

**NATIONAL AGRICULTURAL RESEARCH, EXTENSION,
EDUCATION, AND ECONOMICS ADVISORY BOARD**

**GENERAL MEETING AND FOCUS SESSION:
*Educating the Future Workforce for
Agriculture, Natural Resources and Related Areas***

March 18-20, 2008

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TUESDAY, MARCH 18, 2008

GENERAL SESSION

Welcome and Introductory Remarks

Martin Massengale (Chair, NAREEE Advisory Board) welcomed participants and asked them to introduce themselves (see attached list).

Edward Shafer (Secretary of Agriculture) said that he was adjusting to his new duties and expressed his gratitude to the Board for its service and contributions over the years, particularly in addressing issues like bioenergy and germplasm that are at the top of the nation's agenda. As Governor of North Dakota, he depended on Extension to help his farmers and keep them abreast of the latest scientific and economic trends, and as a businessman he knows that every dollar invested in agricultural research returns ten dollars to the U.S. economy, particularly in the area of agricultural exports – the only sector with a consistent trade surplus in recent years.

Shafer reported that, although Congress was currently in recess, negotiators have made good progress on the new Farm Bill and have every expectation of resolving their differences before the extended deadline of April 18. The White House wants reform, so long as they don't raise taxes or grow the government, and does not believe that it would be a good idea to extend the existing Farm Bill for another five years. In the Research, Education, and Economics (REE) mission area, the goal is to invest limited resources in the most important research, such as exports, nutrition and renewable energy -- all of them topics on which the Board has given valuable advice in the past, as they have on specialty crops, unified organics, and pesticide review. He looks forward to the Board's findings and recommendations on workforce issues, the topic of the current meeting. In closing, he noted that these are good times for agriculture: prices are high, producer debt is low, and exports are growing. However, issues like the environment and energy present continuing challenges.

In response to questions, Shafer added that new grants would be issued soon on watershed protection and other water issues, which promise to become more important in the future. He was less certain on the subject of carbon trading – his usual assumption would be that the market can manage this kind of issue best, but we need a balanced approach to protect and promote environmental values. This may be an area that would benefit from government oversight of industry standards and procedures.

Gale Buchanan (Undersecretary for REE, USDA) told the Board that he was impressed with his new boss and grateful for his appearance at this meeting, which will address critical questions facing agriculture, USDA and the Board.

Presentations on Potential Future Activities and Directions of the Board

Dan Dooley (University of California), who served as Vice Chairman during the first six years of the Board, presented its current members with a challenge. The Board has always struggled for attention, and the present moment may provide an opportunity. The world is changing more rapidly than research institutions and research agendas, and more change is on the way. The Board can be a catalyst for bold new thinking, but to do so it must rise above disciplinary boundaries and transitory issues. All of the big questions and important issues are interdisciplinary, multicommodity, and require public-private collaboration.

Take California as an example – its agricultural sector is large, diverse and dynamic, but it is changing at lightning speed. Cash receipts were over \$37 billion in 2007, and over 25 percent of the state's crops are exported. Every billion dollars in farm sales creates over 18,000 jobs, 40 percent of them in non-farm industries. Agriculture is increasingly important as a steward of the natural landscape, yet it is under growing pressure from urban development. Between 1988 and 2002, almost 3 percent of California's agricultural land was converted to urban uses, and the state expects another 25 million residents by 2050. This growth will bring changes in educational priorities, as well as increased competition for budget resources and expanding environmental challenges.

California's universities have responded to these challenges by adopting a demand-based model for research and education planning: forecast the issues that universities will face, identify the gaps in their capacity to respond, and develop aggressive plans to fill those gaps. In other words, recognize and embrace the challenges of the future and define yourself by how you respond to them, rather than by your past achievements.

Dooley challenged the Board to something similar – step back, look forward, identify gaps, and move to address them. To do this will require that the Board also identify its critical audience and address its message to them. In many ways, we – the Board and the agricultural community – have been reactive rather than proactive; this is an opportunity to change. But it is important that the Board not accept limited resources for this endeavor. Think big enough, and address the right audience, and the resources will become available.

In response to questions, Dooley added that scenario planning would be a better basis for this activity than forecasting, which has many drawbacks and failures. Scenario planning, based on simple if-then questions, allows for more alternatives. Energy markets and flows would be a logical test case, since they loom so large in the future of agriculture. Another question is the growing role of women in agriculture, which in California has accompanied the emergence of high-value specialty crops. Growth and vertical integration also create opportunities for new entries. But the salient fact is that 60 percent of the undergraduate enrollment in ag schools is women, so there is a growing labor pool; many widows and daughters also seem to be taking over family farms.

Dooley later said that, if the agricultural research budget hasn't kept pace with the importance of agriculture to the U.S. economy, it may be in part because the land grant universities (LGUs) haven't developed a research agenda with a rationale that makes compelling sense to broad enough clientele. The National Institutes of Health (NIH) didn't start with a doubling of its budget and then figure out how to spend it; they developed a convincing vision of the next 10 to 20 years as a *justification* for that increase. The trick is to reinvent agricultural research in a way that has value to its constituencies as well as its customers, one that doesn't make any of them feel disenfranchised. In California, for example, faculty is eager to participate in this vision, so long as they have a voice and a role in the process.

Arden Bement (Director, National Science Foundation [NSF]) reported that USDA and NSF are partners in a number of research programs, including crop and microbial genetics, biofuels, water processes, climate change, and ecological research. To monitor its side of these projects, NSF has instituted a series of advisory boards. At the top is the National Science Board, created by the NSF's organic act and advises on all of its activities; others report to the director or are appointed by the director to oversee large areas of science (e.g., networking, energy, nuclear science, high-energy physics); and still others are created at every level of NSF, including the committees of visitors that are in charge of performance evaluation. Some of these advisory boards have subcommittees that long-range planning, usually with a ten-year horizon, while other subcommittees are responsible for problem-solving, public outreach and emerging issues. The benefits of this advisory superstructure is access to a broad range of ideas and opinions, as well as early warning of issues emerging in the community and a sounding board for the foundations plans and programs. Ad hoc working groups can be convened to address broad institutional problems or to engage in blue-sky planning.

In response to questions, Bement added that each of these advisory boards is staffed by a senior federal employee and administrative assistant and funded to provide for travel and honoraria. An important subcommittee might get an additional federal employee. NSF's budget increased 14 percent in FY2008 and is on track to double over a five-year period. Too often the concerns of the short term squeeze out the opportunities of the long term. NSF has had success tying its long-range vision to manpower needs in the science, mathematics, engineering, and medicine (STEM) disciplines, as well as the argument that the entire U.S. research enterprise should be at or near the frontiers of science. Needless to say, the latter argument is easier to make if the results of basic research are being applied to human health, welfare and prosperity.

General Advisory Board Business

Martin Massengale asked members to submit ideas on how the Board could do its job more effectively, or it could better serve both its constituencies and its customers in USDA and the Congress. On other Board business, he explained that the usual process for Board reports was that working groups would draft the documents, the Executive Committee would review them, and the full Board would have an opportunity to comment on them before they are sent to REE and the congressional committees.

By a voice vote, the Board approved the minutes of the General Meeting in October 2007 and the meetings of the Executive Committee and Specialty Crops Committee that have taken place in the past 6 months. The Board also approved the agenda for the present meeting.

Daryl Lund (chair, Relevance and Adequacy [R&A] Committee) reported that the committee will be using a new format for their congressionally mandated report. Board members and their constituencies will be given an opportunity to comment on this new format, but the committee is not asking for new ideas or comments on the President's budget. Work will begin on the annual report in the next few weeks, with a draft to the Executive Committee by mid-April. The subcommittee will meet briefly before tomorrow morning's session.

Massengale added that the report would not address previous R&A recommendations that have not been acted on, but will stick to new critical needs, such as additional budget for bioenergy. Other members commented that past reports recommended bland priorities without asking for additional money, and often ignored pressing issues such as the full impacts of higher costs for energy and other inputs. The key questions are (1) what research is going to be important and (2) is there enough money to pursue it? Some members wondered if the R&A reports had any effect on budget decisions, and a few wondered if there would even be a budget in October, given the looming election. REE managers insisted that they do redirect funds that they have managerial control of, for example to air quality and nutrition research, but that ERS has more flexibility in this regard than does ARS or CSREES. Specialty crops may be the best example of the Board's impact on the size as well as the shape of a budget. Several members suggested that a two-page report that presents a logical argument is more effective than a 200-page shopping list.

John Cunningham (chair, Protocol Committee) and Robert MacDonald (CSREES) reported on the plan of work for developing a protocol to evaluate multistate (formula) funding. This will be the first attempt to find common terms and metrics for these programs. The decision has been made to change the format from a narrative to a database, but to update it rather than completely rewriting it. The Board reviewed and approved the database concept two years ago. Members who had participated in that review commented that there wasn't always a clear connection between budget dollars and knowledge areas; REE has been working to correct this gap.

Edward Runge (chair, Peer Review Committee) reported that Board members have participated in ARS peer review for 4 or 5 years, and a new set of six review cycles will soon begin, a prospective review of some 1200 intramural research projects. Three cycles will be conducted online, three others in Beltsville (forecasts, agronomics, and ornamentals and annuals); NAREEE will pay for members to participate in Beltsville. Board members are invited to notify ARS if they are interested in participating in one of these cycles. At the end of each 5-year cycle, these evaluations are collected into a program review that feeds into the Board's R&A process.

Walt Armbruster (chair, Specialty Crops Committee) reported that he sat in on the recent farm mechanization meeting and will also sit in on the upcoming meeting on precision spraying in

orchards and vineyards. The committee has received good input for its draft report and should deliver it to the Executive Committee within 30 days.

Tom Fretz (chair, National Agricultural Library [NAL] Committee) thanked the members of the Ad Hoc Task Force and the Board for their contributions and endorsement of the most recent NAL report, but he also reported that he had received no feedback yet from the Secretary. Recommendation #1 of the report was to support a Digital NAL, including a stakeholder summit, and the next step is to begin planning for that summit. Peter Young (Director, NAL) has said that he can find 80 percent of the funding for this summit and would like to move forward on it prior to the next Board meeting, in November 2008. Fretz added that he would encourage the Secretary to approve the report and provide resources for the summit, but Martin Massengale noted that the Board has made its recommendations and is now finished with this issue.

There being no public comment, the Board recessed at 5:30 p.m. pending their evening program.

EVENING MEETING AND RECEPTION

Presentations on Potential Future Activities and Directions of the Board (cont.)

Gale Buchanan (Undersecretary for REE, USDA) asserted that, as currently constituted, the NAREEE Advisory Board is uniquely qualified and positioned to influence the shape and direction of agricultural research. The most important quality in this role is vision, and the most important issue is sustainability, the greatest challenge to the nation and the world after war and famine. USDA particularly needs the Board's vision in addressing the three grand challenges of the twenty-first century:

1. Energy security. – USDA's mission includes not only food, fiber and flowers, but energy as well. The United States currently pays over \$1 billion per day for oil imports, and the world will soon reach peak oil production. Of the available alternatives, solar is clearly the best, whether gathered by photovoltaic panels or by means of plants.
2. Water. – There is no replacement for human health or industry, and demand will more than double by 2025. Agriculture is the single biggest user of water, and biofuels will place even greater pressure on supplies. We've done a lousy job of researching water harvesting and storage.
3. Global climate change. – Even those who dispute the causes admit that change is happening, and that it will have major impacts on agriculture.

To these three, Buchanan added two additional "reserve" grand challenges:

4. Human nutrition and its contribution to health; and
5. Getting agriculture to accept new technologies. – Examples from the past include chemical fertilizers, hybrid seed corn and even tractors; examples for the future include molecular biology and genomics, nanotechnology, and robotics.

Taken together, these challenges are more daunting than sending a man to the moon and returning him. We have no choice but to be successful, but REE faces the difficult task of pursuing these grand challenges in addition to everything it's already doing, and with no prospect of a larger budget anytime soon. This means that REE needs to stimulate more creativity in its mission agencies and indeed throughout USDA.

To help REE face this task, Buchanan proposed a change the Board's standard operating procedure. Instead of just reacting to presentations from the mission agencies and outside experts, he would like the Board to hold a real dialogue on the topic of the day. This means that the Board would talk 80 percent of the time and listen only 20 percent, instead of the other way around, and that REE would have a better chance to hear the Board's innovative ideas and suggestions, and those of their constituencies. This will be a better use of the Board's expertise and time, but it won't work if its work is limited to two days, twice a year.

In the discussion that followed, Board members suggested that earmarks aren't the best way to manage research dollars, but REE staff responded that earmarks reflect the fact that competitive research has been historically underfunded. NSF and NIH have been able to increase their research budgets because they made the case for the relevance of their research; REE can use these grand challenges as a way to make the case for agricultural research – there's always enough money to pursue really important ideas, and the important thing is the money, not the mechanism. Board members agreed that the issue involves both science and politics; it behooves REE to show Congress how agricultural research benefits their constituents. USDA might also use the Roadmap approach from NIH – identify a clear case for investing in a single challenge, and they “tax” every organizational component for 1 or 2 percent of its budget to address that grand challenge.

There being no public comment, the meeting recessed at 8:00 p.m.

WEDNESDAY, MARCH 19, 2008

GENERAL SESSION

Martin Massengale called the meeting to order at 8:00 a.m. and introduced John Riordan (Cindy Zook Associates), who would facilitate the morning's discussion.

Input from Agency Administrators on Potential Future Activities and Directions for the Board

Colien Hefferan (Administrator, CSREES, USDA) presented her own list of grand challenges – bioremediation, nitrogen fixation, nutrition (particularly “smart food”), and sensor technologies – as well as what she called the grandest challenge of all, namely how can we make agriculture serve all these new purposes while still feeding us all. In the past, CSREES has pursued science for agriculture, and education for agricultural research, but these new challenges will expand the purpose of the agricultural sector far beyond food. Universities are a vital resources and basic

mechanism for accomplishing these goals – when you fund science through the universities, you also promote education, and universities have a collaborative advantage in research at the boundaries of science. Examples of ongoing collaborations include plant genomics, microbial genomics, long-term ecological change, environmental services (including economic research to support market mechanisms), and biofuels. Hefferan closed by posing four specific questions for the Board:

1. What your constituencies want from agricultural research and technology transfer – where should be taking the risks?
2. What criteria should we use to sort stakeholder responses to #1 – how do we decide what’s most important?
3. How will scientific opportunities influence educational priorities – how can we educate 20 years in advance?
4. What additional opportunities for partnership and collaboration do you see?

Ed Knipling (Administrator, ARS) made the point that long-term sustained research is the foundation for more sharply focused research. He distributed a list of areas in which ARS will provide “enhanced research emphasis,” many of them representing a new focus on genomics or energy in the agency’s four core research programs (natural resources, crop production, animal production, and nutrition). He emphasized that the stakeholders – producers, consumers, the scientific community, and other agencies – tell ARS what its priorities should be.

Mary Bohman (ERS) explained that her agency conducts economic research to inform policy decisions, and that several current projects reveal their vision of the future:

- Economic forecasts to support decisions on greenhouse gases;
- Developing markets for environmental services;
- Volatility in commodity and energy markets;
- Food safety;
- Behavioral research in nutrition and obesity; and
- The impacts of bioenergy on rural communities.

ERS continues to develop new forecasting tools and new techniques for collecting, analyzing and using economic data. Because science is a continuing collaboration, ERS also seeks out new connections and new collaborations throughout USDA and the Federal Government.

Joseph Reilly (Administrator, NASS) reported that his agency is also developing new techniques for data collection and analysis, including data sampling, remote sensing and data mining. He was careful to add that NASS doesn’t make policy decisions or regulate any activity; their mission is limited to collecting “timely, accurate and useful statistics” that can be used by others to manage USDA programs, support payments to farmers, and assist state departments of agriculture. He appealed to the Board for ideas about how REE can integrate this statistical capability into other areas of research.

In response to questions, Bohman said that ERS is negotiating for access to NHANES data, which is owned by the states, to address the question of access to food stamp programs. ERS is

also working to improve its price forecasts, which have tended to underestimate food inflation. Both ERS and NASS have national advisory boards, and both of them hold workshops on forecasting issues. NASS “tunes up” its forecasts at the end of each year, for example by getting help from the Chicago Board of Trade on previously untracked foreign livestock. Hefferan said that there was a lot of collaboration with the states in the setting of priorities, as well as the conduct of research.

In the discussion that followed, Board members suggested that – since economics seems to trump any other analysis – REE agencies should do more to quantify and include such issues as sustainability and environmental protection. Members also suggested that REE do more to educate consumers on subjects such as bioengineering, but they agreed that education doesn’t always change behavior, because consumers don’t always act on the information they received.

Discussion by Board Members

When the discussion shifted back to the potential role of the Board, and how to carry out that role, members wanted to know if they were to act as independent advisors or whether, like most advisory boards, they would be in some way dependent, if only because of their investment in the agency they advise. Advisory boards, as a rule, like to make lists of things their sponsor could or should do, but they don’t like setting priorities or terminating programs, and they don’t like face-to-face confrontations.

Board members indicated that they were interested in addressing the future, especially the long-term future. What are the long-term consequences of recent events (e.g., commodity markets out of control)? What big changes do we see coming? What will agriculture (and international completion) look like in 20 years, and what do we do now to prepare for it? Perhaps the Board (and REE) needs more input from groups we haven’t heard from (e.g., commodity groups) or more members from relevant disciplines (e.g., sociology). Scenario planning was offered as one possible format, and there was general agreement that the discussions should include a full range of views and outcomes, both positive and negative.

Board members also asked for limits. There are a dozen topics that could benefit from this kind of focused attention; how is the Board to decide which ones to address? However chosen, it would be best to limit the number of topics the Board focuses on at any given time – preferably one, no more than two at a single meeting, since the goal is to look deeply rather than widely. And this will require preparation. The best tactic might be to contract for one or more white papers from different perspectives that members could read ahead of time and use as a common basis for their discussions. At the very least, these white papers and other materials should be in the briefing books, and the briefing books in the hands of Board members, early enough to read them on the plane ride to Washington. This would allow the Board to arrive prepared and ready to talk. Alternatively, since it’s difficult to operate as a committee of the whole, the Board might divide into working groups on specific topics and spend part or most of their two-day meeting in breakout sessions.

This is a different activity for the board, and a different way of doing things; perhaps the product should also be different. The Secretary and REE indicate that they want to hear from the Board about what's important; the congressional committees have also signaled their willingness for the Board to be more proactive in alerting Congress to emerging issues. The form that the product takes is open to question, but several members thought it should be less rather than more. The output should be short and clear; many administrators don't read beyond the executive summary of any report. One member suggested a one-pager, with pictures and bullets about cutting-edge research on one side and an explanation on the other of how this research will impact food production, nutrition or economics. Another suggested that the dialogue was the product, not some fancy report.

The Board did not select a lead-off topic, but there did appear to be consensus around a short list that deserves priority attention:

- Climate change;
- Water;
- Energy; and
- Rural development.

Finally, Board members expressed concern about practical matters. Advance preparation and meetings full of dialogue would certainly make better use of the Board's time, but they would require advance planning, fees for white papers, and above all more staff capability – there's a limit to what the Board members can do for themselves on a volunteer basis. However, REE is currently looking for a new Executive Director for the Board, and the Board's sole administrative person doesn't even have an intern to help in the office. Nor does there appear to be any staff support forthcoming from the REE mission agencies. To take on this new role, the Board will need additional staff capability.

The response to these ideas from USDA staff was mixed. REE wants a free exchange of ideas among the Board, and they want the Board to share those ideas with Congress, but we need to think about the right mechanism. The Board can't be seen as lobbying Congress; "educating" them is a better way to think of it. The Specialty Crops report was very useful to REE in advocating for that part of the new Farm Bill, and industry helped by doing its part. The Board makes its greatest contribution by synthesizing stakeholder inputs; the mission agencies need a more explicit mission statement – what are we doing right, what are we doing wrong, what should we stop doing? They weren't very clear on what form it should take, but they do want to hear from the Board on important topics, and they don't want the Board to revert to the role of hearing and reacting.

Riordan said that he would write up his own summary of this discussion and forward it to the Executive Secretary.

FOCUS SESSION – EDUCATING THE FUTURE WORK FORCE FOR AGRICULTURE, NATURAL RESOURCES AND RELATED AREAS

Overview

Board member Marianne Smith Edge (cochair, Program Planning Committee) noted that agriculture is creating 52,000 food-related jobs each year, but our universities are graduating only 49,000 trained workers to fill those jobs. The Board has previously addressed the future workforce in 2002 and in a 1997 white paper, “Improving Public Appreciation of Agriculture.” Many of the observations and most of the recommendations in those reports remain valid, and the Board finds itself once again talking about (1) how to attract more students into agriculture and national resource fields and (2) what changes universities most make to train the workers we will need in the future.

Trend Data on Student Recruitment, Retention and Opportunities

George Cooper (Deputy Administrator for Science and Education Resource Development [SERD], CSREES) reported that SERD’s statutory role under the National Agricultural Research, Extension and Teaching Policy Act of 1977, as amended, includes both land grant (LGU) and non-land grant universities. In fact, only half of the college graduates who go into agriculture-related jobs each year come from LGUs. SERD provides funds to institutions, not students, and primarily supports teaching and capacity building, especially at minority-serving institutions. However, it does support programs to recruit and retain students, help the transition from two- to four-year colleges, and provide information on employment opportunities. In addition, SERD promotes agricultural literacy at the K-12 level through Agriculture in the Classroom, a national curriculum enhancement program that reaches 120,000 teachers and 5 million students.

Data sets compiled by the Food and Agriculture Education Information System (FAEIS) include enrollment, graduation and placement information to support the future workforce for food and agriculture. A recent report on “Employment Opportunities for College Graduates in the U.S. Food, Agricultural and Natural Resources 2005-2010” (2005) showed an annual demand for 52,900 new workers but only 49,300 available graduates, of whom 32,300 were in agriculture and natural resources and 17,000 in allied disciplines. In terms of function, 25 percent of these jobs are scientific or engineering, 16 percent in production, and 46 percent in management or business. Shortages are greatest in management and financial specialists, marketing and sales reps, and communications and education.

The greatest opportunities for meeting demand lie in expanding opportunities for women, especially minority women. University recruitment and retention strategies are beginning to change to reflect these demographic trends. Recent classes have seen increased numbers of women in natural resources and conservation, as well as Ph.D. programs generally, and increasing numbers of non-U.S. citizens.

In response to questions, Cooper added that FAEIS is tracking new undergraduate majors into food and agriculture jobs, such as information technology, systems engineering, and synthetic chemistry. Some of the increase in female enrollment has come from a growing emphasis on “nontraditional” students. Retirements at ARS and CSREES run about 4 or 5 percent per year

for scientists, a little higher for senior management, and more than 35 percent of these federal workers will be eligible for retirement in the next five years. USDA personnel already report that they receive few applications when they advertise an open position. The situation in universities is harder to track, but current data show that the average age of LGU faculty is 53. FAEIS will hold its annual meeting in June in Utah and hopes to learn more at that time about what's happening in the classroom and where best to recruit students.

Agriculture in the Classroom and 4-H

Suzanne LeMenestrel (National Program Leader for Families, 4-H and Nutrition, CSREES) described several science, engineering and technology (SET) initiatives that have been launched in response to the "Rising Above the Gathering Storm" (RAGS) report, including SET curricula, teacher training, and other efforts to recruit 1 million new students to SET by 2013. 4-H now has a SET liaison at each LGU, and new SET features have been built into other 4-H programs, such as Operation Military Kids, which targets children on or near military bases. Agriculture in the Classroom provides curriculum units that use agriculture to teach lessons in a variety of disciplines, such as reading, math and science.

In response to questions, LeMenestrel explained that Agriculture in the Classroom was established with funds from the Noyce Foundation, but that 4-H will apply to NSF for a training grant. Both programs rely heavily on volunteers (4-H reaches 500,000 students but needs 600,000 adult volunteers), but volunteers are getting harder to find every year. In response, 4-H has been experimenting with "episodic volunteer" programs. As rural populations decline, 4-H has been serving more and more minority and urban populations who previously weren't exposed to the program. The \$70 million federal budget for 4-H is matched 2:1 or 3:1 by state and local funds, often from other youth development sources such as the Department of Justice.

Panel: Perspective from the Young Professionals and Students

Russ Weathers (Agriculture Future of America [AFA]) said that the major issue for the future workforce is to replace retirees with young workers who are equally talented, passionate and committed. AFA creates local partnerships that will identify and encourage college students preparing for careers in food and agriculture. Ag schools provide academic training in 76 different majors, and many students are dual-enrolled, but students also need the kind of "value-added learning" that comes from leadership training, internships and foreign travel and study. AFA provides a strong program of "resume building" for 125 students each year; thus far they have reached 500 students in 27 states and 60 colleges and universities.

Jessica Colyar (graduate student in Food Science, Brigham Young University [BYU]) reported that her school has about 80 undergraduate food science majors each year and achieves a 100-percent placement rate, thanks in part to opportunity fairs and the use of a career interest inventory. The Institute for Food Technology (IFT) is also active on campus, providing leadership training for students, science kits for teachers and a counselor's kit to reach out to high school students. Colyar sees a remaining gap in her own business training, but she also

cautioned that BYU (like many other schools) may be dropping some of its agriculture offerings. Colyar recommended that USDA and ag schools conduct research on how best to reach potential knowledge workers in agriculture, how early to reach out to them, and with what message. She also recommended that academic institutions find new and innovative ways to partner with agriculture-related organizations.

Joel Mathiowetz (Farm Credit Services of Minnesota) admitted that he was a traditional agriculturist, largely because he was educated at South Dakota State University, which still focuses primarily on production agriculture. However, he also participated in 4-H and Future Farmers of America got valuable leadership training in through AFA conferences and opportunities to study abroad. He is now a member of the AFA Alliance, an organization of recent graduates and young professionals. His first job was as a county organizer for 4-H. He insists that there is a lot of talent out there, but there are high financial barriers to the future agricultural workforce.

Amanda Taylor (agriculture counsel to Sen. Charles Grassley) called herself an Iowa farm girl who missed out on 4-H because her high school didn't have a chapter, and she felt that lack. She studied agronomy at Iowa State but hated the science courses, gravitating instead to industrial topics such as commodities and sales. She was fortunate enough to win a Cargill scholarship and participate in an AFA leadership team, and she later held a succession of internships (including one at USDA) that helped to broaden her perspective. She returned to Iowa State to study agricultural law and then came back to USDA's legislative office before taking her current job with Sen. Grassley. Taylor credits AFA with exposing her to ag business on a grand scale, but she thinks her key skills are the ability to read and understand, and to write for different audiences. She believes that high school students need more mentoring in agriculture, and that undergraduate ag programs need more emphasis on entrepreneurship and public speaking, as well as trade, biotechnology and renewable energy. She believes that retirement eligibility is a problem for federal agencies because government service has lost its attractions, making it difficult to attract younger workers. This might be addressed through networking efforts by the AFA Alliance and by career-changing courses at the USDA Graduate School.

In response to questions, the panelists added recommended more agricultural content in grades K-12, such as "farm days" and tutorials on how to use the environment and where food comes from. Agricultural majors still face a certain stigma in the eyes of family and peers, and some 85 percent of freshman AFA members are in agriculture against the wishes of their parents. It would probably be useful to target high school teachers and counselors, as well as high school students. Student preparation in science, technology, math, and engineering (STEM) has declined in the past 20 years, especially for girls and in rural schools, and faces additional pressure because of state standards. As a result, many students aren't adequately prepared for undergraduate math and science courses. On the subject of business and management training, panelists stressed that there is (or should be) a difference between a major in agriculture and a career in agriculture, the latter demanding a far broader range of skills and knowledge. At present, business assumes that they'll have to train new workers. Generation Y (or the "millennials") will jump from job to job in agriculture, just as they will in other knowledge

fields, and they will be tempted to go abroad (e.g., Eastern Europe) even at the same pay. They may see good career opportunities in rural America, but they also see the lack of cultural amenities and educational and health infrastructure.

Panel: What Does Industry Need?

Thomas J. Hoogheem (University Relations, Monsanto Company) is responsible for hiring the best and the brightest from ag schools as sales and technical workers in Monsanto's branch operations. He reported five-dollar corn and fourteen-dollar soy drive a log of change – ag business is booming, and he can't find enough talent – the best and the brightest are too few, and the competition is furious. In addition, 21 percent of his current workforce will retire in the next five years. For sales positions, the ideal training is ag economics or ag business, with an agronomy minor (agronomy is the limiting factor), but Monsanto also needs plant breeders and finds them in short supply as well. At the same time, however, extramural activities are evidence of a personality, and an ag major with a good GPA also has to be able to communicate, so students need a change to get up and talk. FFA does a good job of providing students with exposure and leadership opportunities.

Conrad Rebello (Commercialization and Program Management, Pepperidge Farm Inc.) recommended that Board members watch a short video called "Shift Happens" at www.youtube.com, which makes the important point that we are preparing today's students for jobs that don't exist yet, using technologies that don't exist yet to address problems that we're not yet aware of. Nevertheless, all students will be required to have some version of the same basic skill sets:

- Technical and functional knowledge, including scientific method, preferably with multiple proficiencies, and the ability to use knowledge networks;
- Communications ability, including verbal, written and presentations, using emerging technologies to engage and persuade key stakeholders; and
- Behavioral skills, including project and people management, leadership ability, and an appreciation for language, culture and global markets.

All of these skills are vital, but communications may be the most important. Business can't be expected to teach all of them; it needs to operate in partnership with ag schools and other ag organizations with compatible mission and vision. An example is the partnership between IFT and Campbell Soup Company, under which Campbell's sponsors two \$1000 Excellence in Leadership Awards to outstanding graduate and undergraduate members of the IFT Student Association.

What Do Government Agencies Need?

Karen Brownell (Director of Human Resources, REE, USDA) explained that, having hired a lot of new scientific and managerial workers in the 1970s, USDA is now faced with an "tsunami" of retirements. Some government workers (notably scientists) may stay for 50 years, but the average retirement age is 62, and in many cases their specialties are difficult to replace. DVM-

Ph.D. positions are particularly hard to fill, as are agricultural engineers; sometimes the agency must cross-train personnel or team them with agronomists. Also in high demand are biostatisticians and economists (30 current openings), as well as wildlife biologists and ecologists, fish biologists, and flavor chemists. In the latter specialty, government is competing directly with industry. Entomologists and chemists are also retiring, and there is an emerging need for social scientists and even climatologists, if their training has a significant rural or agricultural or natural resources component. In terms of personal skills, the best applicants will be good public speakers with interpersonal skills such as collaboration, team-building and conflict resolution. Economics is a plus, as is financial management, and while government can provide leadership training, it's better if the candidate has it already.

The labor pool in which USDA must look for these workers contains a lower number of Ph.D.s than in previous years, especially U.S. citizens. More troubling is that the current cohort of "Millennials" isn't as patriotic as prior generations and doesn't value government service per se, although the same job with a nonprofit or NGO might be acceptable. The word "agriculture" itself can be a turnoff for some potential applicants. Overall, there seems to be a need to better publicize the range and sophistication of the science, engineering and technical careers that are available in the federal government.

Discussion

In the discussion that followed, Board members noted the larger demographic trend that creates systemic issues for the U.S. workforce. The 75 or 80 million-strong Boom generation was followed by a smaller Generation X, and the first wave of the 45 or 50 million Millennials simply doesn't have enough people to replace the current wave of retirees. Ten years from now there may be enough new workers, but what do we do in the meantime? The obvious answer is a new paradigm that involves more immigrants and guest workers, more "nontraditional" job entrants, and more worker retraining. On the other hand, foreign students often lack the necessary language skills, and their skills can be far more valuable to the United States (and their own country) if they take them home again, rather than staying here.

Several members suggested that we may now be reaping the results of underinvestment in some fields and disciplines, but that in other fields the problem is short-term. There was general agreement, however, that finding quality new talent is a more important part of almost everyone's job. 4-H and FFA do a fine job in rural communities, but perhaps the need is greater (and the returns more promising) in the suburbs or the inner city. Several members pointed to AFA as doing what industry wants, but others asked how to teach passion and dedication, particularly to a generation notorious for its restlessness and lack of loyalty. One member said, "If he's smart and he can talk, I'll hire him," but another pointed out that a college diploma will get you in the front door, but then you'll have to learn everything all over again.

During public comment, Tom Tate of CSREES noted that Agriculture in the Classroom is working more closely with science teachers and wants to add career options. He urged the Board to help USDA grow this program.

The meeting recessed at 5:50 p.m. pending the evening's reception and presentation.

EVENING SESSION AND RECEPTION

What Are the Land Grants Doing?

Robert Easter (Dean, College of Agricultural, Consumer and Environmental Sciences, University of Illinois) reported that the central question – Where is the next generation? – is very real and on many lips. The number of bachelor's degrees in agriculture and natural resources has recovered nicely after declining in the 1980s and early 1990s, but many of those graduates are not seeking careers in science, especially the integrative sciences of agricultural production. Instead, recent ag school graduates from the University of Illinois have chosen degree options in consumer finance, companion animal science, hospitality management, and environmental studies. This is the culmination of a century-old trend in which the increasing labor efficiency of production agriculture has allowed young people to leave the farm, get a solid education at a LGU, and find careers in agribusiness. In a very real sense, U.S. agribusiness was built by four generations of rural youth who understood farming, possessed a broad array of technical and social skills, and wanted to work in a field connected with their roots.

That experience is over. There are very few farm boys coming to LGUs today; the new cohort includes a lot more women, and none of them is studying swine production (as an example). In fact, there are fewer and fewer studying swine production every year, and many LGUs have stopped offering the course. The manpower shortage facing U.S. agriculture has two components: (1) how can we attract young people into professional careers in production agriculture, and (2) where will these future professionals get a technically adequate, practical education?

The answer to the first question is to begin early and use programs like Agriculture in the Classroom sell students a positive message. It's also necessary to educate parents, teachers and counselors. And we need to support agricultural education in both rural and urban high schools – a perfect example is the Chicago High School for Agricultural Science, a magnet school that attracts promising young people from the suburbs and inner city. The growing awareness of food prices and shortages is a perfect opportunity to drive home the importance of production agriculture.

The answer to the second question is more complex – LGUs have performed this mission well in the past, but LGUs are at a crossroad. As recently as 1970, public universities received seven dollars in state appropriations for every dollar of tuition; today the two revenue sources are equal. As their funding became more tuition-driven, universities have shifted their priorities. At the same time, growing dependence on federal research funding has placed greater emphasis on fundamental sciences and less emphasis on applied research and technology transfer to producers. USDA overhead payments, at 28 percent compared with 58 percent from NIH, are hardly enough to pay utility bills. LGUs only hire new faculty who can attract federal research

grants, and there is less and less chance of that in agriculture. As a result, the faculty has changed from a group of agriculturalists who have special knowledge of different disciplines to a collection of disciplinary experts who just happen to work for an agricultural college.

The bottom line is that there is a very real shortage of faculty who have the expertise *and* *experience* to prepare the next generation of food and agriculture professionals. And the solution is to increase student interest in agricultural careers, prepare them thoroughly in the LGUs, and collaborate with the private sector in programs to recruit the most promising students and support applied research through mechanisms like the Midwest Poultry Consortium and the National Swine Production Center of Excellence. Importantly, the best students and teachers may come from urban backgrounds and even from abroad, where there are still a lot of talented kids “on the farm.” This kind of public-private partnership in agricultural education is the norm in other countries, and it may well become the new paradigm in the United States. To make this happen, industry needs to engage with decision makers not only on campus but also in the state legislatures, convincing them that these are changes that the private sector needs and will support.

In response to questions, Easter added that “environmental” carries a better connotation than “agricultural” on most college campuses, and probably most high schools as well. Members agreed that this transition has been coming for a long time; in California, for example, education used to be the biggest expenditure on the budget, but today it’s prisons. This raises the question of whether we still need a LGU in every state, or whether every LGU should try to remain a “full-service” operation – perhaps Iowa should be the one center for swine, Illinois for corn, Kansas for wheat, and so on. Federal programs have been putting pressure on states and LGUs to collaborate and to form regional or national consortia, but legislators resist sending their dollars to other states. There was general agreement with Easter’s assertion that the solving these problems will require leadership, not just another committee.

The meeting adjourned for the evening at 9 p.m.

THURSDAY, MARCH 20

FOCUS SESSION (continued) – EDUCATING THE FUTURE WORK FORCE FOR AGRICULTURE, NATURAL RESOURCES AND RELATED AREAS

Martin Massengale called the meeting to order at 8 a.m.

NAS Report on NIOSH Agriculture, Forestry and Fishing’s Health and Safety Research

As an example of an educational need, Board member Jim Zuiches and Paul Gunderson (Dakota Center for Technology Optimized Agriculture) reviewed a recent report from the National Academy of Sciences (NAS) of the health and safety research conducted by the Agriculture, Forestry and Fishing Program of the National Institute of Occupational Health and Safety (NIOSH). The NAS review focused on the relevance and impact of the research on the

workplace and its effectiveness in identifying emerging issues for future research. Its strategy was to formulate an “ideal” research program and compare that with the actual research program from 1990 to 2006 and scoring the actual program for relevance and technology transfer, as well as quality. The full report can be read at http://books.nap.edu/catalog.php?record_id=12088.

The report found that NIOSH research on health and safety did a good job of addressing relevant topics, but not such a good job of transfer, and effectively failed to keep a clear record of its impact on the workplace. Among the limitations of the program were a lack of consistent leadership and strategic planning, a need for comprehensive surveillance, fuller engagement with stakeholders, and a clearer definition of the populations at risk. The report went on to identify a number of topics for high-priority research:

- Changes in the demographic characteristics of the workforce;
- Changes in the fisheries industry;
- Emerging forestry issues;
- The blurring of boundaries between food production and food processing;
- Food safety and food security; and
- The transformation and industrialization of agriculture.

In addition, the report made several recommendations for improving the program:

- Establish strategic goals for the overall program and for specific subpopulations;
- Provide national leadership and coordination for technology transfer;
- Implement a comprehensive surveillance system;
- Clearly identify and track targeted populations;
- Conduct research on knowledge diffusion to identify more effective research-to-practice programs;
- Involve stakeholders throughout the research process, including at-risk workers;
- Implement integrative and interdisciplinary approaches in its research practices; and
- Develop a greater awareness of national policy issues that have an impact on worker populations and risks;

In response to questions, Zuiches and Gunderson added that NIOSH conducts a lot of research on the safety and health of children, including the children of migrant workers. California has done long-term studies of pesticides, finding that the number-one danger is dermatitis from sulfur, and that this danger can be removed by urging workers to change their clothes before they go home. Experience has shown that surveillance and reporting are useful management tools that can change practice. California and other states have used social marketing to educate workers on health and safety issues. However, the most effective programs first look for engineering solutions (to remove the danger) or protective devices (to reduce the risk), both of which are less difficult than worker education.

Professional Perspective – What Is AAVMC Doing to Address the Student Shortage?

Board member Tom Rosol (Dean of Veterinary Medicine, Ohio State University) reported that, despite a serious national shortage of veterinarians, no new public school of veterinary medicine has been opened since 1983, and only one new private school. In addition, over 80 percent of veterinary students are women, which (in combination with other generational changes) means that every FTE requires 1.25 veterinarians. On the other hand, the new “Gen-Y” or Millennial veterinarians are interested in research and public health, have a systems and team orientation, and are committed to society (if not to particular institutions).

Fewer and fewer veterinary students come from farm backgrounds, and surveys have shown that few of them are interested in food animal veterinary medicine. This comes at a time when the larger society demands companion- and small-animal specialists. The overall shortage of veterinarians poses problems in a number of public health and research areas, not least of which is biomedical research (NIH funding alone creates an insatiable demand for specialized mice and nonhuman primates, and other research program demand rats, dogs and other species). As a result, there is a chronic shortage of food animal vets, and in Ohio alone there are 12 counties that have no food animal veterinarians at all.

In response to these problems, the Association of American Veterinary Medical Colleges (AAVMC) has launched a “foresight” project to envision the future of veterinary medicine and ways to expand educational opportunities. The latter includes a number of strategies to attract students to veterinary medicine, especially those who might specialize in food animals. These include K-12 education initiatives, veterinary early experiences, and public awareness campaigns on the role of veterinarians. Member schools have streamlined their admissions process and now offer joint degree programs in veterinary medicine and public health. Loan repayment programs are in place at the state and federal levels to address the average \$106,000 in student loans that graduating veterinarians face. As incentives to pursue careers in food animals, schools offer scholarships, admissions weighting, mentoring, externships, and additional loan repayment programs. At the federal level, legislation has been introduced that would provide \$300 million in competitive grants for facility infrastructure for veterinary public health. [NOTE: There has been no action on HR1232 and S746 since the bills were introduced in February and March, 2007.]

In response to questions, Rosol added that partnerships among veterinary schools are very difficult and require high-level support from NASULGC and other organizations. Many students aren’t ready for Biology 101 in their freshman year, pointing the need for curriculum enhancement in K-12, possibly in cooperation with local universities. Schools have experimented with webcast lectures and other innovations, but with limited success. It would be difficult to expand the number of students, given the existing facilities and faculty and the need for lab and practice classes in years three and four. Veterinarians receive relatively low starting salaries, on the order of \$52,000 to \$55,000, and their debt load negatively affects their life choices. Most loan repayment programs are capped at \$80,000.

Discussion

Several Board members agreed with the importance of early exposure, for example taking undergrads to feedlots. They also made the point that not every vet is a scientist, and that LGUs may need a new model of veterinary education. They noted that business is looking for core competencies that are as much social as they are technical, and the Food Service Leadership Institute has launched a fellowship program that aims to produce “strong organizational leaders who understand the food system.” Others suggested that “food” itself is too narrow and possibly negative; agriculture comprehends feed, fiber and flowers as well as food, plus natural resources and community development.

Programs like Agriculture in the Classroom and FFA really work, but they are too small and too limited. It would be useful for USDA to dedicate more funds to support these programs, and for Board members to urge their colleagues and constituencies to support them. Several members sought broader support for STEM program that would also prepare K-12 students for veterinary medicine. It is symptomatic that Ohio’s “Third Frontier” initiative sees agriculture and veterinary medicine as part of the first frontier; how can we help people see that agriculture is also part of the third frontier and a vital component in the New American Competitiveness?

There was general agreement that veterinary education is facing a systems failure, although there was some disagreement on whether the system was a little bit broken or totally collapsed. Solving a systems failure takes leadership, but in this case the components are pretty straightforward: expose students to agriculture earlier, get more students into the veterinary pipeline, and make sure that they get the extracurricular skills that industry demands (leadership, public speaking, etc.) as well as their technical training.

This led to a broader discussion of a “new paradigm” in agriculture – now that it includes the limitless market for bioenergy, agriculture is more important than ever to the U.S. economy. Perhaps this is a teachable moment, an ideal time to launch a comprehensive, well-organized campaign to change the image of agriculture and agricultural research, with initiatives aimed at parents and teachers as well as students, food stamp recipients as well as members of Congress, retirees as well as K-12 students, inner cities as well as rural communities, returning veterans as well as farm kids. Among the messages to convey:

- Agriculture isn’t what it was 20 years ago; who knows what it will be in another 20 years?
- What do food and high profile technologies have to do with one another?
- Food and agriculture are a lot more interesting than you might think.

GENERAL SESSION

Other Board Business

Martin Massengale indicated that a working group would develop recommendations on workforce issues, but he also wants the Board to give more attention to their future role and activities. He scheduled a conference call on Wednesday, March 26, to address that topic and beginning planning for further discussion at the November meeting. He emphasized that this

would be a continuing effort to help REE prioritize, not a one-shot effort. The Executive Committee will choose the final topic and format, but Massengale suggested several initial topics from which to choose:

- Bioenergy;
- Water;
- Sustainability in agriculture;
- Natural resources.

Other member praised this attention to the “big picture,” but they also asked the Board Office to distribute more materials in advance of the meeting. Several members asked for a compilation of past Board reports and recommendation, or at least a list of topics that the Board has discussed in the past. One member suggested that the Board might have a look at the list of long-term issues that USDA is *already* looking at; another suggested that it might be just as valuable to tell REE what they should stop *doing*. Others stressed the need for an advertizing blitz to “re-brand” agriculture, possible in collaboration with the Ad Council.

Public Comment

Sarah Davis (staff scientist, Institute of Food Scientists) described her organization’s Food Science Ambassadors program, which provides learning, networking and experiential opportunities for undergraduate food science majors. They also produce materials for students, parents and counselors to attract more students to food science, as well as documentaries for the Discovery Network. She thinks there is an opportunity for collaboration between IFS and the other initiatives described today.

The meeting adjourned at 12:15 p.m.

ACTION ITEMS

- John Riordan will provide a summary of the Board’s discussion of future roles and activities.
- Board members are invited to submit nominations for the FSLI fellowship program.
- The program planning committee will develop recommendations on workforce issues.