



THE DEPARTMENT OF PLANT BIOLOGY, ECOLOGY, & EVOLUTION

Bluestem

Plant Biology
Ecology &
Evolution

From the Department Head:



Dr. Andrew Doust

Fall is starting, and it is a good time to reflect on the department's accomplishments and successes over the spring and summer. Doctoral student Bill Hammond (advisor Dr. Henry Adams) won a coveted National Science Foundation Graduate Research Fellowship, which gives him a stipend and research money for his project on drought-induced water stress in forests on a global scale. He also received an award from the Oklahoma Chapter of the Wildlife Society for his presentation on water stress and tree death, and one of our own McPherson Awards to present his

research at the 2018 Ecological Society of America meetings in New Orleans. Other graduate student successes include doctoral student John Hodge (advisor Dr. Andrew Doust), who received an award from the Society of Developmental Biology for his research on environmental control of branching in grasses, senior Luke Wilson (advisor Dr. Henry Adams), who received a Wentz Research Grant for his undergraduate research on the response of Oklahoma trees to variable water regimes, and junior Jenny Swinton (advisor Dr. Ming Yang), who received a scholarship and research award from the American Society of Plant Biologists for her research into the genetic control of epidermal cell number in *Arabidopsis*. In addition to Bill Hammond, our departmental McPherson Awards allowed graduate students Nikolai Starzak (advisor Dr. Mark Fishbein), Dylan Franks (advisor Dr. Bill Henley), and Tony Sabella (advisor Dr. Bill Henley) to continue their research projects and present results at national conferences.

In other news, we are launching our pre-pharmacy option in Plant Biology this Fall, and have crafted an agreement with Tulsa Community College to allow their pre-pharmacy students to gain credit for their courses when they transfer to OSU. We have

done the same for TCC's pre-forensics and biotechnology programs, so that we can make it easier for students from TCC to attain a bachelor's degree. As part of our enhancement of our molecular biology program we plan to hire an assistant professor this year whose teaching and research will support the new pre-pharmacy option.



*Dr. Scott Poethig and
Dr. David Meinke*

On a sadder note, we said goodbye in May to two of our most beloved faculty members, Associate Professor Dr. Janette Steets and Regents Professor David Meinke. More will be found about Dr. Meinke's retirement in the following story, but here I would like to

pay special tribute to Dr. Steets, who has moved with her children to Dayton, Ohio to join her husband Jeff, who is working in geospatial research for Radiance Technologies. She has been a huge contributor to the department, especially in undergraduate education and assessment, and was a co-investigator for the Howard Hughes Medical Institute grant that allowed us to reinvigorate several of our undergraduate courses. In recognition of her role in undergraduate education she was awarded the inaugural College of Arts and Sciences Award for Excellence in General Education Teaching in 2017. She and I started together at OSU in the Fall of 2007, and worked closely together to transform



Dr. Janette Steets

and modernize the labs in our introductory course (BOT 1404, now PBIO 1404). We changed from a format of weekly labs with worksheets to a largely student-led experimental plant biology course. Students work in groups to design and conduct experiments over several weeks, analyze data, and then present results in a combined poster session. This has been very successful. Dr. Steets also devoted much attention to General Ecology, where she will be greatly missed. We will miss her and Dr.



Left to right; Sitting: Tama (Schneider) Barfield; Joe Don Heath; Ann (Dirksen) Baus; David Meinke; Joe Shellhammer; Laura (Meinke) Simmons; Standing: Linda (Franzmann) Adamski; Clay Holley; Steven Hutchens; Michael Berg; Becky Rogers; Todd Nickle; Jennifer (Guertin) Goldman; Kelsey (Aupperle) Smith; Julie (Guertin) Sullivan; David Patton; Karl Hansen; Nicole (Bryant) Parker; Johnny Lloyd. Not shown: Scott Meinke (late arrival) and multiple family members also in attendance.

Meinke, but wish them the best in their new endeavors!

In other news from the department, Professor Bill Henley is on sabbatical at Colorado State University this fall, working on algal mutants that may have enhanced biofuels potential, we have a great interview with Dr. Ming Yang about his diverse interests and career, and we are working hard to enhance both undergraduate and graduate experience and opportunities through fundraising and grant applications. We hope you all, too, have had a great summer and are poised for a successful Fall!

Visit our Department of Plant Biology, Ecology, and Evolution website at plantbio.okstate.edu.



Dr. David Meinke Retirement Celebration

The department hosted two events in April to honor David Meinke's retirement from OSU last fall. The first was a seminar by Scott Poethig, distinguished professor of plant biology at University of Pennsylvania, National Academy of Sciences member, and longtime friend and colleague of Dave's, who attended the same undergraduate school (College of Wooster) and graduate research lab (Ian Sussex) at Yale University. Scott educated and entertained the diverse audience assembled in the browsing room at the OSU library about the regulation of vegetative phase change in plants, highlighting complementary research efforts utilizing maize, *Arabidopsis*, and several exotic plants not widely studied by geneticists. It was an elegant presentation and a wonderful capstone to a celebration that began 24 hours earlier with the first Meinke lab reunion. For that event, 20 former lab

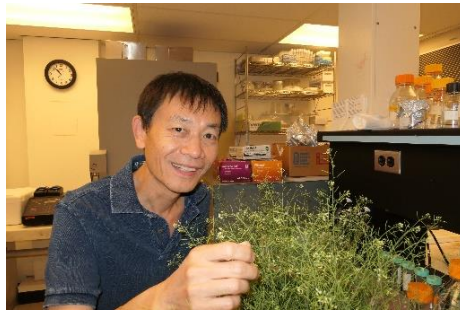
members representing 35 years of *Arabidopsis* research at OSU returned to Stillwater from across North America (California; Montana; Alberta, Canada; Michigan; Illinois; North Carolina; Texas; Kansas; Oklahoma) to renew friendships, reminisce about formative lab experiences, and reflect on the significance of time spent pursuing science and establishing future careers. Twenty-three other lab members sent along their best wishes for the event and a collection of pictures. From the Old Timers dinner on Thursday night, featuring Meinke lab members from the 1980s, to lunch in the banquet room at Hideaway Pizza, to a lab history slide show (125 slides and counting) and trivia quiz (the quirky things, not the hard science part), to an elegant public reception Friday evening at the home of Linda Watson and Chris Wood, it was a memorable time for all involved, and the best possible way Dave could have imagined to celebrate his retirement.

Dr. Andrew Doust visits with Dr. Ming Yang

Associate Professor Dr. Ming Yang has been in the Department since 2001, and teaches Introduction to Biology, Plant Anatomy and Biological Microtechnique. However, his research is much more wide-ranging, spanning the continuum between genetics and biophysics. I sat down with him to talk about his life and career and found out that there was more to Dr. Yang than meets the eye!

Dr. Yang is originally from the north eastern part of China, from Benxi, a coal and steel town developed into a city by the Japanese after they invaded in the 1930's. His father was a western medical doctor and his mother worked in a bank.

Growing up, he excelled in school, and upon graduation had his pick of either of the top two universities in China,



Dr. Ming Yang

Beijing University or Tsinghua University. Eventually, he chose Beijing University, where he majored in Physiology and Biophysics, a hot new area in the early 1980's. The major concentrated on neurobiology, and the experimental work involved preparing muscles, neurons and other tissues. However, all the surgery on mice and other animals required for neurobiology, began to weigh on him, and, when Dr. Yang turned to his graduate studies, he decided to switch to plant systems, as plants offered the most powerful genetic systems at the time. He enrolled in the Master's program in Genetics at the Chinese Academy of Science, where he started to work on regeneration of plants from cell cultures in rice, asking why some varieties of rice are much more easily regenerated than others. His research took a cell biology perspective, attempting to understand why cells in some varieties in cultures remain undifferentiated whilst those of other varieties easily differentiate into roots and shoots.

After completing his Master's he worked for a year in a research institute, but in 1989, the Tiananmen Square protests began. Dr. Yang, like many of his classmates, decided that research opportunities in China were too limited, due to the intellectual and political climate, the traditional way of operation in the institutes, and economic hardships. There were more and better opportunities elsewhere.

Dr. Yang chose to go to Ohio State to work with Dr. Fred Sack, who was influential in determining the direction of Dr. Yang's subsequent career. In the early days of his Ph.D., Dr. Sack mentioned that it would be great if Dr. Yang could manage to isolate stomatal mutants in the popular new experimental system, *Arabidopsis thaliana* (mustard cress).

Dr. Yang gave himself one year to find mutants, mindful that he could only identify them under the microscope. He worked out a fast method of preparing epidermal peels for examination, and was simply looking for anything out of the ordinary. One weekend in September, six months after starting, he found the first true genetic stomatal mutant, which Drs. Yang and Sack named *too many mouths*, as it had clusters of stomata when normal plants have single stomata that are evenly spaced. Another important mutant they named *four lips*, as it had two stomata in each position instead of one. Each of these mutants was controlled by a different gene.

After five years at Ohio State, he went to Cold Spring Harbor Laboratory for a post-doc with Dr. Hong Ma, concentrating on cloning genes in *Arabidopsis* through transposon tagging. He eventually identified the gene responsible for the *ask1-1* mutant, in which chromosomes fail to properly segregate during meiosis, but instead remain clumped around the spindle. This gene has turned out to be important in the regulation of the cell cycle in plants, yeast, animals, and humans, and has become the material he has worked on to the present day.

Dr. Ma's lab moved from Cold Spring Harbor lab to Penn State, and it was there that Dr. Yang first realized that a physical constraint might come into play in the *ask1-1* mutant. He realized that the way the chromosomes are clumped together in the *ask1-1* mutant will affect how the spindle elongates,

and, that the spindles were of different lengths: multiples of 0.7 micrometers. This struck him as extremely unusual, as there was no obvious reason for such regularity. He started to think more carefully about the biophysical basis of plant phenotypes, a question that has stayed with him right up until now.

In 2001 he started at Oklahoma State University in the Botany Department working on genetics including the *ask1-1* mutant. However, his interest in biophysics remained and in 2010, he saw a Science paper describing newly formed segments of microtubules labeled by an antibody. He measured the segments again and found that the segments can be quantified as multiples of .35 micrometers, and that this earlier observation of lengths in multiples of 0.7 micrometers could be explained by spindles elongating by multiples of 0.35 micrometers on both sides of the spindle. But the mechanism for such regularities in growth was unknown, and it has taken

Dr. Yang years to sketch out a theory that can explain this phenomenon. Convincing others that growth at the cellular level is not continuous has not been easy. One way forward has been to provide a satisfactory model that can simulate staggered growth, and Dr. Yang has had the great good fortune that his son, Louis, is a mathematician who can help him! Still, the regularity of the differences in spindle length and other related cellular phenomena such as biological rhythm continues to intrigue him.

When I prompted Dr. Yang to explain what drives his scientific research, and what he could say to help students who were just starting the research adventure, Dr. Yang immediately stressed the need to look beyond the face value of a phenomenon and try and work out what is behind it. He mentioned the story of the young Einstein, who was given a compass by his father, and then tried to work out why it worked.

Similarly, Dr. Yang advises, follow your curiosity and go beyond what is at face value. This is a very important way of thinking for a scientist. Make that a habit, to want to know the pattern and then to find out what is beneath the pattern. Try to work out what is at the root of the pattern, what kind of physical principle determines the pattern in living systems. As he says, that kind of question can drive you for a whole career!

Dr. Yang is taking these research interests with him on his sabbatical in Spring 2019, where he will be a fellow at the Mathematical Biosciences Institute at Ohio State University. We wish him the best of luck in advancing our understanding of how basic cellular processes affect growth in organisms!



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