

Plant Science Says



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Summer travels: CropLife (France), Switzerland and a Gordon Conference By Andreas Fischer

Isabelle (my wife) and I traveled quite extensively this summer – first to France, where I was a visiting scientist at INRA-Versailles (near Paris) for two weeks, then to Switzerland for some long overdue family visits, and finally to the Boston area for the Gordon Research Conference on Plant Senescence (which takes place every four years).

At INRA, I was involved in teaching an international group of graduate students participating in 'CropLife', a large, multinational (EU-funded) project centered on barley senescence. Specifically, I organized both the lab and classroom



The INRA-Versailles plant nitrogen metabolism



Students hard at work measuring plant protease activities

activities focused on senescence-associated protein degradation, with an emphasis on standard methods for the analysis of proteolytic enzymes. I also had the opportunity to visit with several INRA scientists working on different aspects (genetics, molecular biology, cell biology) of plant nitrogen metabolism. We are finally starting to understand the role of macroautophagy in plant nitrogen remobilization, including its role in the recycling of Rubisco and other chloroplast (stromal) proteins. However, much work remains to be done before the details are worked out, including the identification of major proteases responsible for the process. Accordingly, my lectures focused on methods which may be useful to achieve that goal, but which have not been (widely) used by plant scientists including N- and C-terminal 'degradomics' and activity-based profiling (let me know if you're interested – these methods are quite powerful, but technically challenging). I'm planning to return to Versailles for two weeks in October of 2013 to participate in the bi-annual European senescence meeting, and to further explore possible collaborations in the area of barley senescence.

Besides teaching, we also found the time to profit from the incredible variety of tourist attractions in both Versailles (~15 miles southwest of Paris) and in Paris itself. The main (but by far not only) attraction in Versailles is obviously the palace. The court of Versailles was the center of political power in France from 1682, when Louis XIV moved from Paris, until the royal family was forced to return to the capital in October 1789 after the beginning of the French Revolution. The INRA site is tucked into a corner of the huge (~2000 acres) palace gardens, which I



Main entrance of the Versailles Palace (as a little joke, I was planning to say that this is the INRA Administration Building!).



The Swiss Capitol ('Bundeshaus') in Bern



The famous Versailles Palace Hall of Mirrors



Farmhouse in the village where I grew up.



Versailles Palace gardens

crossed by bicycle every day on my way to work. For those among you interested in history, the Palace was also the site where the treaty of Versailles was negotiated after World War I, a treaty which may have created more problems than it solved (but hindsight is always 20/20...).

In mid-June, we traveled to Switzerland by TGV ('train à grande vitesse', or high-speed train – it runs at up to 200 mph on some lines) for some long overdue family visits. We spent time at the place where I grew up, and where my mother still lives (just north of Bern, the capital of Switzerland), and in the village in the French-speaking part of the country where Isabelle's parents live (in the Rhone valley). That part of Switzerland is known to many tourists, as some of the best-known peaks of the Alps, including the Matterhorn, are situated in that area.

While Isabelle stayed in Switzerland until mid-July, I returned to the U.S. on July 8 to participate in the 2012 Gordon Research Conference on Plant Senescence (entitled 'Epigenetic, Genetic and Signaling Processes in Senescence'). This time, the meeting site was at Stonehill College, a private Catholic school located ~20 miles south of Boston, Massachusetts. It is



Meeting auditorium at Stonehill College

home to only ~2,000 undergraduate students, and has a quite large and beautiful campus. At the meeting, I chaired a session on 'Protein Degradation and Senescence' on Tuesday morning, and presented my group's recent work on the connections between barley flowering time and senescence regulation on Thursday. The largest problems in senescence research, namely a) its regulation by transcription factor and miRNA networks, and b) the functional details of senescence-associated nitrogen recycling (see above) were addressed by several speakers. However, given the importance of senescence processes for plant productivity and quality, amazingly few plant scientists work currently in this area, and only two labs working full-time on plant senescence are left in the US (my own and one at Cornell). It is therefore good news that, at the business meeting, it was decided to hold the next conference in the U.S. again, as opposed to one of the European sites used for GRCs. As I will co-chair that meeting with a colleague from Israel, I will be responsible for its continued success (Plant Senescence GRCs have a 36-year history), and I will also have to start thinking about how senescence research can be strengthened in the US.

After all the traveling, we were happy to find quiet Bozeman again on July 16. At times, we felt like tourists in Switzerland. Living away from your home country for 18 years would probably do that to most people...

WERA-97

By Alan Dyer

On July 11-13, WERA-97 (Western Cereal Diseases Coordinating Committee) met in Pullman, Washington in conjunction with Western Wheat Workers and WCSSA. John Sherwood, Bill Grey, and I attended the meeting graciously hosted by Drs. Tim Murray and Xianming Chen at Washington State University. Our attendance at the



Why does Bill always look like he is pulling a fast one?

meeting started with dinner at Dr. Murray's house with good food, good beverages and good conversations. On the second day, there was the WERA-97 business meeting and tours of research being conducted by Drs. Murray and Chen. Many interesting developments were discussed and presented including the development of the first *Cephalosporium* resistant wheat lines as well as evaluations of Phil Bruckner's advanced winter wheat lines for resistance to *Cephalosporium* stripe, strawbreaker and stripe rust. Due to greater humidity in the Pullman area, Tim and Chen get greater disease pressures than we can hope for here in Bozeman. In particular, symptoms like stunting which are seldom displayed in our *Cephalosporium* plots were in full expression and quite impressive there in Washington. The last treat of the tour was visiting barberry plants infected with stem rust (see photos). This is something most living plant pathologists have never seen but was common two generations ago when



Aecia of wheat stem rust (Puccinia graminis) on barberry, the alternate host.

the disease was regularly causing food shortages throughout the U.S. Forty years of barberry eradication had dramatic impacts on the disease. Keeping that in mind, the rust being found on barberry in Washington could represent as big a risk to US wheat production as Ug99. Already highly virulent races of rust have been detected

from these plants. We continue to be lucky for now.



Barberry (Berberis vulgaris) alternate host of stem rust.

After a brief meeting on the 13th, the three of us drove home worn and bedraggled but satisfied with good information and improved contacts.

**NACTA Co
nference 2012**

By Bill Hoch and Tracy Dougher

Bill Hoch and Tracy Dougher attended the 58th Annual North American Colleges and

Teachers of Agriculture (NACTA) Conference June 26-29 at the University of Wisconsin-River Falls campus near Minneapolis/St. Paul. The theme for this year's conference was "Celebrating and Sustaining Agriculture" and consisted of a variety of informative oral and poster presentations, workshops, special sessions, committee meetings and social gatherings, all focused on improving the scholarship of teaching and learning. Key workshops covered mobile computing, online learning, edible salad competition to engage students, gamefication, using concept maps, perceptions of teacher immediacy, and celebrating advising as teaching.



2011-2012 NACTA Executive Board



Tracy in the Minnesota Twins dugout

Wednesday night we were treated to a tasty barbeque and tour at the Mann Valley Laboratory Farms. Participants were also

treated to tours of local attractions, including farms, nurseries, micro-breweries, a scenic river boat ride, and a tour of Target Field. Both Bill and Tracy are members of the

editorial board for the NACTA journal. Tracy's term as Western Region director ended at this meeting (see picture of the 2011-2012 executive board). Her name is going on this year's ballot for president-elect and Bill's name will be on the slate of candidates for Western Region Director.

If anyone is interested in learning more about NACTA and attending a conference, the 60th Annual NACTA conference will be held right here at MSU in 2014!

Mycological Society of America Convention

By Cathy Cripps

The 80th meeting of the Mycological Society of America (MSA) was held July 15th-18th on the Yale Campus in New Haven, CT. The variety of architectural styles found on the 260-building campus reflect the long history of the university which dates to a charter in 1701 pre-dating the Revolutionary War. The "old campus" is reminiscent of a medieval religious complex with its Gothic churches and ornate libraries. Today the university hosts 11,000 students divided into 12 residential colleges, each with its own courtyard, dining hall and residence hall stretched over 300 acres. Unfortunately, the heat wave was not quite over when the mycology society arrived and temperatures in the 90's with high humidity were tough on us mountain residents. Our MSU group (Erin Lonergan, Ed Barge and myself) selected the terrestrial option (the foray) over the aquatic option (a schooner cruise),

although given the weather conditions, sailing might have been preferable. The pre-meeting Mycology Foray at the West Rock Ridge State Park eight miles from campus did not net many fungi as it had been hot and dry, but it did serve to join professionals with the local amateur mushroom club (those who actually know the local fungi!).

The opening ceremony was held in the Great Hall of the Yale Peabody Museum of Natural History and we had appetizers and wine and under the watchful eye of a giant Brontosaurus skeleton and surrounded by the 110 foot mural "The Age of Reptiles". A highlight of Monday morning was the Presidential Address by Dr. David Hibbett who is actually my "mycological" nephew since he was a student of Rytas Vilgalys who in turn was a student of Orson Miller, my mentor. David's phylogenetic work on the Basidiomycota has helped re-arrange the whole phylum and confirmed unlikely relationships. It was David who revealed that puffballs are related to *Agaricus* (i.e. Portobellos) and that the famous shiitake mushroom is not related to other 'gilled' mushrooms but is a polypore exhibiting convergent evolution. His recent article in Science molecularly dates the Paleozoic origin of lignin decomposition by white rot fungi which coincides with the sharp decrease in organic carbon burial at the end of the Carboniferous period. In other words, once the fungi developed lignases, deposition of organic carbon destined to become coal was reduced.

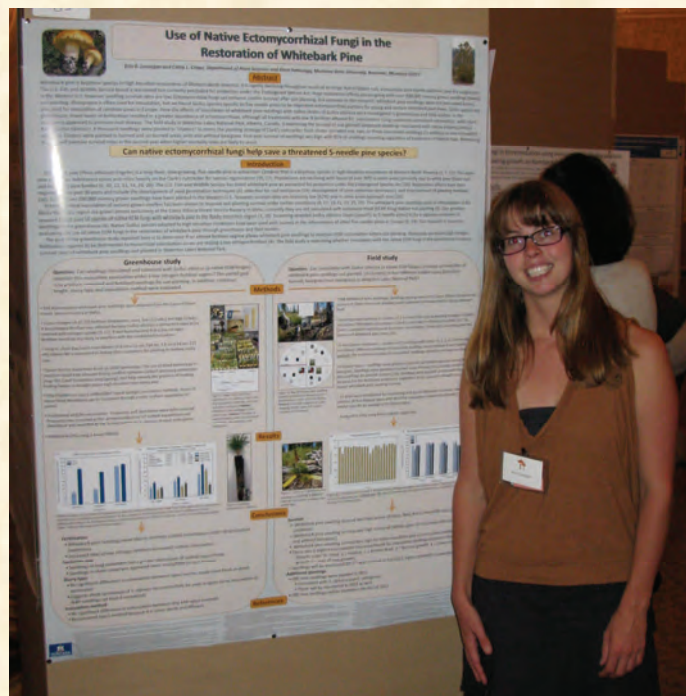
The Karling Lecture given by Dr. Barbara Valent from the University of Colorado on "Stealth Strategies of a Cereal Killer" covered her research on the rice blast fungus *Magnaporthe oryzae* and how she applies advanced techniques to understand how specialized biotrophic hyphae (apressoria and haustoria) invade and hijack living rice cells. She has demonstrated how a fungal avirulence gene actually triggers the rice resistance gene on a detailed level with implications for genetic engineering to enhance disease resistance in crop plants.



Yale campus

Another highlight of the conference was the Symposium on Comparative Genomics of Fungi. In the PSPP department, there is always ongoing discussion on the Oomycota (which includes the damping off and potato blight “fungi”)—are they true fungi or not? These organisms are ‘fungal-like’ with ‘mycelium’ and ‘spores’ but unlike fungi, their cell walls are composed of cellulose and they have a diploid nuclear condition. So for years, certain plant pathologists in our department have claimed that if it ‘walks like a duck (a fungus), it is a duck” and I have maintained that molecular analysis tells us these organisms are related to brown algae. Well, now we learn that it is likely horizontal transfer of fungal genes that is responsible for the fungal-like characteristics of this group. So.....does that make it a fungus or not? Another concept that needs time to sink in is the idea of “dispensable chromosomes” found in some Dothideomycetes---whole sets of chromosomes maintained in some populations that are also a result of horizontal gene transfer and that are apparently not necessary for survival. Dr. Gary Strobel was one of the first to suggest that horizontal gene transfer occurred in fungi.

The overall theme of the conference was “Linking Fungal Biology to Application” so with that in mind, I summarized my work on “Linking Fungal Biology to Restoration of Whitebark Pine, a tree in peril with Host-specific Native Ectomycorrhizal Fungi” in the session I chaired on ‘Ectomycorrhizal Ecology and Conservation Biology”. MSU graduate student Erin Lonergan presented some of this information in her poster on “The Use of Native Ectomycorrhizal Fungi in the Restoration of Whitebark Pine”. A significant portion of the conference was on phylogenetic analysis of various fungal groups ---we are still trying to figure out “the species” and their evolutionary histories and we are behind other disciplines since only 5% of our organisms are named. Dr. Lee Taylor’s new research now suggests that there are an estimated 6 million species of fungi, not the 1.5 million we once hoped to name. In addition, nomenclature (naming system) is in



Erin presenting her poster at MSA.

transition as we move to the “one fungus, one name” goal in which the separate names for the asexual and sexual stages of fungi are combined. Right now, I would say that this is rather a mess as we figure out “which” name is to be used and currently either the sexual or the asexual name can be used! However, some progress is being made in modernizing the nomenclature system as Latin descriptions are no longer required and e-publication counts as a legitimate reference for new species. Notification to Mycobank now appears to be a requirement.

MSU graduate student Ed Barge presented his preliminary work on the phylogenetics of the “Ectomycorrhizal Genus *Lactarius* in the Rocky Alpine Zone” which was of particular interest to our colleagues who collect in Alaska and Greenland. The session on bar-coding of fungi was of particular interest to Ed. It was great to see former MSU student, Todd Osmundson who completed his PhD at Columbia and is now a Post Doc at Berkeley. He chaired a session on Fungal Conservation and presented his research on fungal evolution. He recently helped Ed in his molecular analysis. **T**odd’s family consists of Todd, his wife **A**ngela, daughters **G**retchen and **C**lara which some of you might recognize as representing the **ATGC** basepairs of DNA (yes, it was intentional!).



Ed discussing his poster at MSA.

The conference ended with the Banquet at the lush Omni Hotel at the edge of the Yale campus and the annual "Mycology Auction" which is always interesting. Mycological reprints, books, and mushroom paraphernalia (jewelry, hats, socks, etc.) were available at the silent and the oral auctions. The auction provides a way to donate money to the organization and gain mycological items (useful or not). Next year the meeting will be in Texas in August with APS so 'hot weather' will again be on the agenda!

New Combine for the Post Farm By Bill Grey

Bernie Schaff was nice enough to pose with the new combine that was purchased from the Kincaid Enterprises. The combine arrived last week and will be put to work on the coming harvest of grain and pure seed. Bernie became a major advocate during the last 4-5 years for a replacement of the International Harvester that was approaching 25 years old. After many contacts with manufacturers and farm personnel with multiple makes and models, it was decided that the Sampo-Rosenlew 2450 would be the best fit for departments involved with small grains and pulse

research. The combine is manufactured in Finland where it is used widely for mid-sized farms and also in many foundation seed programs in the US. The combine has a system for thorough clean out necessary for pure seed certification and is efficient in harvesting fields upwards of 20 acres. The former combine will remain functional and be called upon for field clean-up of the research plots. Funding for the Kincaid combine came from the Experiment Station, Post Farm, Montana Foundation Seed, and MAES Variety Research Fee Program.



A new harvest combine and an old harvester

Workshop Held for Bitterroot Valley Beekeepers

By Kevin Wanner and Ruth O'Neill

Commercial honey bee colonies raised to pollinate crops have experienced significant declines during the last decade due to a syndrome termed colony collapse disorder (CCD). Media reports and educational efforts by the USDA have raised public concern and the interest in hobby beekeeping nationwide has increased. In response to popular demand in Montana, MSU Extension Entomology has begun supporting this public interest by arranging or participating in introductory beekeeping workshops. In many locations there is a waitlist to participate, including the workshop that was held on Saturday July 7th at the Grange Hall in Hamilton. The event was hosted by Ralph Johnson and Al Pernichele of Ravalli County Extension. Even without advertisement the maximum enrollment of twenty-five people registered, a mixture of hobbyist beekeepers and



Commercial beekeeper Warren Neyenhuis (right) shares his beekeeping expertise"

commercial producers. There were also quite a few people with no beekeeping experience at all, interested in learning more about beekeeping before jumping in.

The morning session featured an introduction to basic honey bee biology by Kevin Wanner. Ruth O'Neill then did a hands-on demonstration of how to assemble a hive and introduce a new package of bees to a hive, as well as an inventory of cold-climate overwintering strategies. Cam Lay, State Entomologist with the MDA and coordinator of the state apiary program, provided an overview of honey bee regulatory information and MDA's hive inspection practices, and Ruth O'Neill finished the morning with a summary of common pests and diseases of managed honey bee hives.

After lunch, the group headed out to a cluster of hives in an apple orchard adjacent to the Western Agricultural Research Center in Corvallis. In spite of the fact that the air temperature by this time was approaching 95°F, participants cheerfully put on bee suits, bee veils, and gloves, and then braved a cloud of disturbed bees as several of the hives were opened for inspection. Experienced commercial beekeeper Warren Neyenhuis along with Al Pernichele, who owns the orchard and hives, showed the group how to inspect the hives and move the frames

without disturbing the queen (you do not want to loose your queen bee!). A variety of practical topics, such as supplemental feeding and disease inspections, were demonstrated. People attending introductory beekeeping workshops are highly motivated and inquisitive and most workshops include lots of lively discussion. This group was no exception, generously sharing information and asking thoughtful questions.

Class Focus

BIOB 105 Introduction to Biotechnology, team taught, organized by David Sands

What better way to start college than to have a look at some world class problems and some current biological innovations that might make a difference? Examples: general malnutrition, drought, overgrazing, caloric and protein deficiency, resource depletion, obesity, emigration from rural regions, plant and animal diseases, growing chronic diseases, human parasites, soil infertility, violence due to dietary deficiencies, water purity and water availability problems. We have combed the campus for people who will present their spiel on what it might take to actually mitigate some of these problems. These will be a potpourri of scientists from diverse departments who look for new solutions to old problems. They tend to be readers, thinkers and successful doers. The student who takes this course might end up with an open optimistic attitude and perhaps a clearer sense of direction of where modern biology might be headed. And if, heaven forbid, the student's parent or relative is diagnosed with a serious disease, one might be able to ask some very relevant state-of-the-art questions about the quality of science involved in the diagnosis. No one can predict with much accuracy where modern biology is going to take us. The new and powerful tools we have to detect environmental toxins, genetically inherited traits, nutritional mitigation and disease



prevention, early stages of cancer, and emergent diseases can improve humanity significantly. This course is designed to be an open door to some world class problems, be they medical, animal health, human nutrition, or third world subsistence agriculture.

New Employees

Jie Xie - Gary Strobel



Jie Xie is an Associate Professor at Southwest University in China. Her main research field is the biological control of plant pathogens. She has also been interested in isolating and characterizing enzymes from certain microbes that make chitinase, cellulase and elastase.

She is presently a visiting professor in the lab of Gary Strobel and will be here for one year. Jie will work on endophytes that have the potential to control plant pathogens.

New Graduate Students

Erin Gunnink - Alan Dyer, Adviser



Hi, I am Erin Gunnink. I will be a starting graduate student this August and will be working with Dr. Alan Dyer concerning root diseases of wheat and barley. Some of you may already know me as I am a local Bozemanite and

graduated this spring from MSU. When I am not being a student you may see me hanging out downtown or up to my elbows in my much-loved perennial garden (or, alternately, cursing my vegetable garden). I have a fondness for Jane Austen, Terry Pratchett and a broad variety of other authors, both silly and serious. Although I enjoy gardening, taekwondo is my passion. I am a 4th degree black belt; I enjoy the extensive taekwondo family and stress relief it brings to my life. I look forward to starting this fall, meeting new faces and

learning new things. So if you are bored and would like someone to chat with concerning perennial groundcovers (Woolly Thyme is my favorite), stop by and say hi!

I aim to earn a Master's in Plant Science and will be studying plant pathology. My focus will be pathogen-pathogen interactions. This spring I graduated from MSU with a B.S. in Environmental Horticulture.

Master Gardeners Convention By Toby Day, Extension Horticulture Associate Specialist

The MSU Extension booth at the Gallatin County Farmers' Market has been successful now for several years. The booth started with an idea and grant won by Mary Burrows, who oversaw the booth for two years. For the last two years there has been an addition of the Master Gardener Booth adjacent to



Extension specialists and Master Gardeners manning the Farmer's Market Booth

Extension's. With the addition of the Gallatin County Master Gardeners, our Extension Specialists and volunteers have been more available to the public to answer question pertaining to home and garden questions.

Each Saturday at 7:30 a.m., the booths are hauled to the Gallatin Valley fairgrounds where canopies, tables, chairs and displays of MontGuides are set up by the local Master Gardener volunteers who need to fulfill their volunteer commitment hours to become certified. Even before the opening bell (to signify that the market has opened) the Master Gardeners and Extension

Specialists will probably answer up to 20 questions. Throughout the morning, the specialists and volunteers can get as many as 300 visitors. The average is around 175. It is a busy atmosphere with people perusing the long list of MontGuides, which often spurs conversations and questions. People can bring in samples of insects, diseased plant material, soil issues, abiotic issues, or they can simply describe their issue to one of the many people available for questions. My favorite part of the booth is that all of us learn from one another. You almost always see the Master Gardeners listening to the specialists give their recommendations to the clients that come to the booth so that they know how to answer the question next time it is posed to them. It is a win – win for all.

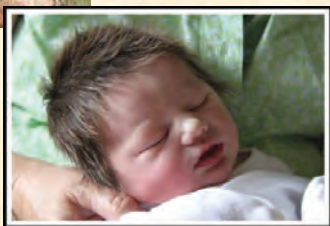
Samples that are not easily identified or explained are taken to the Schutter Diagnostic Lab the following Monday for identification and for control measures. This opportunity is a rarity in any county, but because of the proximity of MSU campus to the market, the people of the Gallatin Valley have a greater opportunity to meet the folks face-to-face.

I'm particularly proud of what the booths accomplish each week. Be sure to attend the Saturday market and say "Hi" to those manning the booths. The Gallatin Valley Farmer's Market is open on Saturdays from 9:00 am to noon through Sept 8.

New Arrivals



Rebekah VanWieren and Brent Rosso welcomed Noelle (Ellie) VanWieren Rosso into their family on July 9. She weighed 7 lbs 5 oz. and joins older sister Penelope.



Dillon Hofferber was born on July 10, 2012. He is the first child of Nathan and Jamie Hofferber of San Jose CA, and the first grandchild of Perry Hofferber. Nathan was raised in Bozeman and is a graduate of Bozeman High School. Dillon was 8 lbs 7 oz and 21 inches at birth and is a healthy and happy baby boy.

Congratulations to all of you!

Recipe of the Month

Strawberry and Feta Salad

- 3/4 cup slivered almonds
- 2 cloves garlic, minced
- 1 teaspoon honey
- 1 teaspoon Dijon mustard
- 1/4 cup raspberry vinegar
- 2 tablespoons balsamic vinegar
- 2 tablespoons brown sugar
- 1 cup vegetable oil
- 1 head romaine lettuce, torn
- 1 pint fresh strawberries, sliced
- 1 cup crumbled feta cheese



In a skillet over medium-high heat, cook the almonds, stirring frequently, until lightly toasted. Remove from heat, and set aside.

In a bowl, prepare the dressing by whisking together the garlic, honey, Dijon mustard, raspberry vinegar, balsamic vinegar, brown sugar, and vegetable oil.

In a large bowl, toss together the toasted almonds, romaine lettuce, strawberries, and feta cheese. Cover with the dressing mixture, and toss to serve.

August Birthdays

- Anna Snap 3
- Barry Jacobsen 6
- Al Scharen 9
- Mike Ivie 16
- Jean Allen 23
- Peter Suci 24
- Ruth O'Neill 26
- David Sands 30

