UC DAVIS EXTENSION

PROFESSIONAL

BREWING PROGRAMS

YEAST PROPAGATION & HANDLING

MICROBIOLOGY & SANITATION

HEAT TRANSFER & REFRIGERATION

HOPS, BARLEY, MALT & YEAST

FINISHING & FILTRATION

BEER PACKAGING

extension.ucdavis.edu/brewing

Serious Programs for Serious Brewers

Most of the courses in the Professional Brewing Programs at UC Davis Extension take place at an on-site classroom facility at Sudwerk Brewing Company, a world-class microbrewery and brew pub located in Davis. Students have the opportunity to observe brewing and packaging operations firsthand, including beer production by Sudwerk's two systems: a fully automated 65-barrel Steinecker system and their original 15-barrel Caspary brewhouse.

Contents

For more information

For general information, call toll free (800) 752-0881 (within the U.S.) or (530) 757-8777 (outside of the U.S.). For more specific program information, call (530) 757-8899 or email extension@ucdavis.edu.

For the most up-to-date information about these programs, including course dates, class schedule and program overview and objectives, visit our website.

extension.ucdavis.edu/brewing

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Photos by Karin Higgins/UC Davis at Sudwerk Brewing Company

Professional Brewing Programs at UC Davis

With the continued growth of the brewing industry worldwide, owners and managers of major breweries, microbreweries and brew pubs can no longer afford to consider hiring untrained brewing staff. Employers continue to seek professionals who have been trained in the science and engineering of running a brewery operation, as well as those who know and understand the demands of the brewing industry.

The world-renowned brewing programs offered through UC Davis Extension are the only North American programs accredited by the prestigious Institute of Brewing & Distilling in London. And UC Davis has been the leading provider of university-level qualification in brewing science and brewery engineering since 1958.

Not only do our graduates gain unparalleled expertise in brewing science, technology and engineering, they also go on to become leaders in the brewing industry. Discover for yourself the most comprehensive brewing education programs—and join our tradition of excellence.

Our history

Since 1958, UC Davis has offered a unique specialization in brewing science as part of its undergraduate degree program in fermentation science. Michael Lewis, Ph.D., professor emeritus of brewing science, has led the brewing programs at UC Davis for more than 40 years. Throughout his prestigious career, Lewis has authored more than 100 scholarly papers and co-authored the flagship text *Brewing.*

The UC Davis Extension connection

UC Davis Extension is the professional and continuing education provider for UC Davis. Through UC Davis Extension, the general public has access to university-level training without requiring admission to a degree program.

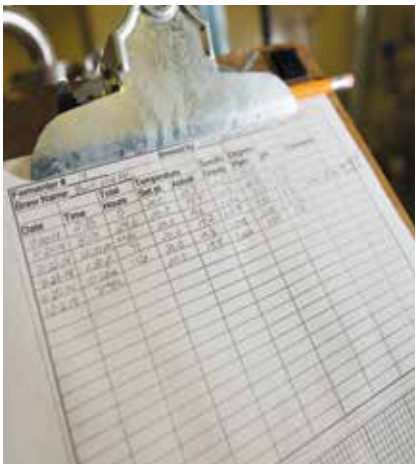
In response to the demand for condensed technical training programs in brewing science, UC Davis Extension and Lewis collaborated to create several professional brewing programs in the late sixties. The purpose of these programs was to teach a variety of skills that are required in the brewing industry.

Master Brewers Program

January-June

An intensive course of study to prepare students for the IBD Diploma in Brewing Exam, an internationally recognized qualification in brewing science.

The *Master Brewers Program* is a unique, 18-week program that provides an in-depth understanding of brewing science and brewery engineering. Major topics covered in brewing science include malting, mashing, brewing, fermentation and finishing, while the brewery engineering subject matter focuses on fluid flow, heat and mass transfer, solid-liquid separation and more. Extensively explore these two fields through courses that are the professional-level equivalents of UC Davis degree-program courses. In addition to such directed studies, students expand their brewing knowledge through assigned reading and writing exercises and visits to breweries in Northern California.



The Diploma in Brewing Examination (DBE)

The objective of the *Master Brewers Program* is to prepare candidates for the Institute of Brewing & Distilling, London, Diploma in Brewing Examination (IBD DBE). Passing the examination is an internationally recognized standard of achievement and professional qualification for practical brewers, managers and executives in breweries and malting and allied industries. This challenging nine-hour, three-part examination, consisting of two papers in brewing science and one in brewery engineering, is administered annually to more than 300 candidates worldwide. The examination is written and graded by a distinguished panel of brewing academicians, brewery scientists and engineers selected by the IBD and impaneled as the Board of Examiners. The examination is held each year in June, immediately following the *Master Brewers Program,* at UC Davis, an approved examination site.

Lecture topics

Classroom lectures are designed to provide you with an understanding of:

- Grain handling, malting, malt analysis and their effects in brewing
- Brewhouse processes and the control of wort quality
- Yeast and fermentation processes and their effects on beer quality
- Finishing beer, sterilization of beer and packaging technology
- Flow of fluids in pipes and through pumps in a brewery setting
- Heat transfer through flat and curved surfaces and the effects of insulation and fouling on efficiency
- Theory and practice of carbonation, including mixed gas technology
- Theory and practice of refrigeration in the brewery

"If you want to learn about brewing, this is one of the most in-depth ways to do it. It takes you from the field to the bottle to the store…every single aspect of brewing. You don't miss a thing!"
~Crystal Fraley, yeast propagation technician, White Labs, Davis, Calif.

Who should attend

This program is designed for persons who desire a formal professional qualification in brewing science and engineering, either to enter the brewing industry or to advance within it, or for those in formal training programs at breweries. The examinations are challenging, and only those seriously committed to study in the field of brewing science should consider enrolling. You should have some college education in science and/or engineering subjects. Practical experience is a plus, but not essential for admission at this level.

Prerequisites

While a degree is not required for acceptance to this program, college-level work in the subject areas listed below is required for success in the program. **All minimum prerequisites must be completed in advance of applying. Incomplete applications will not be considered for admission.** You must be able to provide transcripts documenting the math requirement and at least two other subject areas:

- Mathematics: pre-calculus
- Biological sciences: microbiology, cell physiology or biochemistry
- Chemistry: organic, inorganic or analytical
- Physics: heat and mechanics or process control
- Engineering: topics in mechanical or chemical engineering

For more information about the academic prerequisites, course content, etc., please visit our website at extension.ucdavis.edu/brewing.

Those who cannot document successful completion of the minimum academic prerequisites will not be admitted to the program. Such students should prepare at least one year before entering the *Master Brewers Program* by taking appropriate courses at a local college.

Fees

$16,000

The fee includes all texts, course materials, and Institute of Brewing & Distilling fees associated with the Diploma in Brewing Examination. A nonrefundable deposit of $1,000 is due at the time of acceptance to the program. The balance is due prior to the first day of the program. The fee does not include room and board. **This program has been approved for V.A. educational benefits.**

All fees are subject to change.

Withdrawal/Refund

If a request for withdrawal is received within the first five days of the course and all course materials are returned, a refund will be granted for tuition fees paid beyond the nonrefundable deposit. No refunds will be granted after the fifth class day.

Application details

Applications are reviewed and accepted on a first-come, first-served basis. Class size is limited. Early application submission is encouraged.

Complete application packages must include a completed application form, transcripts supporting the academic prerequisites, a résumé listing any practical experience in brewing or related fields and the application fee of $45.

Preparing to sit for the Diploma in Brewing Examination?

We offer three review sessions just before the examinations in June.

- Review Session I: Materials and Wort
- Review Session II: Yeast and Beer
- Review Session III: Packaging and Process Technology

Fee: $1,300 per session or save $900 by enrolling in all three sessions for $3,000.

If a request for withdrawals is received at least seven days prior to the start of the class, a refund, less a $100 processing fee, will be granted.

Professional Brewers Certificate Program

January-April

This certificate program is designed to provide a legitimate, university-approved qualification for individuals who want to enter the brewing industry, as well as brewery personnel with no formal scientific training who want to advance their careers.

The curriculum is taught simultaneously with the first 10 weeks of the *Master Brewers Program*. Through lectures, the program provides you with a solid understanding of brewing science and engineering. Your learning is measured through weekly exams and written exercises.

More specifically, the program is designed to provide you with an understanding of:

- Grain handling, malting, malt analysis and their effects in brewing
- Brewhouse processes and the control of wort quality
- Yeast and fermentation processes and their effects on beer quality
- Finishing beer, sterilization of beer and packaging technology
- Flow of fluids in pipes and through pumps in a brewery setting
- Heat transfer through flat and curved surfaces and the effects of insulation and fouling on efficiency
- Theory and practice of carbonation including mixed gas technology
- Theory and practice of refrigeration in the brewery

Students who successfully complete the program are awarded the Professional Brewers Certificate.

Prerequisites

While a degree is not required for acceptance to this program, college-level work in the subject areas listed below is required for success in the program. **All minimum prerequisites must be completed in advance of applying. Incomplete applications will not be considered for admission.** You must be able to provide transcripts documenting the math requirement and at least two additional subject areas:

- Mathematics: pre-calculus
- Biological sciences: microbiology, cell physiology or biochemistry
- Chemistry: organic, inorganic or analytical
- Physics: heat and mechanics or process control
- Engineering: topics in mechanical or chemical engineering

Practical brewing experience is a plus, but is not required for entrance to the program.

For more information on the academic prerequisites, course content, etc., please visit our website at extension.ucdavis.edu/brewing.

Fees

$9,800

The fee includes all texts and course materials. A nonrefundable deposit of $1,000 is due upon acceptance to the program. The balance is due prior to the first day of the program. The fee does not include room and board. **This program has been approved for V.A. educational benefits.**

All fees are subject to change.

Withdrawal/Refund

If a request for withdrawal is received within the first five days of the class and all course materials are returned, a refund will be granted for tuition fees paid beyond the nonrefundable deposit. No refunds will be granted after the fifth class day.

Application details

Applications are reviewed and accepted on a first-come, first served basis. Class size is limited. Early application submission is encouraged.

A complete application package must include a completed application form, transcripts supporting the academic prerequisites, a résumé listing any practical experience in brewing or related fields and an application fee of $45.

Frequently Asked Questions

When are the Master Brewers and Professional Brewers Certificate programs offered?

Each program is offered once per year. The *Master Brewers Program* is in session from the end of January to the middle of June. The *Professional Brewers Certificate Program* is in session from the end of January to the first week of April. The *Professional Brewers Certificate Program* is taught simultaneously with the first 10 weeks of the *Master Brewers Program*, so those enrolled in the *Master Brewers Program* will earn the Professional Brewers Certificate as well.

How do I apply?

You must complete and submit an application online for both the *Master Brewers Program* and *Professional Brewers Certificate Program*. Applications are reviewed and accepted on a first-come, first-served basis. All minimum academic prerequisites must be met in advance of applying. Class size is limited. Early application submission is strongly encouraged.

It is the policy of UC Davis Extension to admit students without regard to race, gender, sexual orientation, religion, creed, color, national origin, ancestry, marital status, age, disability, or any other factor prohibited by law.

Do I need to be 21 to apply?

Students do not need to be 21 years of age to apply; however, students **must be** 21 years of age when they begin the *Master Brewers Program* or *Professional Brewers Certificate Program*.

What are the prerequisites for the Master Brewers and/or Professional Brewers Certificate programs?

You must be able to provide transcripts documenting successful completion of the math requirement and at least two of the following four subject areas listed below:

Mathematics — (i.e. pre-calculus); The brewery engineering program does not require calculus for success, but competent and confident algebra skills are necessary. These skills are best described as "pre-calculus," meaning the most advanced mathematics course before a calculus course.

Biological sciences — (i.e. microbiology and/or cell biology); Biology courses, along with chemistry, are the foundation of our brewing science studies, which is about two-thirds of the total effort. You should have completed courses that are general in approach, including cell structure and function, the chemistry and biology of organelles and the cell components (e.g., proteins), and the biochemical pathways that drive the life of cells.

"I owe where I am to this program. It helped get me on a career path, not just a job, a lifelong brewing career."
~Kevin Wright, founder and brewmaster, Third Space Brewing, Milwaukee, Wis.

Chemistry — (i.e. second semester of a general chemistry course or beyond); Inorganic chemistry covering the nature of matter (e.g., atoms, chemical bonds, gases, liquids and solids, solutions, colloids and change of state) and the elements is a necessary start in this field. A similar introductory course in organic chemistry is also desirable as almost all of the molecules relevant in brewing are organic. You should understand nomenclature, structure, bonding/bonds and isomerism of organic molecules; the properties of functional groups on alcohols, esters, organic acids, aldehydes and ketones (including sugars); and aromatic compounds.

Physics — Physics is a fully acceptable substitute for engineering courses, and candidates without engineering course experience should complete some physics coursework. Physics courses on heat (temperature and thermal properties of matter and heat transfer) and mechanics (mechanical properties of matter, motion, work/energy, momentum, gas laws) are useful. Those on electricity, magnetism and light are not applicable. Process control courses are not a substitute for physics courses, but have their own value for parts of the curriculum.

Engineering — Candidates with mechanical and/or chemical engineering courses (whether or not a degree was granted) are likely to have adequate physics and math skills and probably a sufficient grasp of chemistry. Such candidates are often under-prepared in biology. If preparing for this program, you should concentrate on biology courses. Students without engineering preparation should concentrate on mathematics and physics.

Please note: You must take course(s) from an accredited institution and you must receive a passing grade in order for the course(s) to count towards the prerequisite coursework.

(continued on next page)

Do my transcripts need to be official?

No. Unofficial transcripts and/or photocopies of official transcripts will suffice.

How do I transfer credits from another institution?

You will not officially transfer credits to UC Davis Extension. Instead, you will submit a transcript demonstrating successful completion of the academic prerequisites with your application.

How does the waitlist work?

Applicants who are placed on the waitlist, but are not called to participate in the program during the year for which they applied will automatically roll over to the following year, with the top 35 being guaranteed a position and all others going back on a waitlist. The application will continue to roll until the student is offered a formal position in the program.

How much does the program cost?

Tuition for the 10-week *Professional Brewers Certificate Program* is $9,800.

Tuition for the 18-week *Master Brewers Program* is $16,000.

All fees are subject to change.

What does my tuition cover?

The fee includes all textbooks and course materials; and for those enrolled in the *Master Brewers Program*, it also covers all Institute of Brewing & Distilling fees associated with the Diploma in Brewing Examination.

Is financial aid available for the Master Brewers and/or Professional Brewers Certificate programs?

At this time UC Davis Extension students are not eligible for financial aid based on the FAFSA (Free Application for Federal Student Aid), sometimes referred to as Title IV funds, which have requirements UC Davis Extension programs do not meet. However, students in courses and programs offered through UC Davis Extension may be eligible for a tax credit for educational expense, job training funds, alternative student loans (which do not require enrollment in a degree program) or other financial assistance. For more information visit Financing Your Education on the UC Davis Extension website.

What forms of payment are accepted?

UC Davis Extension accepts Visa, MasterCard, Discover, American Express, Wire Transfer, checks drawn on a U.S. bank and U.S. money orders. UC Davis Extension is not responsible for any transaction fees. If submitting payment by wire transfer, contact the Student Services department for banking information at extension@ucdavis.edu or (530) 757-8777 or (800) 752-0881. Please allocate sufficient time to process wire transfer payments.

Does UC Davis Extension accept VA benefits?

Yes. Veterans of the U.S. military who have available educational benefits can enroll in UC Davis Extension certificate programs and obtain reimbursement from the Veterans Administration. UC Davis Extension has approval under the Veterans Educational Benefits program to allow veterans, their dependents and others who qualify for Veterans Educational Benefits to further their education via one of our certificate programs.

Contact UC Davis Extension to find out if the program that interests you has been approved for G.I. Bill educational benefits, ask questions about the process, or, when you are ready to enroll, contact Diane Carr, veteran services coordinator, at (916) 327-0007 or email va@ucde.ucdavis.edu.

Is on-campus housing available for students in the Master Brewers and/or Professional Brewers Certificate programs?

No. On-campus housing is not available to students in either program. Most students rent apartments or homes in Davis or surrounding areas (Woodland, Sacramento, Dixon). For more information about the Davis community and/or rental properties, please visit: https://daviswiki.org/.

Do you offer job placement services for graduates of the Master Brewers and/or Professional Brewers Certificate programs?

While we do not offer formal job placement services to the graduates of our programs, we do actively aid students in finding jobs in the brewing industry. For example, each year we publish a booklet that contains the résumés of each student enrolled in the Master Brewers or Professional Brewers Certificate programs for that year. The Résumé Booklet, as it's called, is then mailed to the 3,500+ microbreweries in the United States.

In addition, a weekly "Job Postings" email is distributed to the alumni of the Professional Brewing Programs, which lists various job opportunities available in the brewing industry. There are ample opportunities to network with industry representatives during the Master Brewers and Professional Brewers Certificate programs as well.

Is the *Master Brewers Program* a master's degree program?

No. The *Master Brewers Program* is not a UC Davis master's degree program. It is an 18-week certificate program. Students who successfully complete the program will be awarded the Professional Brewers Certificate.

Additional questions? Please contact Melissa Marbach, program manager, at (530) 757-8734 or mmarbach@ucdavis.edu.

From the Classroom to the Brewing Industry…

Eric Augustin
Abita Brewing Co.

Eric Bachli
Trillium Brewing Co.

Aaron Barth
Big Storm Brewery

Stephen Borutta
MillerCoors

Luke Burcham
Saint Arnold Brewing Co.

Justin Burnsed
Mockery Brewing Co.

Andrew Carle
Lagunitas Brewing Co.

Nathan Crane
Friends and Allies Brewing Co.

Brent Crowell
Foothills Brewing

Rob Croxall
El Segundo Brewing Co.

Timothy Daglow
Big Wood Brewery

Mark Denari
New World Ales

Laura Gomes de Aguiar
Anheuser-Busch, InBev - Brazil

Preston Doris
21st Amendment Brewery

Thijs Derksen
Heineken

Ronnie Fink
Modern Brewery

Kevin Foster
Anheuser-Busch, InBev

Crystal Fraley
White Labs

Aaron Gibbs
Elliott Bay Brewery Co.

Jeffrey Graves
Anheuser-Busch, InBev

Kelly Harper
Deschutes Brewery

Joe Hamborg
Toppling Goliath Brewing Co.

Jacob Harper
Deschutes Brewery

Patrick Hayes
Firestone Walker Brewing Co.

Chris Helderman
Land Grant Brewing Co.

Jeff Hueneman
Mother Earth Brew Co.

Rod Hughes
Steamworks Brewing Co.

Brandon Jacobs
Stone Brewing Co.

Bruce Johnson
Springfield Brewing Co.

Chris Keeton
Rubicon Brewing Co.

Matthew Kendall
Banks DIH Ltd.

Brian Kiss von Soly
Stone & Wood Brewing Co.

Abbot Koehler
Widmer Brothers Brewing

Amanda Koeller
Big Dog's Brewing Co.

Micah Krichinsky
Dogfish Head Craft Brewery

Jos Kuilboer
Heineken

Katie Liebl
Crux Fermentation Project

Mike Lieser
Frost Beer Works

Steve Luke
Cloudburst Brewing

Patrick Meehan
Swiftwater Brewing Co.

Jasper Miller
Higherground Brewing Co.

Benjamin Mills
Fossil Cove Brewery

Drew Morden
Tioga-Sequoia Brewing Co.

Amanda Petro
Dogfish Head Craft Brewery

Adam Osborn
RaR Brewing

Alex Rabe
The Dudes' Brewing Co.

Dhaneshwar Ramnauth
Banks DIH Ltd.

Robert Rand
Sierra Nevada Brewing Co.

Tyson Read
Iron Horse Brewery

Mackenzie Remington
Creemore Springs Brewery

Dean Roberts
Knee Deep Brewing Co.

Dana Robles
Boneyard Beer

Todd J. Rock
Leaky Roof Meadery

Ben Smith
Surly Brewing Co.

Elizabeth Stairs
Dogfish Head Craft Brewery

Bruce Stamski
Still River Brewery

Nathan Stephens
Ballast Point Brewing and Spirits

Tom Stull
Sudwerk Brewing Co.

Wes Sweigart
Out of Bounds Brewing Co.

Peter Trapani
Sierra Nevada Brewing Co.

Cortlandt Toczylowski
Barebottle Brew Co.

Kenjiro Tomita
Crooked Thumb Brewery

Gerardo Gómez Vargas
Cervecería Libertad Gto MX.

Juan Alejandro Vasquez
Boyaca Brewery

Daniel Vollmer
Oregon State University Food & Fermentation Science Program

Dan Watson
Cleophus Quealy Beer Co.

Dan Weber
Dogfish Head Craft Brewery

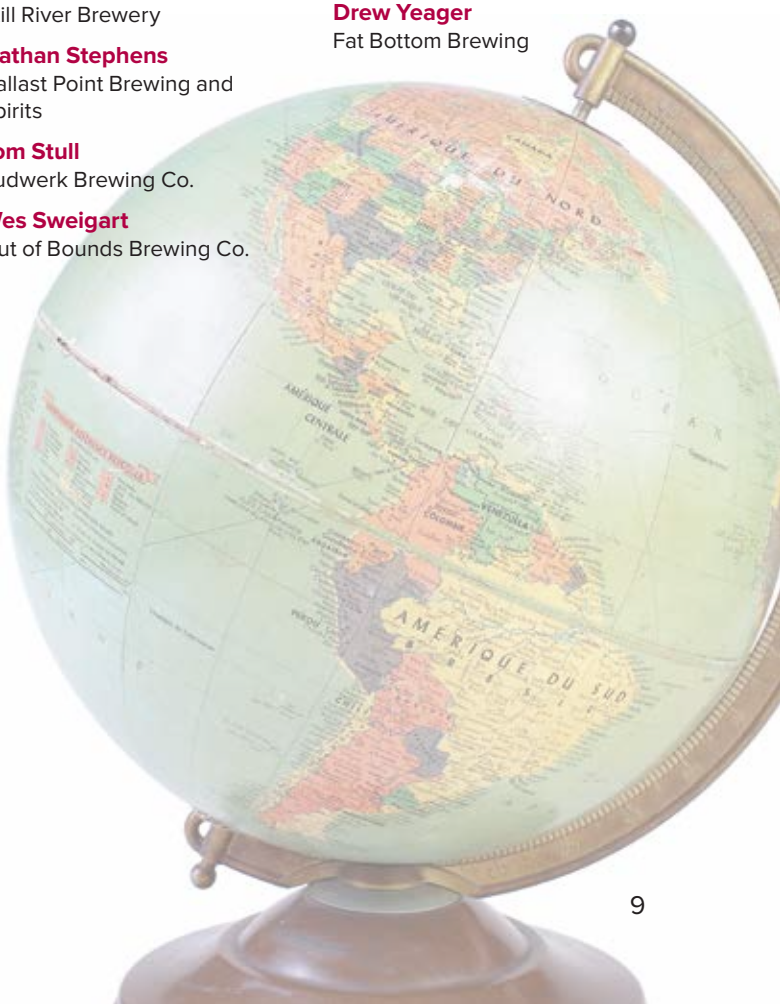
Clark Wiant
Golden Road Brewing

Alan Windhausen
Pikes Peak Brewing Co.

Kevin Wright
Third Space Brewing

Drew Yeager
Fat Bottom Brewing

Check out success stories from some of our graduates at extension.ucdavis.edu/brewing



Learn from the Best in the Business

Principal Instructor Michael J. Lewis, Ph.D.

Michael J. Lewis, Ph.D., is professor emeritus of brewing science at the University of California, Davis, and the academic director and lead instructor of UC Davis Extension's Professional Brewing Programs. Lewis has been honored with the Master Brewers Association of the Americas' Award of Merit and the Brewers Association's Recognition Award. He is an elected fellow of the Institute of Brewing & Distilling. He is also a recipient of the UC Davis Distinguished Teaching Award.

Charles W. Bamforth, Ph.D., D.Sc.

Charles W. Bamforth, Ph.D., D.Sc., distinguished professor and leader of malting and brewing studies at the University of California, Davis, has more than 37 years of academic and professional brewing expertise, including senior roles with Brewing Research International and Bass Brewers. He is honorary professor at the University of Nottingham. A fellow of several organizations, including the Institute of Brewing and Distilling (IBD), Bamforth is also editor in chief of the *Journal of the American Society of Brewing Chemists* (ASBC) and has published extensively on beer and brewing. He is recipient of the ASBC's Award of Distinction and is president of the IBD.

Thomas Stull

Thomas Stull is the head brewer of Sudwerk Brewing Co. in Davis, Calif. He holds a B.S. in economics from George Mason University and is a graduate of UC Davis Extension's *Master Brewers Program.* He has been with Sudwerk Brewing Co. since 2009.

James A. Brown, Ph.D.

James A. Brown, Ph.D., is the UC Davis Extension director of fermentation science at the University of California, Davis. With degrees in fermentation science and microbiology, his graduate research at UC Davis focused on the functional genomics of yeast and fermentation stress. He expanded on yeast responses to environmental stress as a research scientist at Stanford University School of Medicine for eight years before returning to UC Davis. He has taught microbiology of wine and beer since 1994.

Duff Harrold, M.S.

Duff Harrold, M.S., is a Ph.D. candidate in biological systems engineering at the University of California, Davis. His research specialty is thermal fluid systems with a focus on development and modeling of heat and gas transport during the bio-solarization of agricultural soils. His industrial experience includes internships with NASA and Technikon Advanced Technologies. Harrold previously served as the engineering teaching assistant for the UC Davis *Master Brewers Program* and is an avid brewer himself.

Thomas Shellhammer, Ph.D.

Thomas Shellhammer, Ph.D., is the Nor'Wester professor of fermentation science and professor of brewing and food engineering in the Department of Food Science and Technology at Oregon State University where he leads the brewing education and research programs. He has been a brewing engineering instructor for the *Master Brewers Program* since 1993. Shellhammer is a member of the Institute of Brewing and Distilling and serves on their Board of Examiners.

Sue Langstaff, M.S.

Sue Langstaff, M.S., is principal of Applied Sensory, LLC, a consulting company specializing in providing independent sensory evaluation services to breweries and wineries, and has extensive experience in the field of sensory evaluation of beer, wine and other alcoholic beverages. Langstaff has published papers in the *Journal of American Society of Brewing Chemists* and the *Journal of the Institute of Brewing.* She earned her M.S. in food science from the University of California, Davis. Her thesis, under the guidance of Michael Lewis, Ph.D., explored the sensory and instrumental evaluation of the mouthfeel of beer.

Steven P. Presley

Steven P. Presley retired from Anheuser-Busch, Inc. in 2009 as senior assistant brewmaster. During his 30-year tenure with Anheuser-Busch, he held various brewing management positions at several of their 12 breweries and also worked in the company's international brewing division. Presley is a Beer Steward Instructor and was actively involved in the creation of the Master Brewers Association of the Americas' Beer Steward Certificate Program. He is past president of the MBAA's Rocky Mountain and Southern California districts.

"We are true enthusiasts for what we do....We have a lifetime of experience and deep knowledge to share with our students and a dedication to finding and educating the next generation of brewers that far exceeds common sense or reason. The best students tap into this vigorous stream and are enthused by it."

~Michael Lewis, *Master Brewers Program* academic director and lead instructor

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1333 Research Park Drive
Davis, CA 95618-4852

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