

NABC news

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**Providing an open forum
for exploring issues in
agricultural biotechnology**



NABC'S PRINCIPAL OBJECTIVES ARE TO

- provide an open forum for persons with different interests and concerns to come together to speak, to listen, to learn, and to participate in meaningful dialog and evaluation of the potential impacts of agricultural biotechnology
- define issues and public policy options related to biotechnology in the food, agricultural, biobased industrial product, and environmental areas
- promote increased understanding of the scientific, economic, legislative, and social issues associated with agricultural biotechnology by compiling and disseminating information to interested people
- facilitate active communication among researchers, administrators, policymakers, practitioners, and other concerned people to ensure that all viewpoints contribute to the safe, efficacious, and equitable development of biotechnology for the benefit of society
- sponsor meetings and workshops and publish and distribute reports that provide a foundation for addressing issues.

Ralph W. F. Hardy, President
Susanne Lipari, Executive Coordinator
B 15 Boyce Thompson Institute
Ithaca, NY 14853
607-254-4856 fax-254-8680
<http://nabc.eals.cornell.edu>
[nabc@cornell.edu/](mailto:nabc@cornell.edu)

Letter from the Chair....

In keeping with tradition, it is an honor for me, as chair of NABC, to write a few words for this newsletter.

Through its history, NABC has focused on the potential and realized impacts of biotechnology on agriculture. This focus has sometimes been on the technologies themselves, such as at the 2014 meeting on CRISPR-mediated modification of genomes, and sometimes on the boundary conditions in which agriculture operates, such as water availability or food security, the complex interaction of population, economics and development that are related to agricultural production and food distribution. Assessing the current and potential future state of science and policy is often a major component of the meetings—this is not a meeting where breakthroughs are announced but instead one where breakthroughs and potential breakthroughs are examined to determine their potential consequences. NABC meetings include sessions that highlight where gathering scientific information might potentially be translated into actions that affect outcomes.

There are a number of recurring themes in the agricultural arena. Land is limited, water is limited, human populations are growing and growing to the extent that our age has been called the Anthropocene in recognition of the significant global impact human activities are having on Earth's ecosystems. While some want to characterize this geological era by the signature of fossil fuel use and place its beginning near the introduction of coal-based industrial economies and others want to use the appearance of radioactive elements in the fallout from nuclear weapons, another landmark might be the addition of fixed nitrogen to large-scale agriculture. It has



MICHAEL KAHN
WASHINGTON STATE UNIVERSITY
NABC CHAIR 2015–2016

been argued that the development of the Haber-Bosch process for manufacturing ammonia fertilizer was the most important technological development of the 20th century. By itself, nitrogen availability stimulated agriculture, allowing the development of Green Revolutions, in which new cultivars and methods enable much larger production of crops that depend on fertilizer application. Many new technologies have contributed to the rapid and substantial population growth of the last century, but the large-scale addition of nitrogen is one of the few that directly contributes to the fundamental chemistry of life, and it is possible to draw a connection between more nitrogen, more protein and more people.

In thinking about the horizon of agricultural biotechnology, it has become conventional to cite the need for more food to feed more people. The United Nations population estimates are often taken as a target in phrases such as “We will need to feed 9 billion people by 2050.” Unfortunately, that statement is a condensed version of the

Mark Your Calendars

**NABC 28: A Flourishing Agricultural Genetic Tool Box:
Applications for Plant and Animal Improvement**

**Hosted by Washington State University
Pullman, WA, June 1 and 2, 2016**

Michael Kahn

Powerful new versions of classical genetic techniques fueled by new methods that generate and manipulate huge amounts of data are radically altering our ability to genetically modify plants, animals and microorganisms.

These supercharged approaches take advantage of high-throughput genetic and phenotypic characterization and very often involve the creation and manipulation of large data sets. Whole organism and exon DNA sequencing, RNASeq and other expression-profiling technologies, correlation of traits with high-resolution DNA markers, and rapid determination of genetic variants have enabled the creation of genetic maps and their use almost in real time.

These technologies allow characterized libraries of variants to be generated and searched at the molecular level to identify interesting traits that can then be moved into the production pipeline, where various phenotype determination methods can be used to determine their influence on the properties of the whole organism. The effort depends heavily on improved bioinformatics to track and organize information and for correlating genotypes and phenotypes.

Ultimately, integration of this information can be used to guide breeding strategies in order to yield plants and animals with multiple desired traits, including improved quality, yield, disease resistance and nutrition. Combinations of these technologies are lending much more precision in gene discovery, and the meeting will discuss the agricultural implications of this sort of advanced classical genetics■



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Overview of NABC 27

**Stewardship for the Sustainability of Genetically Engineered Crops:
The Way Forward in Pest Management, Coexistence, and Trade**

Gary A. Thompson

NABC's twenty-seventh annual conference was held in State College, PA, June 2-3, 2015, hosted by the College of Agricultural Sciences at The Pennsylvania State University. The conference explored the varied and often complex perspectives on key issues that impact the sustainability of GE crops, including stewardship approaches to resistance management, coexistence, trade and markets, and social and economic dimensions of sustainability. Delegates were welcomed to Penn State by Gary Thompson (NABC 27 program chair, NABC chair, and Associate Dean & AES Director, College of Agricultural Sciences), Ralph Hardy (NABC President), and Richard Roush (Dean, College of Agricultural Sciences).

The conference began with keynote presentations, defining the challenges and setting the stage for four moderated plenary sessions, each followed by facilitated panel discussions that directly engaged the audience through Q&A.

Delegates were addressed by **Russell Redding** (Pennsylvania Secretary of Agriculture) who presented: *AC21—The Journey to Coexistence* at the conference banquet and by **John Tooker** (Penn State) who presented *Sustainability of Genetically Engineered, Insect-Resistant Crops: A View from the Fringe* at luncheon on the

second day of the conference.

Graduate students from Penn State, University of Arkansas, Washington State University, and Iowa State University, participating as members of the Student Voice in the conference, met the evening of June 2 and presented their views on the conference topics to participants on June 3.

Finally, the closing panel session, *Putting It All Together*, moderated by Steven Pueppke (Michigan State University), capped off the conference with a challenging discussion of key issues presented during the two days.

Four keynote talks were presented:

- **Kathleen Merrigan** (George Washington University) challenged the delegates with her presentation, *Thinking across Time: A Twenty-Year Perspective on Biotech Policy*, to take a broad historical view of critical moments within the biotech industry that have framed the current issues.
- **Richard Roush** (Penn State) introduced the challenges faced by agriculture worldwide in developing and managing resistance to GE-based insect and weed control strategies in his talk, *Are the Major Impediments Now to Resistance Management for Crops in the Social Sciences and Governance?*

- Coexistence through combinations of farming practices including conventional, organic, identity-preserved and genetically engineered crops raises complex management, policy, economic and consumer issues that were discussed by **Gregory Jaffe** (Center for Science in the Public Interest) in his presentation, *Coexistence of Biotech, Organic and Conventional Crops: Facts, Issues, and a Path Forward*.
- The final keynote presentation, *Agricultural Biotechnology: Facilitating Trade for Food and Feed* by **Sharon Bomer Lauritsen** (Office of the U.S. Trade Representative) introduced the many interconnected issues such as synchronous authorizations, trade disruption, liability, boycotts, and policies affecting global agricultural and international trade of GE crops.

Three plenary sessions were organized around the topics introduced by the keynote speakers: "Resistance Management," "Coexistence," and "Trade and Markets." A fourth plenary session addressed the critically important "Social and Economic Dimensions of Sustainability."

The first plenary session, **Resistance Management**, moderated by David Mortensen (Penn State), included

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three talks that explored U.S. and Canadian approaches to regulating and managing widely adopted traits for insect protection and herbicide resistance in some of our major crop plants. **Jack Housenger** (Environmental Protection Agency) presented the EPA's perspectives in *Regulating Resistance*. **Nicholas Storer** (Dow AgroSciences) provided a biotech industry perspective in his talk, *Resistance Management for GE Crops: Industry Principles, Policies, and Programs*, focusing on the commitment across the industry to implement strategies for durable GE crop deployment based on effective resistance management. **Hugh Beckie's** (Agriculture and Agri-Food Canada) presentation, *Herbicide-Resistant Crop Management: A Canadian Perspective*, focused on the Canadian approaches to weed resistance in GE canola, corn, and soybeans, including reporting requirements, best management practices to minimize resistance, and systematic monitoring for herbicide-resistant weeds.

Carol Mallory-Smith (Oregon State University) moderated the second plenary session, **Coexistence**, and delivered the introductory session talk, *Coexistence: The University Role*, focusing on the challenges land-grant universities face in fulfilling the mission to provide unbiased information through research, education, and outreach for the broad range of stakeholders that coexist in this technologically diverse landscape. An industry perspective on coexistence was presented in the next two talks.

Lynn Clarkson (Clarkson Grain Company) discussed the issues involved in managing for purity when meeting client quality

standards in commercial-scale handling of conventional, GE, organic, and identity-preserved crops in his talk, *Segregating GMO Crops – Cultural and Functional Challenges*.

Greg Loberg (West Coast Beet Seed Company) told delegates about a highly successful program for coexistence through the Willamette Valley Specialty Seed Association in his presentation, *Coexistence in the Oregon Seed Industry*.

The third plenary session, **Trade and Markets**, moderated by David Abler (Penn State), addressed current issues on the certification of GM crops and regulations affecting their commercialization in the international marketplace.

Michael Schechtman (USDA ARS) discussed the challenges faced by marketing GE crops in commodity agriculture when meeting consumer needs worldwide in *Trade and Markets for GE Crops: A USDA Perspective*.

Randal Giroux (Cargill) reviewed the challenges of managing the coexistence of commodity crops within supply chains and global food systems in his presentation *Enabling Coexistence: Balancing Innovation and Market Access*.

William Kerr (University of Saskatchewan) explained in his talk, *Worlds Apart on GMOs – Can Trade Agreements Bridge the Gap?*, the ways in which regulatory divergence of GE commodities on the world market lead to trade barriers and reduce trade flow.

The fourth and final plenary session, **Social and Economic Dimensions of Sustainability**, moderated by Leland Glenna (Penn State), was

organized as short “lightning talks” by four speakers who introduced the issues for an interactive panel discussion with the delegates. The presenters and topics included: **Paul Heisey** (USDA Economic Research Service), *The Structure of U.S. Agricultural and Food Research, with an Emphasis on Seed/Biotechnology Research*; **J. Rick Welsh** (Syracuse University), *Understanding Social Controversies about Ag Biotech*; **William Hallman** (Rutgers University), *Do American Consumers Want GM Food Labeling? – It Depends on How You Ask the Question*; and **Stephen Palacios** (Added Value Cheskin), *The Limits of Science in Impacting the GMO Discourse: How Food Manufacturers and Retailers Affect Consumer Opinion*. This robust and fascinating discussion of the contributions of biotechnology to a sustainable food and agricultural system explored the evolving roles of the agricultural research and development infrastructure and consumer acceptance of GE technologies.

The closing interactive panel session, *Putting It All Together*, moderated by Steve Peuppke (Michigan State University), was a stimulating conversation with chosen presenters and the delegates that reflected on the issues, scope, and content of the conference. ■



The Student Voice at NABC 27

**Presented by Bastian Minkenberg (Pennsylvania State University) and Jade Newsome (University of Arkansas)
for the other Student Voice delegates**

Imtiaz Ahmad
Pennsylvania State University

Patrick Alves
Pennsylvania State University

Natalie Boyle
Washington State University

Gustavo Camargo
Pennsylvania State University

Lina Castano-Duque
Pennsylvania State University

Long Chen
Pennsylvania State University

Ryan Huffman
Iowa State University

Shan Jin
Pennsylvania State University

Clair Keene
Pennsylvania State University

Demetra Perry
Pennsylvania State University

Swayamjit Ray
Pennsylvania State University

Kelsey Tenney
Pennsylvania State University

Each year, NABC holds a conference discussing issues of agricultural biotechnology in North America. The 2015 conference was about *Stewardship for the Sustainability of Genetically Engineered Crops: The Way Forward in Pest Management, Coexistence, and Trade*.

An important component of the conference is the Student Voice, a program for graduate students from NABC member institutions. Student Voice participants exchange thoughts and ideas on topics related to agricultural biotechnology that they found of special interest. The following report is a summary of our exchange as participants in the Student Voice.

The first part of our discussion focused on science advocacy and education. We acknowledged that one of the hardest tasks for scientists is to effectively communicate our findings to the public. We know that even when talking to close relatives, like our own families, we have trouble finding the appropriate words to explain our research. Unfortunately, many

scientists are intimidated by public communication and instead of learning how to communicate more effectively, they choose to avoid work-related conversations with nonscientists. We feel there is a need to increase communications with nonscientists. The debate about genetically engineered crops during the past few decades shows that we need to better communicate the real dangers and benefits of biotechnology for society. We need to de-mystify science for the public and educate them on the facts behind scientific discoveries. Especially in a time when funding for research is closely connected to the public perception of it, we will only benefit from engaging in these discussions.

Even though we want to encourage our fellow scientists to engage with the public, we recognize that it is hard to explain science and genetic engineering if the audience has only limited knowledge of basic concepts in biology, especially genetics. We therefore agree with a note from Dr. Mallory-Smith's presentation about the importance of early

and thorough genetics education for school children. Knowledge in genetics has become more important than ever before. We live in an era where we regularly encounter genetically engineered crops and where gene therapy is becoming an option for treating disease. People are only able to grasp the concepts behind these new technologies if they understand genetics. Education is the first step toward being an informed citizen who is able to make wise decisions about the use or consumption of products or techniques that result from scientific advances. We therefore ask all NABC participants and readers of this report to talk to their children's teachers and other parents about the importance of genetics education and the need to teach this subject to our children and grandchildren.

The second part of our Student Voice workshop discussed the need to change the focus of the current science and discussions about genetically engineered crops. The main body of scientific publication

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issue—the UN estimates are based on models that actually describe a range of sizes for the populations we might expect. A key element in the UN models is the population growth rate and the observation that birth rates typically decrease as the standard-of-living increases. Thus the smallest UN population projection is associated with higher per capita standard-of-living numbers and the largest population projection with a standard-of-living that does not change much. Because agricultural productivity and food availability are major drivers of the standard of living, this linkage means that the projected need for increased agricultural production is actually more constant than the projections of population increase. For the assumption that the future will have smaller families, people in the smaller population will need to be eating better than they are now. And if we fall short of the standard of living target in the near term, we will have just that much more catching up to do to achieve the stabilization that the UN's models are projecting, since we will need to be raising the standard of living target for that many more people.

Unfortunately, the world's population appears to be increasing faster than the high standard of living/smaller population model predicts, suggesting either that the model's relationship between standard-of-living and fertility is not accurate or that the standard of living is not increasing in poor populations enough to have an impact (see <http://news.nationalgeographic.com/news/2014/09/140918-population-global-united-nations-2100-boom-africa/>). Whatever the reason, fertility rates are not decreasing as fast as needed to achieve the lower population projections. The sentence

above is now revised to “We will need to feed 9.8 billion people by 2050,” which is in line with the latest UN estimates (<http://esa.un.org/unpd/wpp/Graphs/>). More detailed examination of the UN data shows that developed countries are nearing a constant population, but populations in less developed countries are still growing rapidly. So many of the critical efforts in agricultural biotechnology will need to be directed at the less developed countries.

A lot of the thinking in agricultural biotechnology has been about increasing yield and quality in agricultural production, and there is obviously a need for these increases to contribute to a standard-of-living-based future. Those increases will need to occur in an agricultural context that is increasingly constrained by the people it is trying to feed. Competition for land, water and ecosystem services that have been important parts of current production practices will limit many possible alternatives.

Where does NABC fit into this picture? While some of the effort of this group has historically been to evaluate new technologies built around genetic modification of agriculturally important species, there has been considerable resistance to incorporating these technologies into production agriculture, an issue highlighted in the 2013 NABC Specialty Crop meeting. NABC has been a forum for considering the science aspects of these technologies, but as the unknown unknowns have become known unknowns and then knowledge, the reluctance based on uncertainty has shifted away from scientific grounds to resistance based in ignorance or in other ideas about how the food system should work.

The meeting in 2016 will focus on more traditional types of agricultural technology that are being remolded by new information technologies. Breeding and selection have been staples of crop development; horticultural, agronomic and animal husbandry techniques have been key to obtaining the desired potentials in yield and quality. Changes that are based in these areas include new methods for using DNA sequences to discover traits and follow them through crosses; databases that can remember and bring together information from different individuals and species that might reveal common useful characteristics; large-scale phenotyping that can pull multiple trait needles out of highly diverse haystacks; and precision farming methods that can guide combines to plow, water and fertilize in the right places. These techniques are already having significant impact on how new varieties are being bred and will soon be affecting issues such as the domestication of new plants that might be able to grow under conditions that are not favorable for current crops. While the promise of recombinant DNA was said to be revolutionary, these technologies are more evolutionary. But their impact is likely to be substantial as the world attempts to achieve balance ■



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dealing with genetically engineered crops investigated the safety of these crops for human consumption and the danger of outcrossing. These publications were able to alleviate most, if not all, concerns about their safety and showed that people can safely use genetically engineered crops. Considering the wide use of genetically engineered crops around the world, we suggest shifting the investigations away from safety for humans to their effects on other organisms. Currently, major concerns in the scientific community are populations of herbicide-resistant weeds, effects on nontarget organisms, and beneficial insects, such as pollinators. We hope to see more discussion about these effects rather than focusing again and again on safety for human consumption, while safety is well-established for the approved

genetically engineered cultivars. We especially ask for more collaboration between ecologists, microbiologists, entomologists, and weed scientists to obtain a better picture of these complex effects on multiple organisms.

In addition to our more general suggestions about communicating our science, genetics education, and updating the focus of the discussion, we also have a more specific suggestion for future NABC conferences. We would like to see an even broader array of participants during the years to come. The sciences of agricultural biotechnology and genetically engineered crops are well established, and we reached a common consent about their safety among scientists. We therefore think that it is time to invite more diverse groups to attend this conference. We need to convey

these findings more effectively to people who are not biologists or working in agriculture. We should work closer with social scientists to find effective ways of reaching out, and the NABC should invite more experts in the media, social sciences or humanities to participate in the conferences. Maybe it is even time to open the meeting directly to consumers as we need to inform them about our findings and could better cater our research to consumer concerns if we began creating closer ties with nonscientist communities.

At the end of this report we want to thank the NABC for the Student Voice travel grants that enabled most of us to travel to the conference and Dean Gary Thompson from Pennsylvania State University for hosting this year's NABC conference and his great hospitality. ■

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