

Ecological Genomics URM – one-on-one instruction to foster effective learning through hands-on experiences and frequent evaluation

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Background: Kansas State University (**KSU**) received a National Science Foundation (**NSF**) Undergraduate Research Mentoring (**URM**) grant in 2011. URM pairs undergraduates with faculty mentors for research in ecological genomics. Our students employ next-generation sequencing, quantitative PCR, and quantitative trait locus analyses to broadly explore ecology and evolution. URM continues with updated recruitment to increase the quality, diversity, and number of applicants; with competitive travel grants to support networking and integration into the scientific community; plus with increasing numbers of faculty mentors. Entry and exit evaluations in collaboration with Office of Educational Innovation and Evaluation (OEIE) provide a feedback mechanism to continue improvement of the URM program. We aim to attract outstanding undergraduates and inspire them to pursue graduate degrees and careers in evolutionary and ecological genomics research.

Examples of organisms studied by URM scholars and their mentors.



Recruitment

- In conjunction with Developing Scholars Program (DSP) we aim to increase the numbers of intellectually curious underrepresented students
- We target Biology, Entomology, and Plant Pathology core classes to draw from a large pool of undergraduates
- We advertise through i) mentor presentations in classrooms, ii) DSP and academic advisors, iii) fliers, iv) college newspaper articles, v) mentor and peer-to-peer recruitment seminars, vi) open forum panel discussions

2011-2012 (n=7) 4 frican American 9 clucasian 9 clucas

Professional Preparation and Training

URM is tightly integrated with 9 other summer research programs, which provide peer networking and training opportunities. More than 100 undergraduates from different universities and disciplines participate.

Seminars, workshops and panel discussions that support professional preparation and assist in building strong applications for graduate and professional schools cover a range of topics including:

- Introduction to research and research ethics
- Graduate school application process
- Graduate student panel discussion
- Financial support for graduate school
- CV/resume building and documenting research
- Effective presentation skills
- Industry careers and patenting



URMs Kale Lothamer at the Ecological Society of America meeting in August, 2012 (top); Kendra Schuler (middle); and Kale Lothamer, Joshua Ames and Abraham Denner at the 9th Ecological Genomics Symposium in November 2011 sharing their research findings.



In 2011, we had 3 male and 4 female applicants and selected 3 males and 3 females. **In 2012**, we had 6 male and 12 female applicants and selected 2 males and 4 females. Our use of peer-to-peer presentations, classroom appearances, and direct academic advisor contacts increased the number of applications.

Mentoring and Research

Contract: Mentors and scholars sign a contract outlining expectations. URM coordinators discuss them with mentors and scholars at orientation in the beginning of the program.

Evaluation: OEIE evaluates mentor and scholar expectations in the beginning of the year-long URM experience and evaluates meeting them in an exit questionnaire. Steering Committee adjusts URM program base on these evaluations.

URM Experience: During the summer, URM is integrated with KSU Summer Undergraduate Research Opportunities (**SUROP**) and Research Experiences for Undergraduates (**REU**) programs. During the semesters, many URM students participate in DSP activities that provide peer support and define expectations. URM students present their research in **i**) Ecological Genomics Forum; **ii**) REU Summer Symposium; and, **iii**) Ecological Genomics Symposium. i) and ii) are local meetings, whereas iii) serves the international research community with interests in Ecological Genomics.

URM are also eligible for competitive travel grants to support student attendance in (inter-)national meetings.

The Research Experience

The scientific process:

Mentors and scholars develop testable hypotheses, design and implement experiments, and make inferences from them.





URM Scholars participate in outreach activities: presentation in Girls Research Our World (GROW) workshop in 2011 **Research:** URM students are integrated in the mentors' laboratories and thrive to conduct independent research programs. Examples include:

- Joshua Ames Identification of insect immune-related genes associated with the Tomato Spotted Wilt Virus.
- Logan Blunk Small mammal gut microbial community responses to severe anthropogenic disturbance.
- **Abraham Denner** Natural history and mating systems of grassland soil nematodes, particularly the phenomenon of pseudogamy.
- Kale Lothamer Metagenomic analysis of the effect of urbanization on fungal communities associated with tree roots.
- Kendra Schuler Thermal tolerance in Drosophila melanogaster.
- Lindsey Worcester Role of polyploidy in the adaptive radiation of the genus *Phlox*.
- Olivia Eller Genetic basis of phenotypic plasticity in *Drosophila melanogaster*.
- Desiree Harpel Distribution of Allonemobius crickets in the central US.
- **Stephanie Jacques** Development of a protocol to detach *Callosobruchus maculatus* eggs from mung beans without damage.
- **Sofia Sabates** Seed production and phenology of bluestem ecotypes in reciprocal gardens across the precipitation gradient.

Students Highlighted in **boldface**.



Professional Presentations:

URM scholars present posters annually at the International Ecological Genomics Symposium. Scholars may apply for travel grants to present at other meetings.

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Publications:

URM scholars are encouraged to publish their results. Mentors have a strong track record of publishing with undergraduates and have more than 30 publications with undergraduates.