

IN THIS ISSUE

14th Annual Symposium Returns to Kansas City

by Jennifer Rhodes

The 14th Annual Ecological Genomics Symposium is returning to the Marriott Country Club Plaza in Kansas City, MO. The symposium will be held October 28-30, 2016.

This year's symposium will again feature a diverse array of leaders in the field of ecological and evolutionary genomics. The symposium will begin Friday evening, October 28, with talks and a poster session. Saturday will feature additional talks, a poster session, and networking dinner. The symposium will conclude on Sunday, October 30 at noon.

The ten featured speakers this year are:

- Nadia Aubin-Horth, Université Laval

- Hans Hofmann, University of Texas at Austin
- Robin Hopkins, Harvard University
- Christian R. Landry, Université Laval
- Blake Matthews, Eawag
- Suzanne McGaugh, University of Minnesota
- Geoffrey P. Morris, Kansas State University
- Kenneth M. Olsen, Washington University in St. Louis
- Amy Toth, Iowa State
- James R. Walters, University of Kansas

The early registration fee is \$295 for faculty and \$195 for students. The early registration and poster abstract submission deadlines are Friday, September 30.

To discover more, visit ecogen.k-state.edu.



Summer Research Forum Held

Students and faculty presented their research

Page 2

Grants Awarded

Page 3-4

Student News

Several EGI students recognized recently.

Page 4-6

Featured People

Page 7

Recent publications

Page 8

EGI Summer Research Forum Held



The Ecological Genomics Research Forum was held at the Cortelyou Lecture Hall at the Konza Prairie Biological Station on Tuesday, June 28. Eight students and postdocs presented their research. Featured EGI faculty, Tom Platt and Ari Jumpponen, also provided interesting talks.

This event provided a great opportunity for the 12 undergraduate students from the REU and SUROP summer programs to present research in short data blitz talks.

Approximately 50 people attended the event and evening barbeque. This event was funded with support from NSF REU and the Division of Biology.

Herman on faculty of 2016 MDIBL Environmental Genomics Course

The Mount Desert Island Biological Laboratory again hosted the Environmental Genomics Course that was held July 30-August 6, 2016. The goal of the course was to guide research towards understanding how gene function is influenced by environmental conditions while accounting for variation that exists within and among natural populations. The course was organized by John Colbourne, Benjamin King and



Joseph Shaw and featured guest lectures by Michael Herman, Gary Churchill, W. Kelley Thomas and Andrew Whitehead. Seventeen students from all over the country received hands on experience performing environmental genomic experiments that examined the effects of heavy metal contamination on gene expression in the water flea *Daphnia pulex*. The course partially funded by an NIH grant awarded to Shaw and Colbourne. Herman gave the introductory lecture,



“Ecological and Evolutionary Genomics: Using Biodiversity to Explore Biocomplexity.”

Course leader, John Colbourne (University of Birmingham, UK) leads the students through a brainstorming session to define the state of field of Environmental Genomics.

The students then spent the next day preparing samples for RNA-seq analysis and the rest of the week learning approaches to analyze the data aided by the faculty.



Environmental Genomics students gave 10 informal presentations about their own research.



Division of Biology researchers awarded U.S. Department of Education Grant

By: Sarah Hancock, K-State Today

A team from the Division of Biology has been awarded a \$443,213 grant from the U.S. Department of Education Graduate Assistance in Areas of National Need program, or GAANN. The grant will provide fellowships to support interdisciplinary training for graduate students.

This is the second program grant awarded to Loretta Johnson, Michael Herman, Anthony Joern and Brett Sandercock, all professors of biology. Their proposal title, "Integrative Graduate Training for New Frontiers in Ecology, Evolution, and Genomics," indicates both their different specialties and the increasingly complex nature of the problems researchers are trying to solve.

"21st century biology challenges, such as climate change and food security, are complex and require different disciplines working together," Johnson said.

"We are positioned to give students training in new technologies such as bioinformatics and genomics and handling large data sets," she said. "For example, with long-standing questions like how forage grasses cope with drought, we can understand the genetic basis for adaptation to climate."

The Division of Biology's diversity of disciplines and history of interdisciplinary collaboration makes it an ideal recipient of the program's funds. The Konza Prairie Long-Term Ecological Research project funded by the National Science Foundation, for example, works at the interface of ecology, evolution, conservation and other areas.

Another collaborative effort, the Ecological Genomics Institute, explores how organisms react to environments with short-term ecological and long-term evolutionary responses along with genetic underpinnings of such responses. The high level of coloration both in the department and with other areas such as agronomy, plant pathology and computer science is excellent training for students.

"The intention is to train students for a variety of careers, to give them a skill set to compete in a variety of teaching and research disciplines or for industry jobs as well," Sandercock said.

Training for the program's students will support learning and research at the interface of different fields of biology and will emphasize analysis of large datasets and communication skills as well as fundamental research in ecology and evolutionary biology.

"That's the legacy of the land-grant institution: the mix of basic and applied research and using available tools to tackle problems," Sandercock said.

Program fellows from the 2009-2014 grant tackled problems of interest to Kansans such as the expansion of woody vegetation in rangelands, disease outbreaks in small mammal populations, or how insects respond to temperature change. One former fellow is now working for the U.S. Department of Agriculture as a postdoctoral researcher, four others have gone on to win nationally competitive postdoctoral positions, and one is now a K-State faculty member.

A major benefit of the program is helping K-State recruit the top graduate students. The fellowship support is a "real attraction" to come here, Johnson said.

"Students are attracted to interdisciplinary science. Science is becoming so much more interdisciplinary and collaborative, and students are attracted to our program because they need those skills to compete in the workforce," she said.

Carol Shanklin, dean of the Graduate School, is pleased with the opportunities the program's award offers to K-State graduate students.

"The GAANN program will allow K-State researchers to recruit outstanding doctoral students and advance interdisciplinary research while addressing complex environmental and societal problems. The program will provide doctoral students with essential knowledge and skills that will enhance their competitiveness for diverse careers," Shanklin said.

"The Graduate School looks forward to collaborating with the GAANN leadership team in their recruitment initiatives and contributing to the professional development opportunities for the participants," she said.

The Division of Biology is in the College of Arts and Sciences.



Researchers awarded grant to develop microfabricated device for the rapid discovery of bacterial interactions

By: Mary Rankin, K-State Today

Microbes persistently live on plant roots and are critical in promoting healthy plant development by helping the plant acquire nutrients and protect it from microbial pathogens. These microbial communities, termed microbiomes, are genetically diverse, and many interactions that occur between different types of microbes are unknown or poorly understood.

This is where National Science Foundation grant of \$300,000 will come into play at Kansas State University as co-principal investigators, Ryan Hansen, chemical engineering, and Thomas Platt, biology and EGI member, both assistant professors, aim to develop a microwell array platform for high-throughput screening and discovery of microbial interactions.



The award is based on an Early-concept Grants for Exploratory Research, or EAGER, proposal – a National Science Foundation funding mechanism in support of exploratory work in its early stages on untested, but potentially transformative research ideas or approaches.

The goal of the project is to develop a new analytical tool to rapidly and simultaneously screen thousands of interactions among different types of bacteria in order to identify those critical in shaping root-associated bacterial communities. Uncovering these interactions will aid in efforts to make engineered bacterial communities for improved food production, plant pathogens protection and environmental decontamination efforts.

“We anticipate our platform will greatly accelerate the pace at which new bacterial interactions are discovered,” Hansen said. “We are developing a tool that will be highly adaptable and useful for discovery in any microbial system, in any microbiology laboratory.”

The project will establish a new and highly interdisciplinary research collaboration, combining a team of chemical engineers with a team of microbial ecologists.

Student News

Four EGI Students recognized by Friends of the Sunset Zoo

Congratulations to EGI students, Ryan Greenway, Samantha Sharpe, Matt Galliard, and Christine Carson for being selected as 2016 Communication Fellow by the Friends of the Sunset Zoo (FOSZ). The program is dedicated to increasing science communication skills of the graduate students involved.

Additional congratulations to Ryan Greenway, who was selected as the 2016 Conservation Scholar by FOSZ. This scholarship supports the next generation of conservation-minded professionals. The scholarship covers a student's expenses related to a field conservation project.



Student News

Velazhahan Receives Oral Presentation Award

Vaithish Velazhahan, a junior Biology major working in Dr. Kathrin Schrick's lab, received a second prize Oral Presentation Award at the 2016 Midwest ASPB Section Meeting in Brookings, South Dakota, March 19-20, 2016. There were over 100 attendees from 19 institutions, 10 states and 1 Canadian province who were treated to 35 oral presentation and over 50 posters.



Vaithish presented his findings on "Unlocking the Secrets of Land Plant Evolution: A Role for Homeodomain Transcription Factors." He has been investigating various species of the Charophycean green algae, in particular *Penium margaritaceum*, which is an emerging model system to study plant evolution. *Penium*, a unicellular green algae of the Zygnemetales, belongs to the closet lineage of modern plants, and is being used to decipher molecular adaptations that led to the origin of the first land plants ~450 million years ago.

Congratulations, Vaithish!

2 EGI undergraduates receive Most Promising Student awards

Two EGI undergraduates received the Division of Biology's Most Promising Student award. Julie Cooper, senior and member of the Dr. Bradley Olson lab, and Vaithish Velazhahan, junior and member of the Dr. Kathrin Schrick lab.

The Most Promising Student Award is intended to encourage students who are early in their careers and have demonstrated enthusiasm, creativity, and imagination in biologically-oriented courses and projects. Students are nominated by the faculty and award recipients are chosen by a committee within the Division of Biology. Selection is based on faculty letters of recommendation, quality and quantity of classroom work and extracurricular accomplishments, and an interview with the selection committee.

Congratulations to these undergraduates!

Galliarth wins Bancroft Award



Matthew Galliarth, Ph.D. student and member of the Dr. Loretta Johnson lab, recently was awarded the Kansas Native Plant Society Mary A. Bancroft Memorial Scholarship.

The title of Matt's submission was "Experimental natural selection of big bluestem ecotypes across the Great Plains." Matt was awarded \$1,000.

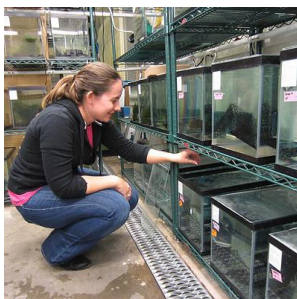
Congratulations to Matt!



Student News

Passow receives prestigious Sarachek award

Taken from K-State Today



Courtney Passow received a Sarachek award for her academic and research achievement. She was awarded the \$17,000 Alvin and RosaLee Sarachek Predoctoral Honors Fellowship in Molecular Biology.

Alvin and RosaLee Sarachek, Wichita, established the fellowship to recognize resident graduate students enrolled in a doctoral program at Kansas State University and how have demonstrated exceptional research and scholastic accomplishments. An interdisciplinary faculty selection committee determines the fellowship and award recipients. The awards program is offered through the university's graduate school.

Courtney received her bachelor's degree from Texas A&M University. She received her doctorate in summer 2016. Courtney's research focuses on determining the underlying genetic and physiological mechanisms of adaptation to extreme environments. Michi Tobler, assistant professor of biology and EGI faculty member, was Courtney's major professor.

Courtney will use the fellowship to relocate to St. Paul, Minnesota, where she plans to pursue a postdoctoral position at the University of Minnesota. She will primarily be working with blind Mexican cavefish, *Astyanax mexicanus*, investigating how organisms adapt to nutrient- and light-poor cave environments.

Greenway won presentation award

Ryan Greenway won the James E. Ackert Award for Outstanding Graduate Student Presentation. J.E. Ackert was a long-time Dean of the KSU Graduate School. He was also a parasitologist in the Department of Zoology. The award is given annually for an outstanding graduate student presentation by a student who has been in the Division of Biology graduate program less than two years.

Ryan is a Ph.D. student, working in the lab of Dr. Michi Tobler. Congratulations, Ryan!



Two EGI Students Successfully Defend Dissertations

Congratulations to Courtney Passow and Hannah Tetreault for both successfully defending their dissertations!!

Courtney dissertation was entitled "Physiological and Transcriptomic Aspects of Adaptation to Extreme Environments." Her advisor was Dr. Michi Tobler. Courtney is continuing her career at the University of Minnesota, where she is a postdoctoral researcher in Dr. Suzanne McGaugh's lab.

Hannah's dissertation was entitled "Transposable element contribution and biological consequence of genome size variation among wild sunflower species." Her advisor was Dr. Mark Ungerer. Hannah accepted a postdoc position in the USDA ARA lab in Lincoln, Nebraska.

Congratulations again to Drs. Passow and Tetreault!!



Student News

Grond earns 2016 University Distinguished Professors Graduate Student Award

Taken from K-State Today

Outstanding achievements in academic work and scholarship has earned EGI doctoral student, Kirsten Grond, an award from the university's highest-ranking professors.

The three winners of the University Distinguished Professors Graduate Student Awards will be recognized at a ceremony September 20. Kirsten, a doctoral student in biology and a member of EGI, will receive \$2,500.

The awards recognize graduate students who have shown exceptional achievement in graduate studies and demonstrate excellence in scholarship through publications and other accomplishments appropriate for their academic field. The University Distinguished Professors Group at the university has established a set of guidelines and criteria for the evaluation of candidates and Carol Shanklin, dean of the Graduate School, coordinates the selection process.

Grond's dissertation is "Linking gut microbiota composition to development and life-history traits in migratory shorebirds." Her research focuses on investigating which environmental and genetic factors affect the microbial communities in the digestive tracts of migratory shorebird species. Her adviser is Brett Sandercock, professor of biology.

"Winning this award confirms that my research is applicable and important to a broader audience," Grond said. "The funding will provide me with the opportunity to explore post doctorate positions and strengthen my application as I start my career in academia."

The awards are made possible through a combination of donations from individual university distinguished professors and support from the university's vice president of research.

Culumber and Greenway earn support

The American Livebearer Association has supported two projects in the lab of Dr. Michi Tobler, assistant professor of biology and EGI faculty. Ryan Greenway, doctoral student, received a Vern Parish Award to investigate repeated ecological speciation in poeciliid fishes occurring along the same environmental gradient.



Zach Culumber, postdoc, received support from the James K. Langhammer Fund for Conversation to assess the current status of multiple endangered *Xiphophorus* species.

Congratulations to both!

Sharpe wins National Sigma Xi Award

Samantha Sharpe was awarded the national Sigma Xi chapter Grant in Aid of Research award. Her proposal was titled, "*Andropogon virginicus* tolerance of heavy metals in abandoned mine sites: an investigation of local adaptation and rapid evolution." She received \$500 towards her research. Sam is a Ph.D. student in the lab of Dr. Loretta Johnson.



New EGI Members



Samantha Fox
Ph.D. Student

Samantha is a new graduate student working in the lab of Dr. Ari Jumpponen, Division of Biology.



Priscila Guzman
Ph.D. Student

Priscila is a new graduate student working in the lab of Dr. Tom Platt, Division of Biology.



Priscilla Moley
Ph.D. Student

Priscilla is a new graduate student working in the lab of Dr. Lydia Zeglin, Division of Biology.



Elsie Shogren
PhD Student

Elsie is a graduate student working in the lab of Dr. Alice Boyle, Division of Biology.



Kasey Swilley
PhD Student

Kasey is a new graduate student working in the lab of Dr. Brad Olson, Division of Biology.



Jianan Wang
Postdoc

Jianan is a new postdoc in the lab of Dr. Geoff Morris, Department of Agronomy.

Disease that threatens Kansas wheat crop subject of genetic study by postdoctoral researcher

By Sarah Hancock for K-State Today



With the help of a federal fellowship, a Kansas State University plant pathology postdoctoral research associate will study a serious disease that has caused substantial losses to wheat and other grain crops in Kansas and around the world.

Alma G. Laney has been awarded a two-year \$150,000 postdoctoral fellowship to lead a study on the genetics of barley yellow dwarf viruses, which cause barley yellow dwarf. This disease of wheat and other grains worldwide is carried from plant to plant by sap-sucking aphids. In years with severe outbreaks, the losses to Kansas wheat growers have been significant. In 2012, the disease caused a 2.3 percent yield loss in the state that was estimated to be worth \$78 million dollars.

The fellowship was awarded through the U.S. Department of Agriculture-National Institute of Food and Agriculture's Food, Agriculture, Natural Resources and Human Sciences Education and Literacy Initiative, or ELI.

Laney's project is an extension of work on barley yellow dwarf in Kansas winter wheat that has been ongoing in the Kansas State University Plant Virus-Vector Interactions Lab and Center for Excellence for Vector-Borne Plant Disease Control. The project is led by Dorith Rotenberg, research associate professor of plant pathology at Kansas State University.

Rotenberg said Laney brings curiosity, enthusiasm and rigor to virological research.

"Laney strategically developed a project of agricultural significance to tackle the problem of emergent plant viruses in Kansas wheat – an important and challenging project with big payoffs to stakeholders," Rotenberg said.

The 20-year average loss caused by barley yellow dwarf in Kansas is about 1 percent, a portion that adds up to significant losses over time. Rotenberg's lab discovered that barley yellow dwarf virus isolates in Kansas possess unique genetic characteristics that may explain their prevalence. Laney's project is developing tools to study the biological consequences of the genetic features of these viruses and determining if these features affect the spread of viruses via aphids. The results of the project will enhance understanding of how to control the spread of plant viruses in Kansas.

The ELI fellowship program is intended to help train the next generation of agricultural scientists, extension professionals and educators. This competitive fellowship supports innovative research as well as outlining a professional mentoring plan and a strategy for sharing new findings with both the scientific community and general public.

"Laney's fellowship has launched a promising career for him in infectious disease research aimed at securing the U.S. food supply," Rotenberg said.



Pond scum and the gene pool: One critical gene in green algae responsible for multicellular evolution, understanding of cancer origin

Written by Stephanie Jacques, K-State Today

Kansas State University biologist are skimming pond scum for clues of multicellular evolution and possible origin of cancer.

Brad Olson, assistant professor in the Division of Biology and EGI faculty; Erik Hanschen, doctoral student at the University of Arizona; Hisayoshi Nozaki, University of Tokyo, and an international team of researchers found a single gene is responsible for the evolution of multicellular organisms. The study is publishing in a recent issue of Nature Communications.



Olson and Hanschen were looking for what caused a single-celled organism to evolve into multicellular organisms when they discovered the importance of a single gene, retinoblastoma, or RB. Olson and Hanschen found that RB, known for being defective in cancer patients, is a critical gene necessary for multicellular life. According to Olson, previous theories indicated that multiple genes might be responsible for multicellularity.

“Rather than the situation where hundreds of genes have to evolve simultaneously, it’s a very subtle change in one gene that causes a reprogramming of the cell cycle,” Olson said. “Not only did we find a critical gene for multicellularity, it turns out to be a tumor suppressor and it is much easier to evolve multicellularity than anticipated.”

Funded by the National Science Foundation and the National Institutes of Health, Olson, Hanschen and their colleagues compared genomes of multicellular alga called *Gonium pectorale* and its single-celled alga relative, *Chlamydomonas reinhardtii*. The RB gene is in both algae but has small differences in structure and how it regulates cell cycles.

“RB plays a fundamental role in cell multiplication by regulating cell cycles just before DNA replication starts,” Olson said. “Cancer occurs when this gene is defective. In terms of cell cycle and cancer progression, think of RB like the brakes on your car. When the brakes are defective, there is no way to control how the vehicle stops.”

“Multicellularity has evolved dozen of times independently,” Hanschen said. “It is well-known that plants, animals and fungi evolved independently, but so did red, green and brown algae, volvocine algae, slime molds and bacteria; it’s a process that has happened many, many times. The result we find with RB is intriguing because this pathway and this gene are shared among so many of these independent multicellular groups, which are separated by hundreds of millions of years.”

When the researchers took the RB gene from *Gonium* and introduced it to *Chlamydomonas*, it caused *Chlamydomonas* to become multicellular.

“*Gonium* is representative of the first steps toward the evolution of complex multicellular organisms such as plants and animals,” Olson said. “These findings have the potential to help scientists understand the origin of cancer and may contribute to future abilities to treat and detect cancer.”

Research contributors at Kansas State University include Tara Marriage, postdoctoral associate; Jaden Anderson, senior in Biology; Halle Sparks, senior in Biology. Additional collaborators include Richard Michod, University of Arizona; and Takashi Hamaji, University of Tokyo.

Olson first tested the RB gene in 2012 and then organized the entire research team to investigate numerous other theories for multicellular evolution.

“There have been so many hypothesis about how multicellular evolved,” Olson said. “We went through and tested all those hypotheses. We wanted to make sure that our finding was the best.”



Recent Publications

Bagley, J.C.; Matamoros, W.; McMahan, C.; **Tobler, M.**; Chakrabarty, P.; Johnson, J.B. 2016. Phylogeography and species delimitation in convict cichlids (Cichlidae: *Amatitlania*): implications for taxonomy and Plio-Pleistocene evolutionary history in Central America. *Biological Journal of the Linnean Society*. Accepted.

Brenton, Z.W.; Cooper, E.A.; Myers, M.T.; Boyles, R.E.; Shakoob, N.; Zielinski, K.J.; Rauh, B.L.; Bridges, W.C.; **Morris, G.P.**; Kresovich, S. 2016. A Genomic Resource for the Development, Improvement, and Exploitation of Sorghum for Bioenergy. *Genetics* DOI: 10.1534/genetics.115.183947.

Hanschen, E.R.; **Marriage, T.N.**, Ferris, P.J.; Hamaji, T.; Toyoda, A.; Fujiyama, A.; Neme, R.; Noguchi, H.; Minakuchi, Y.; Suzuki, M.; Kawai-Toyooka, H.; Smith, D.R.; **Sparks, H.**; **Anderson, J.**; Bakaric, R.; Luria, V.; Karger, A.; Kirschner, M.W.; Durand, P.M.; Michod, R.E.; Nozaki, H. and **Olson, B.J.S.C.** 2016. The *Gonium pectorale* genome demonstrates co-option of cell cycle regulation during the evolution of multicellularity. *Nature Communications* 7 (11370): doi:10. 1038/ncomms11370.

Schulz-Mirbach, T.; Eifert, C.; Riesch, R.; Farnworth, M.; Zimmer, C.; Bierbach, D.; Klaus, S.; **Tobler, M.**; Streit, B.; Indy, J.R.; Arias-Rodriguez, L.; Plath, M. 2016. Toxic hydrogen sulphide shapes brain anatomy: a comparative study of sulphide-adapted ecotypes in the *Poecilia mexicana* complex. *Journal of Zoology (London)*. In press.

Sung, W.; Ackerman, M.S.; Dillon, M.M.; **Platt, T.G.**; Fuqua, C.; Cooper, V.S.; and Lynch, M. 2016. Evolution of the Insertion-deletion Mutation Rate Across the Tree of Life. *G3: Genes, Genomes, Genetics*. 6(8): 2583-2591.

Tobler, M.; **Passow, C.N.**; **Greenway, R.**; Kelley, J.L.; Shaw, J.H. 2016. The evolutionary ecology of animals inhabiting hydrogen sulfide rich environments. *Annual Review of Ecology, Evolution, and Systematics*. Accepted.

Voelker, G.; **Tobler, M.**; Prestrdige, H.L.; Duijm, D.; Groenenberg, M.R.; Hutchinson, A.D.; Martin, A.; Nieman, C.; Roselaar, S. and Huntley, J.W. 2016. Three new species of *Stiphornis* Forest Robins (Aves: Muscicapidae) from the Afro-tropics with a molecular phylogenetic assessment of the genus. *Systematics and Biodiversity*. Accepted.

Wilson, L.R., Gibson, D.J., Baer, S.G., and **Johnson, L.C.** 2016. Plant community response to regional sources of dominant grasses in grasslands restored across a longitudinal gradient. *Ecosphere* 7(4):e01329. 10.1002/ecs2.1329.

