beverage industry. We offer a wide array of filtration, enhanced filtration, and purification equipment for the most efficient water treatment methods. Our line of wastewater treatment technologies, including chemical/physical, biological, evaporation, and recovery, provides the tools you need to meet compliance issues, minimize waste, reduce BOD levels, or attain "zero water discharge". USFilter designs, builds, installs, and operates complete water and wastewater systems according to your specifications.

## Waste Management

## Poster 21

720 E. Butterfield Rd., Lombard, IL 60148; Phone: +1.630.572.2016; Fax: +1.630.782.8726; Website: [www.wastemangement.com](http://www.wastemangement.com). **Products or Services:** Waste Management is the largest environmental services company in North America. With the most extensive network of recycling and disposal sites in the United States and Canada, our sales and service professionals can provide comprehensive solutions to your total waste management needs. Waste Management strives to improve in the areas of safety, operational excellence, environmental stewardship, and ethical conduct. Our in-plant services division will offer solutions specific to your industrial waste and recycling needs.

## Westfalia Separator, Inc.

## Poster 43

100 Fairway Ct., Northvale, NJ 07647; Phone: +1.201.767.3900; Fax: +1.201.767.3416; Website: [www.wsus.com](http://www.wsus.com). **Products or Services:** Westfalia Separator, Inc. is a major supplier of high-quality centrifugal clarifier equipment and technology to the brewing industry since 1893. We manufacture and service clarifiers and decanters for brewery applications such as tank bottom beer recovery, green beer, hot/trub wort, and (prior to) kieselguhr clarification. Westfalia Separator's high efficiency and economy ensures a fast return on investment, reduced waste disposal volumes, no storage capacity requirement for filter residues, and low operation, servicing, and maintenance costs.

## Weyermann Specialty Malts

## Poster 46

Brennerstrasse 17, Bamberg 96052, Germany; Phone: +49 951 93220 33; Fax: +49 951 35604; Website: [www.weyermann.de](http://www.weyermann.de). **Products or Services:** Weyermann is a family-operated malting company that produces the widest range of specialty malts made out of only Bavarian-grown two-row barley. We ship all over the world in 20' and 40' containers, bulk, or 25-kg and 50-kg bags to brewpubs, microbreweries, and macrobreweries. Just give us a call.

## Advertiser Index

Anton Steinecker Maschinenfabrik GmbH	3
Briggs of Burton, Inc.	11
Buhler, Inc.	5
Ecolab Inc., Food & Beverage Division	15
ENERFAB	7
EUROCHEM	Cover III
Rockwell Automation	Cover II
Südmo North America	Cover IV
Tuchenhagen Flow Components	13

## Attention Women Brewers!

Join your colleagues for the Woman in Brewing Networking Session. This informal networking session sponsored by Alltech, will be held Monday, October 6, 5:30 - 6:30 p.m. Don't miss this great opportunity to connect with other women working in the brewing industry!

**We'll see you there!**



# BUSINESS WILL BE BREWING IN SAN DIEGO IN 2004.



**WBC 2004**  
**July 25-28, 2004**  
**Manchester Grand Hyatt**  
**San Diego, California**

The international brewing community is coming together for the World Brewing Congress 2004, a unique meeting designed to bring brewing and associated professionals together to discuss technological advancements, new research results, brewing methodology and the future of brewing. Building on the outstanding success of WBC 2000, this meeting will have a global focus and will provide educational and networking forums such as plenary presentations, technical and poster sessions, workshops and seminars, as well as an exhibition highlighting the latest products and services available to the industry.

Mark your calendars and plan to attend the World Brewing Congress 2004. To receive further information on the Congress, please contact WBC 2004, 3340 Pilot Knob Road, St. Paul, MN 55121 U.S.A. Tel: +1.651.454.7250, Facsimile: +1.651.454.0766, E-mail: [wbc@scisoc.org](mailto:wbc@scisoc.org)

*Organized by the American Society of Brewing Chemists and the Master Brewers Association of the Americas in partnership with the Brewery Convention of Japan, the European Brewery Convention and the Institute and Guild of Brewing.*

# Hyatt Floor Plans



