



**Testimony of the National Association for the Advancement of Animal Science (NAAAS)
Senate Appropriations Committee Hearing:
Driving Innovation through Federal Investments
April 29, 2014**

As the world's population grows and natural resources become limited, animal agriculture research is necessary now more than ever to improve efficiency in order to continue providing safe and abundant food supplies for the growing global community. It is imperative that the increased food production be done in a manner that will protect our natural resources while maintaining America's global competitiveness in producing animals and animal products.

With the continued rise in global population, demand for food is expected to increase from 70 to 100 percent by 2050. Meat consumption is estimated to increase by 73 percent, dairy consumption is estimated to increase 57 percent, and per capita egg consumption in developing countries is expected to rise by almost 40 percent.

Innovations in animal science will play an important role in the future success of animal agriculture and the rural economy. Livestock and poultry sales account for 40 percent of all farm income. When feed crops consumed by livestock are included, the contribution to farm income is 60 percent. The United States must step up its investments in agricultural research to maintain its status as a leading producer of safe, affordable and abundant food and meet increasing demands.

Unfortunately, current funding by the United States Department of Agriculture (USDA) to support the animal sciences is not proportionate with the economic contributions of animal agriculture. In fact, investment in the animal sciences has been declining for many years, even for programs such as the Agriculture and Food Research Initiative (AFRI) that have received increased appropriations. This imbalance in support for animal science puts U.S. animal agriculture at a major disadvantage at a critical time when livestock and poultry producers are striving for global competitiveness, improving sustainability and working to feed a growing global population.

To address this shortfall in federal investments supporting the animal sciences, new resources must be dedicated to meet critical priorities in animal science. The National Association for the Advancement of Animal Science (NAAAS) has identified a series of value propositions where additional federal investments can drive innovation in the high priority areas of Food Security, One Health and Stewardship.

Food Security - Challenges and Opportunities: With a projected increase in global population by 2050, food production must double which requires increased efficiency of the use of limited natural resources to meet expected increases in meat and milk consumption by 73% and 58%, respectively. With land, water and other natural resources being limited relative to this demand, maintaining or reducing the environmental impact of increased production will be challenging. The application of new knowledge and technology offers meat and dairy producers and the allied pre- and post-harvest industries that support them an opportunity to increase income using sustainable production methods while meeting expanding demand.

Accelerated research in systems biology linked to genomics biology, education and adoption of new knowledge and technology will inform about characteristics of animals that can provide sustainable increases

in overall production efficiency by 50% in 2025 through enhanced performance. Such applications will provide abundant, safe, nutritious and affordable food from animal sources to consumers across the world.

Innovations

- Develop new methods for more efficient use of existing sources of energy and increase the efficiency of low energy and alternative feedstuffs.
- Interrogate the genomes of economically important livestock species to understand the basis for high production efficiencies. Select and develop more efficient animals for use of marginal or residual feeds through marker assisted genetic approaches.
- Increase reproductive efficiency (new products, whole herd efficiency, postnatal survival and growth) and milk yields (amount, low fat content and low somatic cells content).

Outcomes

- Increased efficiency of low energy use and alternative feedstuffs in pasture, stocker and feedlot operations will reduce production costs and increase efficiency by 20% in 2030.
- Developing and assisting in adoption of the application of marker assisted genetic approaches will enhance efficiency and reduce the cost of beef and dairy cattle production by 20% in 2030.
- Through a broad systems biology and genomics biology approach using nutrition, genetics, biologically active products and natural selection, reproductive rates in food animal species will be increased from 70% to 85% by 2040, and milk production will be increased by 25% during that same period.

One Health Challenges and Opportunities: The rapidly emerging one health concept recognizes that animal, human and ecological health are inextricably linked and are best addressed using a systems biology/interdisciplinary/multidisciplinary approach as alluded to in the National Institutes of Health Roadmap (see <http://nihroadmap.nih.gov>). The human genome project and livestock genome projects are providing revolutionary insights for improving human health; however, the application of genomics biology to animal agriculture offers much more for our global society. It is clear that an abundant, affordable and safe food supply continues to be the ESSENTIAL foundation for human health, economic stability and political stability necessary for improved quality of life in the United States and worldwide. A major opportunity of the One Health concept is to enhance and preserve vital agricultural and biomedical capabilities that embrace functional genomics, proteomics and bioinformatics to sequence, map and explore genomes of important species of animals, crops and microbes. This is essential for increasing profitability of livestock enterprises through improved production efficiencies and approaches to enhance animal health and wellbeing.

Modern transportation, global movement of animals and people, and intensive livestock management systems create increased risks for either accidental or intentional introduction of infectious diseases. Zoonoses pose risk of disease transmission from animals to people and vice versa, with both health and economic impacts. Some 58% of new human diseases are zoonotic, and environmental conditions influence the transmission of disease. The results of outbreaks of highly infectious diseases in animals cause mortality and morbidity, as well as catastrophic trade and other economic impacts. A major concern with such outbreaks is the need to employ systems of containment and eradication that ensure continuity of business operations during intervention, especially in intensive livestock production systems. In agricultural and biomedical research, from individual genes to entire organs, systems and whole organism, interdisciplinary teamwork is essential to explore the broad array interconnected pathways of communication among genes, molecules and cells. The goal is to understand how these

pathways are integrated in complex organisms, determine how disturbances in these pathways lead to disease and disease resistance, and desired phenotypes that enhance production agriculture and animal health, as well as mitigate transmission of zoonotic diseases. Through this approach of using systems biology to generate new knowledge and technologies, major opportunities will be forthcoming to improve human and animal health using sustainable management practices, as well as advanced methods for early detection, prevention, and recovery from outbreaks of disease and to produce safer foods of animal origin.

Innovations

- Use modern biological research and enhanced manufacturing approaches to develop and accelerate the production of more effective lower cost vaccines and diagnostic tests for priority animal diseases, including the zoonoses.
- Develop improved overall systems approaches for management of host-pathogen interactions to prevent or reduce the impact of disease introduced in livestock production, and develop new pre- and post-harvest methods for prevention of or intervention for key foodborne pathogens, chemicals and physical hazards.
- Identify and develop biologically active molecules present in feedstuffs that stimulate key physiological processes to enhance disease resistance and improve wellbeing.
- Identify key feeding strategies that capitalize on these effects or that minimize deleterious interactions of nutrient supply and metabolism on animal health. Use these methods to create foods of animal origin with enhanced health effects.
- Apply genomics biology to animal agriculture to ensure that an abundant, affordable and safe supply of food and other products of animal agriculture contribute to this essential foundation for human health and economic and political stability that underpin a high quality of life for the US and global communities.
- Understand the genomic basis for disease resistance and desired phenotypes that enhance production agriculture and animal health, as well as mitigate transmission of zoonotic diseases.

Outcomes

- New monitoring and diagnostic tests will dramatically reduce the impact of introduced disease through early detection before spread occurs. New vaccines for the highest impact diseases with accelerated development will be stockpiled for immediate use, and modern manufacturing methods will allow new vaccines to be produced in a timely manner for use in epidemic or pandemic outbreaks.
- New science-based management methods that employ improved detection and intervention in all segments of the supply chain for foods of animal origin will shift emphasis from intervention to prevention and will reduce both human health and economic impacts of such outbreaks. This will reduce the incidence of foodborne diseases of animal origin by 25% by 2020 and accelerate the recovery from outbreaks.
- Livestock morbidity rates will be reduced by 35% by 2030, resulting in net increases in production efficiency while reducing the requirements for pharmaceutical intervention.
- Foods of animal origin with enhanced nutritive value and positive health effects will provide market incentives for such products with enhanced dietary value.
- Animal agriculture in the US continues to be a leading industry serving our country and our world through production of high quality animal protein and other animal products.
- Genetic lines of livestock that are resistant to disease and have desired production characteristics will be derived through selection based on genetic markers for disease resistance and production efficiency.

Stewardship Challenges and Opportunities: Livestock operations must continue to make major advances in the efficiency and sustainable use of natural resources for both extensive and intensive production systems. More effective use of land, water, energy and other natural resources that generate inputs to animal production as well as for animal production itself are needed. Stewardship of the animals and their relationship to the communities in which they exist are key elements of the total equation. As demand for food increases, animal production will be increasingly forced to use marginal lands where stewardship is even more challenging. New innovations and technologies are urgently needed to optimize the relationships critical to meeting demands for foods of animal origin, stewardship of natural resources, and economic survival of food animal production. Science-based information for appropriate policy and regulatory paradigms is required. Modern science, ranging from basic research in plant and animal genomics, transcriptomics and bioinformatics is essential to underpin genetic selection for development of new and more drought-resistant feeds and forages to improve overall food animal production efficiencies and management practices. Collectively, this approach is essential to realizing major advances in animal and plant agriculture required to meet demands and maintain a healthy, natural resource base.

Innovations

- Develop multifaceted research for improved use and responsible management of natural resources, including marginal lands, for food animal production.
- Provide new methods to reduce and find alternative uses of pollutants from animal production and reduce production of greenhouse gases through genomics-based research to improve animal genetics and feedstuffs, provide better management and transform wastes to useful products.
- Improve animal wellbeing in all segments of food animal production, including improving knowledge of the physiological basis for improved management policies and practices, better housing systems, and improved transportation practices.

Outcomes

- Continue the trend in producing more food from animals with less land and other natural resources through enhanced genetics, better use of natural resources and environmentally sound practices that increase the ratio of animal food produced per unit of input by 25% in 2025.
- Reduce nutrient loading and pollutants and greenhouse gas emissions from food animal systems and related pre- and post-harvest industries by 35% in 2025.
- Improved methods for housing, handling, transporting and feeding animals in overall production systems will improve health and productivity and enhance environmental stewardship in livestock production enterprises.

NAAAS appreciates the opportunity share its views on the drivers for innovation in animal science and the need for increased federal investments. Please let us know if you have any questions or if NAAAS can be of any assistance as the committee continues its work on the federal investment in science.