

The DiGEST Issue 3

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Winter 2016 Newsletter

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the diGEST

NC State Genetic Engineering and Society Center



See what the GES Center has been up to!

Our monthly newsletter details the latest news, activity, and scholarship from our esteemed faculty and students. In this issue:





Discover how one PhD student is using CRISPR for her research on beetles.



Find out what happened when Jennifer Kuzma talked GMO's at the CATO Institute.



Learn more about the work the GES Center is doing with our two NSF grants.

Recent Media Appearances

[The Unregulation of Biotech Crops](#)

The Scientist

Quoted Jennifer Kuzma

[A Facelift for Biotech Begins](#)

Nature

Quoted Jennifer Kuzma

[Around the country, organic farmers are pushing for 'GE-free' Zones](#)

Washington Post

Quoted Jennifer Kuzma

[Genetic Engineering and Society: NC State's Interdisciplinary Hub](#)

[Addresses Science, Ethics, Policies Surrounding GMO's](#)

NCSU Humanities and Social Science News

GES Center Featured

PhD Student Uses CRISPR for Beetle Research

Nicole Gutzmann is a second year PhD student in the Department of Entomology working under Associate Professor Marce' Lorenzen. She is also a part of the third Genetic Pest Management (GPM) IGERT cohort which focuses primarily on agricultural pests. This is one of the reasons Gutzmann decided to focus her research on beetles that are developing a resistance to pesticides. According to Gutzman, 80 percent of US corn and cotton are protected by pesticides which are composed of a wide variety of toxins that are found in Bt, or *Bacillus thuringiensis*. The Red Flour Beetles, or *Tribolium Castaneum*, on which she is testing



have developed a resistance to Bt. She wants to use CRISPR/Cas9 (CRISPR) to discover why they have developed this resistance and if there is a way to reverse it.

Before tackling the Bt resistance in the Red Flour Beetles, Gutzmann wanted to get familiar with using CRISPR, and began building her expertise with the technology. Gutzman's project which involved Engineered Green Fluorescent Protein (EGFP) in Tribolium beetles gave her that opportunity. She attempted to knock out the EGFP from a muscle fluorescing strain of the beetles as a proof of concept. Initially her attempts were unsuccessful, but recently all of her attempts and readjustments began working. This success has given her the confidence and familiarity with CRISPR that she will need to undertake the task of unlocking the mystery behind the Flour Beetles' resistance to Bt. Gutzmann says that she will use some of the molecular pieces from the EGFP project to assist her in the next project involving the Bt resistant beetles. She hopes that this will cut down on the time it will take to accomplish the overall project.

Why CRISPR? Gutzmann believes that CRISPR is the best of the genetic engineering technologies that are available right now. She believes it to be more efficient, more flexible, and because it is less costly than the other technologies, more accessible. Looking towards the future and next steps in the Flour Beetle Bt resistance project, Gutzmann says she needs to optimize system from previous work which may take a few weeks. Before she can feed them the Bt, she needs for the beetles to evolve past the larvae stage. This development may take awhile, so Gutzmann is unsure as to how long the project may take to complete. She is very excited about the results of her project and optimistic about the possible implications of her research in this new realm of technology.

By Maurizo Lewis



GMOs and the Future of Global Food Supply and Medical Innovations

For thousands of years, farmers used selective breeding to produce more plentiful harvests and increase the usefulness of domesticated animals. Today, genetic engineering allows businesses to do the same—but more precisely and speedily.

Unbeknownst to most people, the use of genetically modified organisms is not limited to agriculture. GMO technology is all around us, helping to produce life-enhancing products

agriculture. GMO technology is all around us, helping to produce life-enhancing products, such as synthetic insulin, and life-saving medicines, such as cancer-fighting Avastin. Still, controversy surrounding GMOs persists.

In this public discussion, Robert T. Fraley, Executive Vice President and Chief Technology Officer, Monsanto, and our Co-Director and Distinguished Professor in the Social Sciences, Jennifer Kuzma, presented about their viewpoints on the science, risks, benefits, and socioeconomic impacts of GM crops.

Each participant had twenty minutes to present their information, then another five minutes to respond to the other speakers' comments. The discussion concluded with questions from audience members. You can watch the entire video of the discussion [here](#).



GES Center Receives Two NSF Grants

Last Fall the National Science Foundation awarded the GES Center two grants totaling \$500,000. The grants will fund a three day workshop on the governance of gene drives and a three year program aimed at motivating ethical and responsible biotechnology innovation. Co-Director Jennifer Kuzma is heading each of these initiatives as Principal Investigator. Brief descriptions of each grant are provided below:

Gene Drives: A Deliberative Workshop to Develop Frameworks for Research and Governance

This award provides funding for a workshop that is to occur February 24th - 26th. The topic of the conference is the governance of gene drives. Experts from four areas will participate in the workshop: Genetics and molecular biology, ecology and ecological modeling, political economy, and STS (science, technology, and society). The structure of the workshop is designed to engage participants in working together to generate analyses and summaries useful for future decision and policy making about gene drives.

Papers on case studies and issue domains were drafted by workshop presenters and disseminated prior to the workshop. The mornings of days one and two were dedicated to

the presentation and discussion of these papers. Following the workshop, papers will be finalized for publication in a special journal edition. Also drafted from the workshop will be a summary article on the key findings of the workshop, an abridged summary submitted to a high profile venue such as Nature or Science Commentary, and an editorial for major newspapers. Dissemination of the workshop results will serve to guide future research, innovation, and oversight of gene drive systems.

Day one of the workshop allowed participants to develop a draft typology of technologies, purposes, and contexts of gene drives, and a framework of issues and research needs for three key areas: ecological risk analysis, political economy analysis (including governance regimes), and ethical analysis.

Day two saw collaborative systems modeling to identify important relations and variables, and integrative thinking across biology, policy, economics, and ethics.

Day three was dedicated to identifying key research and governance needs as well as discussing observations across cases and from system maps, issue frameworks, and typologies.

Click [here](#) to learn more about the purpose of the grant, the three day workshop, or the leadership team and program committee.

Also, look for a special addition of the diGEST coming soon which will go into more detail about the workshop.

Comparing Cultures of Responsible Innovation across Bioengineering Communities

NSF recently funded the Center for 2 years in the cross-directorate program of Cultivating Cultures for Ethical STEM. Because issues surrounding genetic engineering, biotechnology, and synthetic biology are contentious, especially when applied to food, the environment, and industrial applications for which direct human consent and medical benefits are not present, Co-director Jennifer Kuzma was interested in getting a grant to study how researchers, developers, and policy-makers communicate about and reflect upon their work is of utmost importance to the fields of bioengineering. This research fills an important niche by encouraging those involved in biotechnology innovation systems to

reflect on the ethical dimensions of their work and what it means to innovate responsibly. At the same time, this research contributes to important comparative research on conceptions of responsible innovation across four types of institutions (industry, NGOs, academia and governance) Increased understanding about how participants within and across various professional contexts conceive of and frame the ethical dimensions of their work can assist with future cross-sector dialogue, and potentially conflict resolution.



Director's Corner

Fred Gould: Time with NAS

Dr. Fred Gould is one of the leaders in his field of Entomology. He is also one of the founders and a current Co-Director of the GES Center. Gould has been a part of a committee with the National

Academy of Sciences whose focus has been assessing the concerns around genetically engineered crops. One of the concerns is about food safety. Some groups and individuals in countries where genetically engineered crops are being grown feel that the regulatory agencies have not rigorously tested the new engineered foods. Others feel that genetically engineered crops are over-regulated and that this over-regulation is stifling innovation. There has also been an expression of distrust of the corporations who engineered these crops, a worry that these corporations are being dishonest and that the engineered food could potentially be harmful. Beyond food safety there are ecological concerns about herbicides used in conjunction with engineered crops killing off plants that are needed by the monarch butterflies and other species that feed on weeds. On the other side, proponents of the technology point to the fact that the new crops have decreased the use of insecticides and that the fields with engineered crops have more beneficial insects than those where conventional pest control is used.

The goal of the NAS study is to examine the evidence supporting and negating the many claims that have been made about genetically engineered crops. The Academy report will also focus on new technologies used to develop engineered crops. Dr. Gould shared that a lot of the new agricultural technologies are not regulated by the USDA, which presents a problem in terms of gaining consumer trust and support. The Academy is discussing these gaps and is trying to find ways to build bridges to connect the corporations that create these technologies and the consumers who use them. Dr. Gould explained that the committee has been looking at past reports on GE crops to determine where GE crops and the technologies surrounding them may lead to in the future. They have been looking at

the feasibility of ideas which scientists have been trying to develop in order to improve upon technology and crops that already exist. This research includes ways to change basic processes like photosynthesis by using synthetic biology.

This committee is made up of twenty people with diverse backgrounds ranging from molecular geneticists and toxicologists all the way to economists and lawyers. They have devoted themselves to thinking about these concerns and also these new innovations in agricultural crop technology from their unique perspectives. Dr. Fred Gould is right there in the mix offering his expertise and he is excited about the possibilities that can come out of this meeting of minds.

By Maurizo Lewis



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