

NABC

Letter from the Chair...

news

Fall 2010 No. 41

*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.

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The second Green Revolution is in our midst with the explosion of sequencing output.

As we enter a new century of plant, animal and health improvements through the application of genome-scale technology, we are both building an unprecedented view of gene content and genome organization and developing the ability to make genetic selections and improvements based on DNA roadmaps. Advances in genetics, laboratory automation, and information management permit vast amounts of information to be collected and analyzed, allowing the identification and expression of genes that are of central importance to the health sciences, agriculture and veterinary medicine. These genomic approaches have created nearly complete gene lists for humans and for species of plants, microbes and animals that are important to us. Vast amounts of genetic information have been discovered and made available to researchers throughout the world. However, many discoveries are still to be made to improve our understanding of the relationship between variation in gene sequences and variation in each organism's form and function. Quite simply, future discoveries will be all about phenotype, or, specifically, our ability to measure phenotype in a reproducible and sensitive way and then reduce this information to a description at the molecular level. Making these discoveries will require investments into basic and applied research such as have never before been made in the life sciences, to ensure that our ability to create knowledge from information keeps pace with our ability to generate data.

The generation of complete genomic sequences for a wide range of species has enabled a new genetic



BILL F. McCUTCHEN
NABC CHAIR 2010-2011

discovery paradigm where the acquisition of sufficient DNA-sequence variation can increasingly account for the corresponding phenotypic variation. Recombination and selection within breeding and natural populations is used to identify recombination break points and narrow the range of physical location for candidate genes and regulatory sequences; now, several current approaches allow the direct identification of regions of the genome responsible for phenotypic variation that can be used to identify areas related to traits of particular interest. Building on these results, high-resolution genetic mapping and positional cloning methods can then be used to ascribe gene functions that control these traits.

As more genomes are sequenced, comparative genome analysis will provide a powerful tool for identifying conserved coding and non-coding or regulatory sequences that have been selected over evolutionary time. Connecting these observations to phenotypic data will require substantial investment in bioinformatics programs that

continued on Page 6

NABC 23—Mark Your Calendar

Food Security: The Intersection of Sustainability, Safety and Defense

June 15–17, 2011

UNIVERSITY OF MINNESOTA

F. Abel Ponce de León and Jessica Weaver

According to the United Nations Food and Agriculture Organization (UN-FAO) report, *The State of Food Insecurity in the World 2010*, approximately 925 million people worldwide are undernourished. Despite innovations in agricultural technology leading to increased food production, hunger lingers as an unremitting reality for nearly one in every seven people in the world. With ever-increasing demands on natural resources and a multitude of forces exerting pressure on the ability of each individual person and state to gain access to safe, nutritious food, global food security remains a fundamental, but as of yet, unattainable goal.

The reasons behind food insecurity, be they global, regional or local, are complex and multi-disciplinary, encompassing far more than crop and livestock production. Similarly, any attempt to characterize the problem demands attention to various issues: plant and animal biosecurity, climate change and natural-resource management, economic and trade policy, politics, socio-cultural norms, food sovereignty and justice, sustainability, and biotechnology development and use.

Like many organizations around the world, the University of Minnesota shares a commitment to local, national and global food security, safety and sustainability. Having signed a historic Memorandum of Understanding with UN-FAO in February 2010, the University of Minnesota is actively working to understand and mitigate factors threatening food security and

safety, and to develop best practices and viable solutions for food-insecure populations around the world. With this charge in mind, we at the University of Minnesota are especially pleased to host the twenty-third annual NABC conference, titled *Food Security: The Intersection of Sustainability, Safety and Defense*, June 15–17, 2011.

NABC 23 will bring together experts in the fields of agriculture, public health, biotechnology, climate change, natural-resource management, and plant and animal biosecurity, to engage the broad issues underlying global food security through discussion and discourse on the following topics:

- *Sustainability and Needs of 2050 Agriculture*: Climate change, water resources, and developing- and developed-world perspectives on food security;
- *Systems-Based Approaches to Food Protection and Security*: Risk and vulnerability, detection and prevention, and risk transference;
- *Emerging Biotechnologies to Promote Safety, Enable Defense, and Discourage Fraud*: Safety, defense, fraud, and the use of sentinel systems; and
- *Preparing for Emerging and Unknown Threats*: Crops, animals, and public health.

To set the stage for the conference, Dr. Daniel Gustafson, director of the FAO Liaison Office for North America, has agreed to deliver the keynote opening address. The welcome reception on the night of June

15 will afford excellent networking opportunities as will the banquet on June 16, at which The Honorable Amy Klobuchar, US Senator for Minnesota, will speak. Attendees will have the opportunity to participate in breakout workshops, to discuss issues raised by the featured speakers and during Q&A sessions, and to formulate recommendations for policymakers.

All sessions and events will take place onsite at the Hilton Minneapolis-St. Paul Airport/Mall of America Hotel, conveniently located three miles from the Minneapolis-St. Paul International Airport and approximately 12 miles from downtown Minneapolis and St. Paul. Attendees will enjoy complimentary shuttle service to and from the airport and close proximity to the Mall of America and the Minnesota Valley National Wildlife Refuge as well as the Metro Transit Light Rail, with service to downtown Minneapolis. Conference details, including the full program and registration, hotel and travel information, will be accessible via the NABC website.

We welcome your questions, comments and suggestions. Please contact:

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Overview of NABC 22
Promoting Health by Linking Agriculture, Food, and Nutrition

Alan B. Bennett

NABC's twenty second annual conference was held in Davis, CA, June 16–18, 2010, hosted by the College of Agricultural and Environmental Sciences at the University of California, Davis. The conference addressed one of the major issues of this century: promoting health through agriculture, food, and nutrition. With healthcare consuming so much of the developed world's resources, there is a critical need to understand how diet, nutrition, and the underlying agricultural production systems impact human health. Speakers at NABC 22 addressed the science linking agriculture, food, and nutrition to health, with the goal of informing both research priorities and government policies that seek to improve human livelihoods. Agriculture and conventional food systems have provided the basis for long and healthy lives, which have improved dramatically over the last century, and much of that improvement can be traced to healthier diets. At the same time, the current food systems in the United States and other developed countries are faced with a growing critique that they are significant contributors to the health crisis, particularly related to obesity and diabetes. It was with this dichotomy—agriculture and diet being both the problem and the solution to an increasing health crisis—that this conference was framed, addressing both sides of the issue.

The conference was oversubscribed with 159 registered participants. All were welcomed by Neal Van Alfen, dean of the College of Agricultural and Environmental Sciences at UC Davis, AG Kawamura, Secretary of the California Department of

Food and Agriculture and Mark McLellan, NABC's chair. The welcoming remarks were followed by five plenary sessions and the banquet keynote speaker, Martina McGloughlin, whose address was titled *Plant Biotechnology: The Answer to your Nutrition Needs!* The plenary sessions were organized around the following topics.

Session 1: Agriculture, Food and Health: The Problem and the Solution. This session was structured to present the tremendous health benefits that the current food system has delivered to the public over the last century, food innovation trends and areas where the current food system is not responding to identified health threats.

Session 2: Food for Health Successes and Prospects. The speakers in this session highlighted research-based successes in delivering agricultural and food products that address health benefits.

Session 3: Choosing Foods for Health. In spite of the potential to deliver health benefits through diet, people make food choices that are based on a range of factors and the diverse drivers of food choices were explored.

Session 4: Regulatory Frameworks for Food Health Claims. The business of delivering health benefits through food products is strongly influenced by the ways in which these benefits can be communicated to consumers. This session explored the existing and emerging governmental frameworks that regulate food labeling.

Session 5: Food for Health Strategies and Programs. The final session explored examples of institutional

and governmental frameworks as well as investment strategies to deliver innovations in both research and food products to promote health benefits.

The conference theme is not new. It is essentially the same topic that was addressed in NABC 14—*Integrating Agriculture, Medicine, Food and Health*—but it remains timely and important. With the societal healthcare bill in the United States approaching 20% of GDP, we simply cannot afford to treat health and wellness as we have. Movement towards a sustainable national healthcare system must be underpinned by healthier lifestyles as a starting point and diet will be one key element. NABC 22 highlighted the fact that there is no magic bullet to a healthier diet but emphasized that any solution will require collaboration among agriculture, food companies, regulatory agencies as well as marketing and healthcare professionals. This was one of the major take-home messages of the conference, that real progress in supporting development of healthy diets on a national scale will require progress and collaboration in many dimensions. A number of food companies appear to recognize that their future long-term success is linked to ability to deliver diet and health and that they are in perhaps the best position to integrate research that spans the agricultural production systems that produce their raw materials all the way to clinical outcomes from consuming the food products they sell. A few academic institutions recognize the importance

continued on page 5

Summary of the Discussions at the NABC-22 Breakout Workshops

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Two breakout sessions were held, each comprising three parallel workshops. The following questions were addressed:

- How can we ensure more-efficient interdisciplinary linkages among those working in the agricultural, food and human-health fields?
- How should the obesity epidemic in North America be addressed?
- What should be the research priorities?

This is a synthesis of key points that emerged.

HOW CAN WE ENSURE MORE-EFFICIENT INTERDISCIPLINARY LINKAGES AMONG THOSE WORKING IN THE AGRICULTURAL, FOOD AND HUMAN-HEALTH FIELDS?

- Encourage multi-departmental and multi-institutional projects.
 - Calls for proposals should stipulate multi-disciplinary collaboration as a condition for funding.
 - Provide funding for projects that require input not only from academia but also from researchers in industry and government and from farmers.
- During their training, graduate students should be exposed to multi-disciplinary collaborative projects. Graduate students in the applied sciences should be exposed to political science and learn skills

for communicating with lay people.

- Faculty should be provided with incentives—other than funding—to collaborate in interdisciplinary efforts, including joint appointments and participation in joint graduate programs.
- Follow the recommendations laid out in the National Research Council's 2009 report, *A New Biology for the 21st Century*.

HOW SHOULD THE OBESITY EPIDEMIC IN NORTH AMERICA BE ADDRESSED?

- There is need for improvement in communication, in both directions, between academia and consumers.
- Socioeconomic-appropriate education on nutrition is needed.
 - Make nutrition information simple and easy to understand, e.g. red for unhealthy foods, yellow for neutral foods and green for healthy foods.
- Food cost is an issue. Nutritionally poor processed food is often less expensive and attractive for low-income families.
 - How a problem is addressed often is based on the discipline of the investigator. Attention is needed to framing problems. For example, improving human nutrition may require data on median income and food costs.
- Sound dietary advice is needed.

Consumers absorb much inaccurate information on nutrition from sound bites and commercials.

- More information is needed on why people eat what they eat and how life-time-long habits can be altered.
- Campaigns are needed to encourage people to eat less, using all available media: print, radio, television and the Internet.
- Rather than expect lifestyle changes, government could provide incentives to food producers to make gradual improvements in ingredients.
- A long-term effort similar to the anti-smoking campaign of the past couple of decades may be successful.
- However, increased taxation—a factor in the reduction in smoking—would be an unpopular means of influencing diet, and politically ill-advised.
- Biotechnology has a role in the modification of foods that are already in demand to make them more healthful.
- Strictures should be instituted on foods purchasable with food stamps to encourage consumption of fresh fruits and vegetables.
- Healthcare providers have a potentially important role. On the other hand, there is very little

education on good nutrition in medical school curricula.

- More formalized physical activity is needed in grade schools.

WHAT SHOULD BE THE RESEARCH PRIORITIES?

- It's important to realize that science can drive policy only in the appropriate political climate.
- Behavior/communication-based research is needed to elucidate the forces shaping consumers' choices of food in order to develop effective tools to motivate change in eating habits.
- Consumer input can be critical to assigning research priorities. High protein corn had no market in Central America because the tortilla flavor was altered.
- Develop metabolomics for identification of biomarkers as surrogate indicators of disease, with emphasis on identifying early stages of disease onset to minimize treatment costs.
 - Develop biomarkers as a means of measuring the success of research programs aimed at long-term prevention

of disease.

- Develop metabolomics as a means of identifying groups and eventually individuals for the development of personalized diets to minimize disease risk.
- Breeding of bio-fortified crops.
 - However, we should also think beyond individual nutrients. Limitations to increasing the diversity of crop production and consumption need to be understood and addressed.
- Research is needed on the effectiveness of Food Nutrition labels. ■

¹Recorder, workshop 1; ²recorder, workshop 2; ³recorder, workshop 3; ⁴discussion facilitator, workshop 3, and verbal reporter at the conference; ⁵recorder, workshop 3; ⁶recorder, workshop 2, and verbal reporter at the conference; ⁷recorder, workshop 1, and verbal reporter at the conference; ⁸discussion facilitator, workshop 2; ⁹discussion facilitator, workshop 1.

continued from Page 3: Overview

of integrating research across this entire spectrum, but a national research agenda is needed to support the developments that will contribute to a dietary shift that supports healthier lifestyles and diminished reliance on an overburdened healthcare system.

The benefits of an effective research strategy would address two of the most important issues of this decade and indeed of this century. The most direct impact will be on the healthcare crisis in the United States and other developed countries, but will also indirectly contribute to strategies that are deployed for agricultural and economic development of underdeveloped countries globally.

A fuller overview will be available in the proceedings volume *NABC Report 22*, which will include manuscripts by the speakers. ■

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Continued from page 1: Letter

will allow interpretation of these data. Computation methods and strategies must continue to develop to improve genome annotation. DNA re-sequencing efforts are beginning to sketch out the complex nature of genome organization and diversity, providing a fresh view of the complexity of gene regulation and organization and genome evolution. The ability to compare the data from these efforts with previously collected data in order to achieve new insights will be critical.

Current and future genome-science technologies share several attributes that make a focused and applied strategic investment worthwhile. First, these technologies are generic, without any bias towards a particular organism; technological breakthroughs will have immediate and broad application. Second, they are cost-driven, and we can expect to see ever-greater access to more complex information for a decreasing price; thus, investments in genomic technologies will yield returns with increasing economy. Finally, they are capable of providing comprehensive and detailed views of DNA, RNA, and protein and chemical compositions, im-

proving the ability to model, predict and describe cellular structure and function. Today, high-resolution mass spectroscopy is capable, not only of generating a fingerprint of the cell's metabolic response to perturbation, but also of identifying individual metabolic compounds changing in response to perturbation. Investments in genome-science technologies will help move research programs beyond simple information gathering to knowledge generation.

The present challenge in the genome sciences is to align these technologies in such a way as to accelerate the transformation of information into knowledge by organizing these efforts around well-defined basic and application-oriented issues. By maintaining diverse research programs that include projects across the spectrum of basic-to-applied, opportunities are created for research collaborations between industry, government agencies and universities that focus on achieving discoveries that have maximal societal impact. These mission-oriented projects can expedite the identification of organisms best suited for various regions of the target markets and can yield important infor-

mation that will increase the efficiency of breeding and selection programs, leading to continuously improved agricultural production. As stated by Norman Borlaug in his Nobel Peace Prize acceptance speech, "The first essential component of social justice is adequate food for all mankind." The age of "phenotypes to genotypes" is clearly upon us, and this genomics revolution will likely be the most important component of a second Green Revolution for feeding the world, with significant impacts for improving crops, livestock, microbes and the like. ■



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Are you a graduate student at an NABC member institution and would like to participate in *The Student Voice at NABC 23* in June, 2011, in Minneapolis, MN ?

Please visit the *Student Voice* webpage at
<http://nabc.cals.cornell.edu/studentvoice/index.cfm>
for application details and deadlines.

The Student Voice at NABC 22

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As *Student Voice at NABC 22* participants, we were asked to discuss our views in terms of what we got out of the conference, what we felt was missing, and some needs that we can address as young scientists. Our backgrounds included food science, nutrition, plant science, animal science, and applied economics.

Overall, our view of the meeting was very positive. We were inspired by many of the high-quality talks and discussion sessions. We identified key strengths and aspects that we especially appreciated:

- Incorporating a variety of speakers with diverse perspectives and opinions.
- Showcasing specific examples and case studies with potential applications. Such as the BioCassava-Plus program and the mammalian milk genome project.
- Addressing problems related to the diet in the United States and Canada as well as in developing countries.
- Referring to scientific studies and the use of specific details or data from these studies to support presentation points.
- Discourse that connected nutrition science and regulation policy.

- An overall excellent flow of the meeting.

As young scientists we identified several messages and needs to address in the area of agriculture, food, and health, including:

- The importance of consumer education and awareness.
- Because human behaviour is very difficult to change, we will need to consider improving the quality of foods that are already a part of the consumers' diets in addition to promoting behavioral changes.
- The application of science, especially biotechnology, to address the need for healthy food among poverty-level populations.
- Development of solutions at the community level, such as *Farm2School* and the *Old Grove Orange Program*, is a valid approach to incorporating healthy foods into children's diets.
- Clinical trials on the health benefits of specific foods must be conducted in order to obtain valid health claims.

Finally, we discussed suggestions that could be incorporated into future meetings:

- A greater emphasis on the potential solutions when discussing the problems associated with human health.
- An additional session focused on social science including:
 - Linking healthful advances in biotechnology to consumer acceptance.
 - How to address public perceptions of biotechnology.
 - Consumer behavior studies focused on incorporation of healthy foods into the diet.
 - The effect of the media on consumer behavior.
- More information on agriculture, farming and the economics behind incorporating genetically engineered crops and biotechnological food products.
- More details on scientific studies, specific case studies, and examples rather than broad, all-inclusive talks.
- We would have liked more time to talk with the speakers either individually or in small groups. Perhaps, speakers could have either been available in designated areas after their talks or incorporated into the breakout-session discussions.

continued on page 8

continued from page 7 : *Student Voice*

- A debate on the topics addressed, including ones with potential for controversy, would have been beneficial.

In conclusion, human health can be promoted by linking agricultural,

food and nutrition; as Hippocrates once said, “Let food be thy medicine, thy medicine shall be thy food.” NABC 22 was an enriching experience that has inspired us to ask questions and to work to find solutions that improve human health through science. We

thank the organizers for giving us the opportunity to attend the conference. ■

¹ The *Student Voice* report was presented verbally at NABC 22 by Rosalee Hellberg. This report was assembled by Ms. Hellberg and Watchareeya Kuldamrong, with input from the other students.

Mark your Calendars

NABC 23—*Food Security: The Intersection of Sustainability, Safety and Defense*

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