

Plant Science *Says*



Volume 17, No. 4

The Department of Plant Sciences and Plant Pathology

May, 2015

Congratulations Graduates!

By Jill Scarson

On May 8, the Plant Sciences and Plant Pathology Department will hold a reception and awards ceremony for our graduates in 108 PBB/Mathre Courtyard at 3:00 p.m. The graduates will receive the following books: Landscape Design graduates - "The Artful Garden: Creative Inspiration for Landscape Design"; Crop Science and Sustainable Crop Production graduates - "Weeds of the West"; Plant Biology graduates - "Rocky Mountain Natural History" and "Foraging the Mountain West"; Horticulture Science graduates will receive loupes (magnifying glass). All the graduates will receive a cowbell and pin from the College of Agriculture, as well as a coffee mug and a geranium from the Department. Following are the names of all those that will receive diplomas.

Graduate Students

Edward Barge - M.S., Plant Sciences
Jay Kalous - Ph.D., Plant Genetics
Vipan Kumar - Ph.D., Plant Genetics
David May - M.S., Plant Sciences
Afaf Nasseer - Ph.D., Plant Genetics
Cecil Tharp - Ph.D., Plant Pathology

Undergraduates

Environmental Horticulture - Horticulture Science

Michael Logatto - B.S.
Rob Partain - B.S.
Joshua Pecukonis - B.S., Honors

Environmental Horticulture - Landscape Design

Scott Samson - B.S., Honors

Plant Sciences - Crop Sciences

Michael Nelson - B.S.
Tyson Stillman - B.S.

Plant Sciences - Plant Biology

Brandon Deily - B.S., Highest Honors
Wesley Dudley - B.S.

Sustainable Food & Bioenergy Systems -

Sustainable Crop Production

Thomas Bowers - B.S.
Tracy Calvert - B.S.
Hannah Manthey - B.S., Honors
Tyson Stillman - B.S.

Congratulations to each of you and we wish you all the best in your future endeavors!

Presentations in the Tallgrass Prairie:

CELA 2015

By Rebekah VanWieren

In March, Jennifer Britton and I attended the academic conference for the field of Landscape Architecture, CELA (Council of Educators in Landscape Architecture). The conference was located in "the little apple", Manhattan, Kansas, hosted by Kansas State University and their Landscape Architecture department.

This year's conference theme was *Incite Change | Change Insight*, exploring the ways we create a difference, deepen our understanding, and broaden application of work through research, teaching, designing, and serving. My paper presentation was on the preliminary findings of one study that is part of the Student Farm Design Project I have been working on this past year. The presentation was part of the Urban Design track, one of 12 conference tracks, and focused on design principles for cultural sustainability of student farms in the campus landscape. At the conference, it was great to connect with potential research collaborators who have been working with their institution's student farm space and program.

I attended excellent presentations on planting design in response to climate change, urban agriculture, and service-learning design studios, in particular, a fascinating studio project out of Iowa State University. The studio course has been working on developing and installing a landscape master plan at a woman's prison, where, prior to the partnership and construction of new outdoor spaces, the women were not allowed to touch any living element when they were outdoors.



Kansas State University student union gallery exhibit presented by the Landscape Architecture program, displaying plans for re-envisioning a surface waterway running through central campus.

Two personal highlights from the conference were a keynote panel discussion and a SketchCrawl. The keynote panel, moderated by Kristina Hill, Associate Professor in Landscape Architecture and Environmental Planning at University of California at Berkeley, included three visionaries from diverse disciplines - an artist (Lauren Bon, The Metabolic Studio), landscape ecologist (Richard Forman, Harvard Graduate School of Design), and plant geneticist (Wes Jackson, The Land Institute). Thought-provoking questions about the ways in which they each incite change for the future of the environment led to discussions where I couldn't stop frantically taking notes. One of my favorite questions was, "How do you know what you know - how do you gain insight?" The SketchCrawl field trip was at the nearby



SketchCrawl at the Konza Prairie Biological Station.

Konza Prairie Biological Station, a native tallgrass prairie preserve jointly owned by The Nature Conservancy and Kansas State University. One of the ongoing studies there looks at rotational controlled prairie burns along with bison grazing. We sketched onsite during a "bluebird" afternoon, and sketchbooks were then part of an exhibit that evening. The spring burns they were doing while we visited made for some great sketching material!



Prairie burns at the Konza Prairie Biological Station (Credit: Konza Prairie LTER).

BIFAD Hosted by MSU: PSPP has Key Role By Florence Dunkel

The Board for International Food and Agricultural Development (BIFAD) is the advising entity for the U.S. Agency for International Development on food and agricultural issues. The Board consists of seven members drawn from academia and the private sector. One of the seven is MSU President Waded Cruzado. The Board's primary duties are to provide guidance in the U.S. Government's Global Hunger and Food Security Initiative: *Feed the Future*.

In BIFAD's several decades long history this is only the second time they have chosen to meet on a university campus. This visit, spanning four days, has been over a year in planning, down to the finest detail, involving most of the campus, including Montana Public Television. Portions of the formal sessions were live-streamed worldwide. Florence Dunkel served on the MSU Planning Committee.

David Sands and Florence Dunkel were selected by President Cruzado to present the first panel of the public session: *Effective Developments for Enhanced Nutrition in*

Smallholder Farming. Their fresh, innovative, field-tested research on how both plant pathogens and insects can play a positive key role in Feeding the Future were new ideas to most of BIFAD. Both professors, working separately, had engaged the small holder farmers in solving their own major food production and food-related health problems: corn production in striga-infested fields; and locally eliminating malaria while reducing under-nutrition. Both initiatives were community-based actions, involving women-run cottage industries. Dave's work in Kenya was well-funded by the Gates Foundation and Florence's work in Mali was substantially funded by USDA NIFA and USAID. To complete the panel of innovative research at the grass roots level, Dr. Edward Dratz, MSU Professor of Chemistry and Biochemistry was added to the panel to provide the biochemical basis of the Kenya and Mali work as well as share his nutritional biochemistry research with cognitive development. Glenn Duff, Department Head of Animal and Range Sciences, served as moderator for their 75-minute panel in SUB BALLROOM A, on April 9.

Following the formal meetings, Mark Young provided a walking tour of thermophilic microbes in Yellowstone National Park. According to Mark Varner, while enjoying the macro-fauna of the Park, he appreciated learning how these microbes relate to Feeding the Future. Mark Varner is Senior Counselor of BIFAD, based in Washington D.C., at the Association of Public and Land-Grant Universities (APLU) and former Department Head of Animal Science at University of Maryland. Other members of the visiting team hosted in part by PSPP was Dr. Brady Deaton, Chancellor Emeritus of University of Missouri and Chair of BIFAD.

Yes! President Cruzado did include tropical *Acheta* smoothies in the breakfast menu for BIFAD members, as well as Chapul bars at the Museum of the Rockies reception for BIFAD. These bite-size bars were also made with *Acheta* (cricket) flour. PSPP played a key role in planting several new ideas in the minds of BIFAD and their USAID and APLU colleagues who traveled to Bozeman with them.

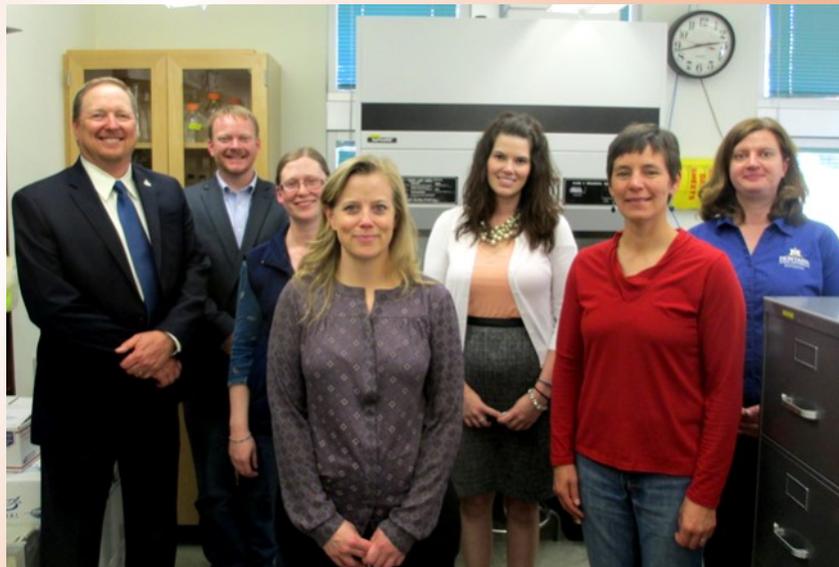
MSU Extension Agents Receive Training from the Schutter Diagnostic Lab **By Laurie Kerzicnik and Eva Grimme**

As part of the Montana Nutrition Conference, a friendly group of 26 extension agents joined us in the Schutter Diagnostic Lab to

receive further training on submitting samples, what to expect for the 2015 season, and to express what they needed from the Schutter Diagnostic Lab. All the insect samples that I have received from the agents since I started were pinned and on display for them to see in addition to a display of spiders, wood-boring insects, and gall-making insects. Mary Burrows had some timely diseased wheat samples to show the agents and she also introduced a new diagnostic kit for wheat streak mosaic virus that she had developed in cooperation with Sue Brumfield. Eva presented current disease issues including winter kill, black knot disease, and turf grass problems. She also showed the agents some plant disease diagnostic kits that are available for the agents to test for certain pathogens like tobacco mosaic virus (TMV), cucumber mosaic virus (CMC), *Phytophthora* sp. and others.

It was great to meet with the agents and to put faces to the names of new agents that recently joined Extension!

In addition, Jeff Bader, Dean and Director of MSU Extension, took one of Congressman Zinke's staffers and the Deputy State Director to visit the Schutter Diagnostic Laboratory on Wednesday, April 22.



Jeff Bader, Dean and Director of Extension, Jeremy Carpenter (Deputy State Director), Mary Burrows, Laurie Kerzicnik, Jocelyn Galt (Congressman Zinke's staffer), Jane Mangold, and Eva Grimme. Jeff Bader took Jeremy and Joselyn on a tour of campus including the Schutter Diagnostic Lab.

New Crop Virus



Bright Agindotan was recently recognized for revealing a new crop virus. The switchgrass he tested exhibited mosaic symptoms—splotchy, discolored leaves—characteristic of a viral infection, yet tested negative for known infections. Deep

sequencing, a new technology, revealed that the plants were infected with a new virus in the genus mastrevirus, the first of its kind found in North America.

“My fear is that this virus is in corn and wheat, and we are not even aware of it,” said first author Bright Agindotan, a former postdoctoral researcher at the Energy Biosciences Institute, housed within the Carl R. Woese Institute for Genomic Biology. “It’s like when you are sick and go to the hospital, but the doctors say nothing is wrong with you because they only test for what they know.”

Please go to this website for the full report: <http://www.igb.illinois.edu/news/first-report-new-crop-virus-north-america>.

Lab Focus

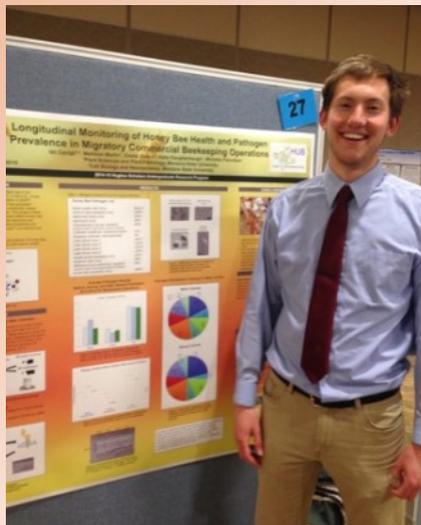
Flenniken Lab – On the Move: Recent Highlights

By Michelle Flenniken

The semester has flown by and we have been “busy bees”. It was too difficult to select one topic to share about for the May PSPP newsletter, so I decided to highlight a few of our recent activities. I am fortunate to have a great lab with really active and engaged students.

Madison Martin – McNair Scholars Graduate Tuition Award recipient, will be a graduate student in the Microbiology and Immunology

Department this fall. Madison recently presented her research investigating the metabolomics signatures of pathogen and pesticide stress in honey bees at the Montana Academy of Sciences event in Butte and at MSU’s Student Research Celebration.



Ian Cavigli, Cell Biology major who will graduate this May, presented his research on bee associated pathogens at the Nation Council on Undergraduate Research in Spokane, WA in April.

Emma Garcia, Bioengineering major and Honors College student, presented her research

Ian Cavigli presenting his research on honey bee pathogens and colony health at the MSU’s Student Research Celebration.

investigating the use of viruses as biomarkers for honey bee health and examining virus abundance in conjunction with agrochemical exposure at the West Coast Biological Sciences Undergraduate Research Conference in San Diego, CA.

Ian, Emma, and Dani Bergey also recently presented their Hughes Undergraduate Scholars Program outreach project that was focused on the development of educational signage for the future bee research/pollinator garden at the Horticulture Farm. Ian and Emma were selected to have their work presented at the meeting of the Board for International Food and Agricultural Development (BIFAD).

Rory Running, a USP student who was co-mentored by Michelle and Sara Mast in the School of Art, showed her work blending science and art in the form encaustic painting/mixed media pieces and an artistic observation colony at MSU’s Student Research Celebration; these pieces will be displayed at



Left to right: Laura Brutscher, Katie Daughenbaugh (red shirt), William Sprow (behind Katie), Elisa Boyd, Michelle Flenniken, Emma Garcia (which sweater in back), Madison Martin (brown shirt), and Ian Cavigli. Photo courtesy of Kelly Gorham.



Rory Running built this Artistic Observation Colony as part of her USP project.

Wild Joe's Coffee downtown through the month of May.

Madison and Emma spoke about their research with young girls during MSU's Expanding Your Horizons event on April 11th. This campus-wide outreach event is focused on encouraging middle school aged girls to pursue education in STEM fields.

Laura Brutscher, Microbiology PhD candidate in the Flenniken lab, gave a presentation at the American Bee Research Conference in Tucson, Arizona in January. In November, Laura was officially recognized as the Project Apis m. Honey Bee Biology Fellowship recipient.

Elisa Boyd gave her first PSPP departmental seminar in April.

Katie Daughenbaugh, PhD virologist, submitted her first honey bee virus manuscript to the journal "Viruses", so we hope to have good news soon regarding the publication of her work focused on the honey bee infecting Lake Sinai viruses; co-authors include Madison Martin, Laura Brutscher, Ian Cavigli, Emma Garcia, Matt Lavin, and Michelle Flenniken.

Michelle Flenniken recently gave invited research seminars at UMass Amherst and the Pacific Branch of the Entomological Society of America meeting in Cour d'Alene, Idaho. Michelle recently received grants from the USDA-NIFA-AFRI program to support her research on understanding the biotic and abiotic factors affecting honey bee health and from the National

Honey Board to support a collaborative research endeavor examining the role of pathogens and agrochemicals on honey bee health. Research in the Flenniken lab is also supported by the Montana Department of Agriculture.

Course Focus HORT 440: Urban Design and Planning By Rebekah VanWieren



Lewis Mumford wrote, "Each generation writes its own *biography* in the cities it creates." An overarching learning objective for HORT 440 is to build an understanding of the ways that design and planning at the city and neighborhood scale impact issues such as,

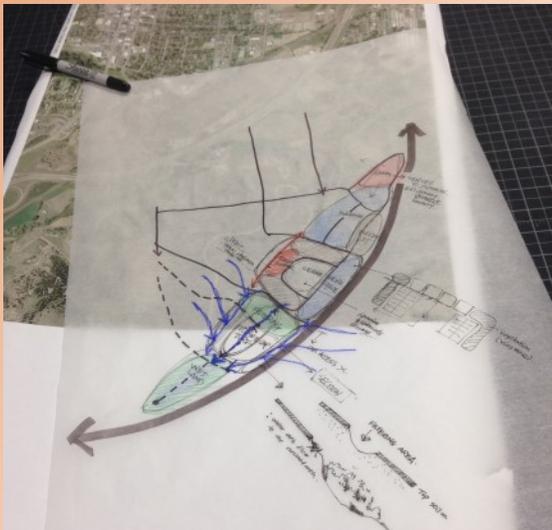
walkability, social justice, ecological function, landscape quality, public health, and agricultural preservation – elements that help describe the *biography*. This course serves as an upper division studio course in the Landscape Design option. The course was developed in 2013 to help fulfill the need for students in the landscape design curriculum to build an understanding of landscape design issues and concepts at the community and regional-scale. You may not know that landscape designers and architects are often the lead or partner on a design team for public streetscapes, neighborhood development, and land planning projects! So, this type of course is essential to equip students for these potential settings.

The first part of the semester introduces urban landscape design by exploring topics including city planning history and theory, neighborhood form and design, street design, sustainable urbanism, and biophilic cities. The second part of the course delves into local design projects, with a focus on site assessment and master planning.

In the first design challenge, students analyze and develop design recommendations for re-envisioning College Street between 11th and 8th (which is identified in the capital improvement plans for the City of Bozeman). Students are charged with improving pedestrian connectivity and the street experience, making visible stormwater management and landscape processes, and engaging community. This project presents students with many typical constraints they would encounter with projects embedded within

the urban fabric, including: overlapping site uses for pedestrians, cars, utilities, and parking; limited and disturbed spaces to incorporate plants, furnishings, or drainage; and a diversity of adjacent land owners and building uses.

The second design challenge focuses on neighborhood or district design, where students develop a plausible solution (master plan) for the future of a large space typically looking out about 25-50 years. This year's 150-acre project site incorporates the property owned by Idaho Pole, between Front St. and I-90, the railroad, and remnant wetlands north of Main Street near I-90. This project site is a complex one, which lends itself to more in-depth site assessment and evaluation of existing and historical environmental, cultural, and physical characteristics. Working at this large scale, students learn how block and lot layout, street design, and land use relationships impact the "open" spaces in between, which, in turn, are the spaces where we design specific landscape and planting plans.



Student iteration for developing a master plan schematic drawing.

This is one of my favorite courses that I teach. My hope is that each student leaves the course understanding how landscape design is integrated within their communities beyond the residential and commercial property context.

Montana Ag Live! Schedule for May

May 3—David Weaver, MSU entomologist, "Recent advances in Sawfly Management plus discuss grain storage insects"

May 10 - Jeff Bader, Dean and Director of Extension Services, "The next 100 years for the MSU Extension service"

May 17 - Greg Pederson, Climate scientist with the United States Geological Service in Bozeman, "Using long term weather patterns to determine if Montana is getting warmer - where is our snow?"

May 31 - Elizabeth Shanahan, MSU Department of Political Science, "The perception of climate change in the west as well as in Montana"

MAES Research Field Days:

June 24	12:00 p.m.	NWARC - Creston
July 1	1:00 p.m.	NARC - Havre
July 14	8:30 a.m.	EARC - Sidney
July 16	9:00 a.m.	CARC - Moccasin
July 17	8:30 a.m.	WTARC - Conrad
July 21	8:30 a.m.	MSU Post Farm
July 23	4:00 p.m.	WARC -Corvalis
July 30	4-7 p.m.	Hort Farm-Bozeman

Grants

Nina Zidack, Co-PI "Biological & economic impacts of emerging potato tuber necrotic viruses & the development of comprehensive & sustainable management practices", USDA - Specialty Crops Research Initiative

Mary Burrows, "Fourth Annual NPDN National Meeting", USDA National Institute of Food and Agriculture.

Ryan Thum, "Spatial and temporal patterns of genotypic variation in watermilfoils: Field studies of resistance evolution potential", Wisconsin Department of Natural Resources.

Ryan Thum, "Yellow perch stock assessment in drowned river mouth lakes and nearshore Lake Michigan", Grand Valley State University.

Michelle Flenniken, "Understanding Biotic and Abiotic Factors Affecting Honey Bee", USDA National Institute of Food and Agriculture.

Michelle Flenniken, "Understanding Biotic and Abiotic Factors Affecting Honey Bee Health", USDA, Agriculture and Food Research Initiative (AFRI), Program USDA-NIFA-AFRI-004412.

Michelle Flenniken, "Investigating the Roll of Pathogens on Honey Bee Colony Health", National Honey Board (NHB)

Michelle Flenniken, "MSU's Pollinator Garden", Montana Native Plant Society

Publications

Agindotan, et al (2015). "Detection and characterization of the first North American mastrevirus in switchgrass", *Archives of Virology*, Volume 160, Issue 5, pp 1313-1317.

Invited Talks

Laurie Kerzicnik, "Insects: Who's moving with us?", Montana Transfer & Warehousemen's Association, Fairmont Hot Springs, 4/18/15.

Laurie Kerzicnik, "Emerald Ash Borer Workshops", April 1-Missoula (with Toby Day), April 2-Kalispell (with Toby Day) April 13-Rocky Mountain College, April 25-Helena

Florence Dunkel, "Community-Based Malaria Management: Solving a Sysiphean Problem, 4/20/15 and "Entomophagy in the Developed and Developing World", 4/21/15, Pennsylvania State University.

Florence Dunkel and David Sands, "Effective Developments for Enhanced Nutrition in Smallholder Farming, BIFAD, Bozeman, MT, 4/9/15.

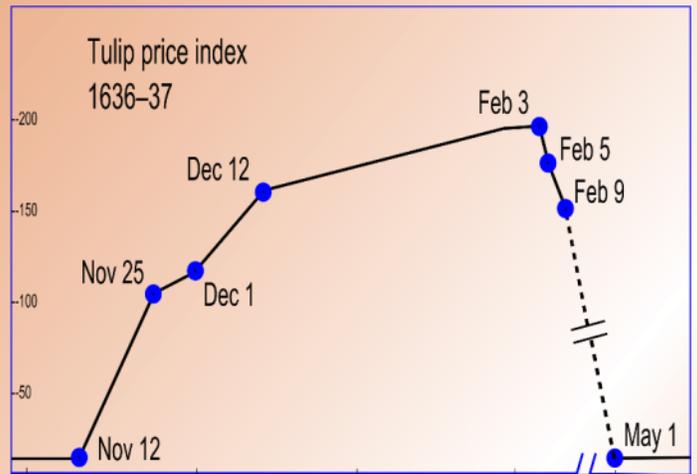
Tulip Mania

By Toby Day, Extension Horticulturist

I recently had a conversation with a colleague in the Extension office on campus about the spring flowering bulbs in my yard. I have a few, maybe a couple of thousand in my front and side yard – nothing that makes me *crazy* or anything? Although, when you think about individual bulbs costing nearly 40 cents, the investment seems like I went a tad overboard. However, tulips make me happy, the neighbors happy and just about everybody else who walks by happy. A good investment if you ask me.

My intrigue with tulips and the outlay I have made in no way compares to the investment that was made in tulips in early 17th century Europe. Although a tulip bulb now costs roughly half a dollar, at the peak of what is now called "Tulip Mania," a single tulip bulb could fetch as much as \$1,500 to \$2,500 in current U.S. currency. During *their* craziness, homes, estates, and even industries were mortgaged so people of status could show off their newly prized bulbs.

The tulip was introduced to Europe from its native Persia by the Sultan of Turkey in the 1550's. It grew in popularity but did not gain full popularity in the Netherlands (where now, 93% of the world's bulbs come from) until Carolus Clusius planted a collection that



Tulip prices during "Tulip Mania," the boom and crash of 1636 to 1637.

survived their harsh climate. That energized a frenzy for the bulbs in Europe. It soon became a luxury item and was the most sought after prize of the wealthy during the beginning of the 17th century. "Tulip Mania" reached its peak in the winter of 1636-37 mostly due to the huge demand with little supply orders being filled. And then there is the crazy part...at that time, some people would invest one year's earnings on a handful of bulbs! Many people made a lot of money. Yet, many of them lost huge sums of money because in 1637, when just one buyer failed to pay for his bulbs, panic set in and spread across Holland. The price of tulips fell to only one-one hundredth of their price – *in just a few days!* And you thought the housing bubble and crash in 2007-2008 was bad!

What makes us repeat history? Cynthia Wood, author of the article "The Dutch Tulip Bubble of 1637" put it best when she wrote



Tulip breaking virus (*Potyvirus TBV*) was unknown during the time of "Tulip Mania." However, a tulip with "petal flames" that was infected with the virus often fetched the most money.

"Human beings have always been prone to want things that are difficult to get, especially if everyone else seems to be doing it. Nutty behavior becomes commonplace when enough people are following along. It's only afterwards that we stand back and shake our heads and wonder what came over us."

That is why people collect Care Bears, Fiestaware, trading cards, and Olympic pins (I know of this because while at the Salt Lake Olympics, the "green Jello" pin would probably have fetched up to \$10,000 at the peak of that craze).

Fortunately, collecting tulips no longer makes us *crazy*. Tulips now are a really inexpensive way to get a great "pop" of color in the garden early in the spring. I may be a touch nutty, but I have many different tulip cultivars that are starting to flower and will continue for a couple of weeks. If you would like to join my nuttiness and purchase and grow different cultivars, I usually put an order in each year. Just remember, if you have deer in the neighborhood, tulips are not an option.

Recipe of the Month

Breakfast Ahead (must be made 1 day before baking)

by David Baumbauer

4 English muffins

1 lb bulk sausage

8 eggs

1/3 c sour cream

8 oz shredded sharp cheddar cheese

1 can green chile peppers (optional)

Butter muffins and lay buttered side down in a 9x13 inch baking dish. Cook sausage and crumble. Drain grease. Spoon sausage over the muffins. Beat eggs, add sour cream and pour over muffins and sausage mixture. Sprinkle cheese over top of casserole and dot with chile peppers. Cover and let set overnight in refrigerator. Bake at 325 for 30 min.

Mixed Vegetable Ball "Pakora"

By Nar Ranabhat

2 1/2 cups Garbanzo bean flour

1/2 cup all purpose flour

Add enough water to make a nice batter.

Then add to batter:

2 large onions - diced

4 medium boiled potatoes and then smashed

1/3 t turmeric powder

1 t cumin powder

1/3 t chili powder

1 t ginger (freshly ground is better)

Salt to taste

Stir and then drop by spoonfuls into the fryer and fry until nicely browned. (From Nar: These are all estimations - if it doesn't turn out, contact me ☺)

May Birthdays

Heather Rimel	12
Darby Kammeraad	12
Chaofu Lu	16
Riyadh Al-Khafaji	17
David May	20
Mareike Johnston	22
Faye Jorgensen	23
Gene Ford	29
Bob Johnston	29
Deanna Nash	31



Congratulations Nar and Mana!



Nar and Mana became the proud parents of Vivaan Ranabhat on March 2, 2015 at 03:01 pm. Vivaan weighed 7 pounds 1

ounce and is 19 inches long. Vivaan joins his four year old sister, Sampada.



The night-blooming cereus plant from the greenhouse collection bloomed on 4/12/15. They are a very fragrant plant and they only bloom for one night! Photo courtesy of Erin Troth.

Strobie's Travels The Battle of Shiloh

Most of my plant collecting, looking for novel endophytes and their products, has occurred in wild and distant lands over the

past 25 years. Now I periodically visit more locations in this country and in so doing I pass through some interesting places that have had a role in American History. The latest is a visit to Tennessee in early April. While there I visited many Civil War sites including this one-Shiloh.

It was April 6, 1862, at a place called Pittsburgh Landing along the banks of the Tennessee River where the most bloody battle (until that point in history) in America's "uncivil" war occurred - Shiloh. General Grant had mustered about 40,000 troops waiting for General Buell, marching from Nashville to reinforce his corps with an additional 20,000 men. General Johnston, of the Confederacy, was not waiting for Buell to arrive and launched a surprise frontal attack with 40,000 men that nearly pushed Grant and his legions into the river. That night, Buell did arrive and crossed the river resulting in a major push back and retreat of the Confederates on April the 7th.

The losses at Shiloh were staggering with 23,000 casualties including General Albert Sidney Johnston who led the southern forces. He died of a bullet wound to the knee and bled to death. He is still the highest ranking military officer in the history of the U.S. to lose his life in battle. The heart of the battlefield is the hornet's nest shown in the photo. At this location was concentrated the largest group of canons ever assembled in one spot in North America. The fighting was intense. As a result, the Confederates broke the union line and captured Union General Prentiss. The goal of the union march southward was the vital railroad junction at Corinth, Mississippi where, in October, another battle occurred. All together there were about 10,000 battles in the Civil War which ended in April 1865 - 150 years ago.



An assemblage of Confederate cannons facing the hornet's nest at Shiloh. Shiloh is one of the oldest, most intact and largest of all civil war battlefields.