



## Gary's Update



The barley CAP has finalized the development of barley OPA1 (BOPA1) and BOPA2. Timothy Close (University of California, Riverside) deserves special thanks for his hard work developing this important resource. A profile of his lab

group can be found on page 4. These OPAs provide the opportunity to examine alleles at over 3,000 SNP loci. Shaioman Chao has used BOPA1 and BOPA2 to genotype breeding lines from year 1 and year 2 of the project. In total 1,820 lines from 10 U.S. barley breeding programs have been genotyped. These data have been used by a variety of barley CAP participants to identify haplotype blocks and population structure, and combined with the phenotypic data the project has obtained, the location of QTL for malting quality traits, Fusarium head blight resistance and winter hardiness has been determined. Thus, the project is on track to understand the structure of the barley breeding populations in the U.S., and to identify regions of the genome that are related to important phenotypes. The first descriptions of these results were presented at the North American Barley Research Workers Meeting in Madison, WI in October (see page 2 for more detail). Manuscripts describing this work have been submitted or are in preparation. The barley CAP annual meeting will be held on January 8, 2009 in San Diego at the Hacienda Hotel. The agenda for the meeting can be found on page 1. I hope to see many of you at the meeting.

## Barley CAP Annual Meeting

**January 8, 2009**

**La Hacienda Hotel, San Diego, CA**

### Tentative Agenda

- 8:00–8:30 am Continental breakfast
- 8:30–8:40 am CAP overview, budgets, renewal proposal  
*Gary Muehlbauer, U Minnesota*
- 8:40–9:05 am Extension and education  
*Peggy Lemaux, U California, Berkeley*  
*Brian Steffenson and Sue White, U Minnesota*
- 9:05–9:20 am SNP mapping and genotyping update  
*Shiaoman Chao, USDA-ARS*
- 9:20–9:35 am Phenotypes and traits, Marker-Assisted Selection, *Kevin Smith, U Minnesota*
- 9:35–10:00 am THT, *Julie Dickerson, Iowa State U*
- 10:00–10:20 am Break
- 10:20–10:45 am Carol Powers, “Practical questions about association mapping using Barley CAP data”
- 10:45–11:10 am Patrick Hayes, Oregon State U  
“Chilling tales from the CAP”
- 11:10–11:35 am Stephen Neate, “Association mapping of QTL for Common Root Rot of spring barley: Preliminary results from assessment of the first 60,000 plants”
- 11:35–noon Jean-Luc Jannink, USDA-ARS, Ithaca, NY  
“Initial LD studies, prospects for SNP tagging and high marker density assisted selection”
- Noon–1:30 pm Lunch
- 1:30–1:55 pm Victoria Carollo-Blake, Montana State U  
“The Barley QTL Community Curation Workbook and Consensus QTL Maps on GrainGenes”
- 1:55–2:20 pm Rich Horsley, “Update on screening the 2006 and 2007 Barley CAP lines for dormancy at NDSU”
- 2:20–2:45 pm Brian Steffenson, “Association mapping of spot blotch resistance”
- 2:20–2:45 pm Sindhu Nair, “Genotypic variation in important food-use traits of barley”
- 2:45–3:10 pm Timothy Close, U California, Riverside  
“SNP mapping and BAC-SNP deconvolution”
- 3:10–3:30 pm Break
- 3:30–5:00 pm Group discussion of CAP II
- 5:00–5:30 pm Summary from advisory boards

## North American Barley Researchers Workshop in Madison, WI

The North American Barley Researchers Workshop was held in Madison, Wisconsin, on October 26-29, 2008. The workshop included a discussion of the barleyCAP activities on Tuesday. The line-up of barley CAP speakers included:

- An overview of the barley coordinated agricultural project by Gary Muehlbauer (UMinnexota).
- Using genetics to advance breeding: donning the winter CAP by Patrick Hayes, A. Corey, A. Cuesta-Marcos, T. Filichkina, P. Szűcs, and J.VonZitzewitz (Oregon State U)
- A new high-throughput screening method for measuring lipoxygenase in barley seed by Yin Li and Paul Schwarz (North Dakota State U)
- Variation, causes, and significance of grain hardness in barley for food by Sindhu Nair, Byung-Kee Baik, and Steve Ullrich (Washington State U).
- Association mapping of malt quality QTL in the U of M barley breeding program: Detection, validation, and breeding by Carol Powers (UMinnesota), Paul Schwarz, Yin Li (NDSU), and Kevin Smith (UMinnesota).
- Association mapping of Fusarium head blight QTL using contemporary barley breeding germplasm by Kevin P. Smith, Jon Massman, and Blake Cooper, Rich Horsley, Stephen Neate, Ruth Dill-Macky, Shiaoman Chao, Yanhong Dong, and Paul Schwarz)

The event also included a poster session and a banquet. The banquet speaker was : Stu Levitan (Beer Battles of Early and Modern Madison). Stuart Levitan has been a mainstay of Madison media and government since 1975. An award-winning print and broadcast journalist, he has written extensively for local and national programs on radio and television. A former county supervisor, he is the only person in Madison history to chair all three of the city's primary land use and housing committees. Since 1987, he has also been a labor mediator/arbitrator for the State of Wisconsin. His radio interview program "Sundays With Stu" can be heard each Sunday morning from 10:00 AM – noon on Madison's Progressive Talk, The Mic 92.1 FM.

## Barley CAP Conducts Plant Breeder Survey

by Sue White

A survey of barley breeders was conducted by Extension Evaluator Sue White in September of 2008. All barley breeders involved with the Barley CAP participated in the survey. There were several purposes for administering the survey. First, we wished to determine the extent to which barley breeders are using Marker-Assisted Selection (MAS) in their breeding programs, for what target traits, and how this compares to their use before becoming involved with the Barley CAP. Second, we wanted to learn if breeders think MAS is a useful tool for their breeding programs. Third, we wanted to uncover obstacles to using MAS in barley breeding programs and to explore ways the Barley CAP can help to overcome these obstacles. Finally, we wanted to discover other ways breeders would like to utilize MAS now or in the future, and whether being part of the Barley CAP has changed their attitude about MAS.

There were several interesting findings from the survey. Although the majority of breeders believe MAS is a useful tool for their breeding program, slightly less than half of them are using it extensively. More than half of the breeders reported they are using MAS more, or slightly more, than they were prior to becoming involved with the Barley CAP. There were numerous obstacles to using MAS cited, but most were related to the cost (in terms of supplies, people and space), and the lack of reliable markers that work across populations. Overwhelmingly, breeders believed the most important thing the Barley CAP can do to help overcome obstacles is to continue to identify and develop reliable and diagnostic markers, but they acknowledged this requires both time and resources. Also noteworthy is the fact that the vast majority of breeders reported that being part of the Barley CAP has changed and improved their attitude about MAS, and overall the additional survey comments made were quite positive regarding the potential for MAS to be a very effective barley breeding tool. All breeders will be eager to utilize the results and tools generated by the barley CAP.

## Article on Survey Published

by Karen Hertsgaard

An article titled *Survey of Barley Producers in Idaho, Montana and North Dakota* has been published in the Master Brewers Association of the Americas Technical Quarterly, vol. 45, no.2. The article was written by Dr. Paul Schwarz with collaboration by Dr. Richard Horsley and Karen Hertsgaard. The article is based on a paper presented by Schwarz at the 120<sup>th</sup> Anniversary Convention of the Master Brewers Association of the Americas, Nashville, TN in October 2007.

The survey was a joint effort of the IBMS, the USDA/CSREES funded barley Coordinated Agricultural Project (CAP), the Idaho Barley Commission, the North Dakota Barley Council and the Montana Wheat and Barley Committee and was mailed 5000 to growers in Idaho, Montana and North Dakota in late November 2006. A total of 1408 responses were received and was analyzed by IBMS personnel. The results of the survey have been used for outreach and education efforts by the barley CAP and the IBMS. For further information see *Barley CAP Update June 2007*.

Copies of the article are available by contacting Karen Hertsgaard ([karen.hertsgaard@ndsu.edu](mailto:karen.hertsgaard@ndsu.edu) or 701-793-1146).

## Updated Brochure and Printed Fact Sheets Available!

by Peggy G. Lemaux and Barbara Alonso

The BarleyCAP tri-fold brochure has undergone a makeover. New images were introduced, and the text has been simplified for easy reading based on feedback from surveys of barley growers and end users, conducted by Sue White in 2007. New copies have been printed and are available from Lynne Medgaarden ([medga001@umn.edu](mailto:medga001@umn.edu)).

The four Barley CAP fact sheets were revised based on grower and end user feedback, printed in color and are available for distribution from Lynne. In addition, they are all available in PDF format for download from the Barley CAP website. We also got feedback from a the IBMS Stakeholders' meeting in Colorado on additional fact sheets that might be useful. So watch for some new fact sheets to be available in the future!

## Follow Up To Extension Team Leader Meeting Addressed by CAP Extension and Education Personnel

by Karen Hertsgaard

CAP Extension and Education Personnel Barbara Alonso, Karen Hertsgaard, Peggy LeMaux, Brian Steffenson, Gary Muehlbauer and Sue White held a teleconference on August 26, 2008 to discuss follow up actions to the June 4 IBMS Extension Team Leader Meeting. The Extension Team Leader meeting was held at Coors Brewing Company in Golden, Colorado, and the barley CAP provided travel funding for participants. (See *Barley CAP Update June 2008* for further details on the meeting).

During the teleconference, the group discussed an evaluation conducted during the June 4 meeting which examined the effectiveness and usefulness of barley CAP educational materials. Results of the evaluation indicated that barley CAP educational materials are helpful and useful for disseminating information on barley CAP research and activities. The group also planned future barley CAP Fact Sheets, discussed methods to track the use of barley CAP educational and outreach materials, and planned a survey of barley CAP breeders on their use of MAS in breeding programs.

The IBMS Extension Teams were developed at the request of the IBMS Board in October 2007. The purpose of the Extension Teams is to help identify research projects and information that will help producers grow profitable, high quality barley and function in an advisory capacity to IBMS personnel. Fifty-five individuals from Idaho, Montana, North Dakota and Minnesota serve on the Extension Teams representing university research and extension personnel, industry personnel, private crop consultants and barley producers



## The University of California, Riverside BarleyCAP Team

by Timothy Close and Stefano Lonardi

The UC Riverside BarleyCAP team is a synergistic amalgamation of geneticists, computer scientists, and a programmer. The team formed about six years ago in the context of previous NSF and USDA barley projects, and since then its members have been meeting regularly to update each other on research progress, brainstorm new ideas, and identify research directions. In the context of BarleyCAP, the UCR team developed the high-throughput single nucleotide polymorphism (SNP) genetic marker system and SNP-based barley genetic linkage maps. The group interacts regularly with Shiaoman Chao to analyze new genotyping data produced at the BarleyCAP genotyping site in Fargo so that the results may be rapidly disseminated to all participants in BarleyCAP.

During 2008 and continuing into 2009 a major duty of the UCR team is to couple the genetic and physical maps to enhance opportunities for additional genetic marker development. The group

provides access via HarvEST:Barley ([harvest.ucr.edu](http://harvest.ucr.edu)) to the consensus barley SNP map, currently containing 2943 SNP loci, and small segments of the genome known as “BACs” anchored to 1150 of these mapped loci. An online portal [www.harvest-web.org](http://www.harvest-web.org) also provides access to directed acyclic graphs, which provide an alternative representation of the genetic maps.

Together, our team provides an example of the academic continuum of biological and computing expertise which has been encouraged at UC Riverside in recent years under the monikers of “Integrative Genome Biology” and “Genetics, Genomics and Bioinformatics”. We are pleased to be linked to barley breeding programs throughout the US and internationally, and thankful to have the opportunity to invest our local efforts into collective fulfillment of the noble and practical objectives of BarleyCAP.



Timothy Close is a Professor of Genetics in the Department of Botany and Plant Sciences in the College of Natural and Agricultural Sciences, which is the home of the Agricultural Experiment Station component of the University of California, Riverside campus.



Stefano Lonardi is an Associate Professor in the Department of Computer Science and Engineering in the Bourns College of Engineering.



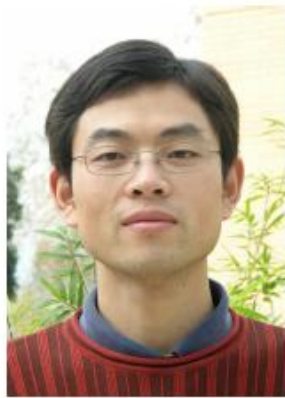
Steve Wanamaker is a Programmer who supports the HarvEST:Barley database, which has been our main engine of SNP discovery and genetic map visualization



Jessica Nguyen, undergraduate student, provides biological research support.



Ray Fenton is a Staff Research Associate who provides biological research support.



Computer Sciences PhD students YongHui Wu (*left*) and Serdar Bozdag (*right*) have been instrumental in the development of new algorithms for single and consensus map construction from very clean genotyping datasets typical of the BarleyCAP data, computation of a minimal tiling path from a physical map of BACs, and for solving gene-BAC relationships.



Post-doc Prasanna Bhat has been a key contributor to SNP data analysis for the BarleyCAP project and a full participant in all greenhouse and wet-lab activities, and data analyses related to solving gene-BAC relationships.

## Barley Genetics Newsletter Under Construction

Barley Genetics Newsletter, vol. 38, is under construction. This newsletter, now in electronic form only, enables rapid publication of research notes and other items of interest to the barley genetics community. Generally, submissions can be posted within a week of submission, so it is an ideal forum for both informal and formal communications that should be made available quickly to the community around the world. BGN is not peer reviewed; however, BGN publications can be cited by volume, page, and year. All volumes, going back to 1971, are available electronically at <http://wheat.pw.usda.gov/ggpages/bgn/>.

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## 2009 Barley Improvement Conference

The 37th Barley Improvement Conference will be held at the Best Western Hacienda Hotel in historic Old Town, San Diego, California, January 6 and 7, 2009. The Barley Improvement Conference, which was first held in 1946, provides barley researchers, barley producers, and malting, brewing, and grain trade personnel the opportunity to hear reports on the status of barley research programs and to meet and exchange information and ideas. The sponsors of the 2009 Barley Improvement Conference are:

- American Malting Barley Association, Inc.
- Idaho Barley Commission
- Minnesota Barley Research & Promotion Council
- Montana Wheat & Barley Committee
- National Barley Growers Association
- North Dakota Barley Council
- Washington Barley Commission

Everyone who is interested in barley research is invited to attend the conference. The registration fee of \$180 includes lunch, evening banquet, and receptions. Registration forms for the Conference are available from AMBA (414-272-4640) or [joann.amba@sbcglobal.net](mailto:joann.amba@sbcglobal.net) or can be downloaded at [www.ambainc.org/ni/09BICREG.pdf](http://www.ambainc.org/ni/09BICREG.pdf)

## Calendar

- January 6 & 7, 2009** Barley Improvement Conference, 37th Barley Improvement Conference will be held at the Hacienda Hotel in historic Old Town, San Diego, California.
- January 8, 2009** Barley CAP annual meeting, La Hacienda Hotel, San Diego, CA.  
Reservations: (619) 298-4707.
- January 10-14, 2009** International Plant and Animal Genome Conference, Plant & Animal Genome XVII, San Diego, CA
- March 17-19, 2009** Borlaug Global Rust Initiative Technical Workshop, Cd. Obregon, Sonora, Mexico ([www.globalrust.org/content.cfm?ID=46](http://www.globalrust.org/content.cfm?ID=46))
- March 25-27, 2009** World Barley, Malt and Beer Conference, Berlin, Germany
- June 1-5, 2009** 6<sup>th</sup> International Triticeae Symposium, Kyoto, Japan ([www.shigen.nig.ac.jp/6ITS/](http://www.shigen.nig.ac.jp/6ITS/))
- July 18-22, 2009** Joint Annual Meetings of the American Society of Plant Biologists and the Phycological Society of America, Hawaii Convention Center, Honolulu, Hawaii
- August 1-5, 2009** American Phytopathological Society Meeting, Portland, Oregon, Oregon Convention Center
- Aug 31-Sept 4, 2009** ITMI Workshop, Clermont-Ferrand, France ([colloque.inra.fr/itmi2009/itmi](http://colloque.inra.fr/itmi2009/itmi))
- Oct 13 - 16, 2009** 12th International Cereal Rusts and Powdery Mildews Conference, Antalya, Turkey. Organizer [Mahinur Akkaya](mailto:Mahinur.Akkaya@icrp2009.org) ([www.icrp2009.org/](http://www.icrp2009.org/))
- Oct 25-30, 2009** 9th International Plant Molecular Biology Congress, St. Louis, Missouri ([www.ipmb2009.org/](http://www.ipmb2009.org/))
- Nov. 1-5, 2009** ASA-CSSA-SSSA Annual Meeting at the David L. Lawrence Convention Center, Pittsburgh, PA

### **BarleyCAP**



The Barley Coordinated Agricultural Project (CAP), funded by the National Research Initiative (NRI) of the USDA Cooperative State Research, Education and Extension Service (CSREES), involves government and public- and private-sector laboratories. The project links laboratory and field research with education and outreach. It uses modern tools of genomics to facilitate classical plant breeding efforts to develop superior barley varieties.

