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## CRITICAL ROLE OF ANIMAL SCIENCE RESEARCH IN FOOD SECURITY AND SUSTAINABILITY

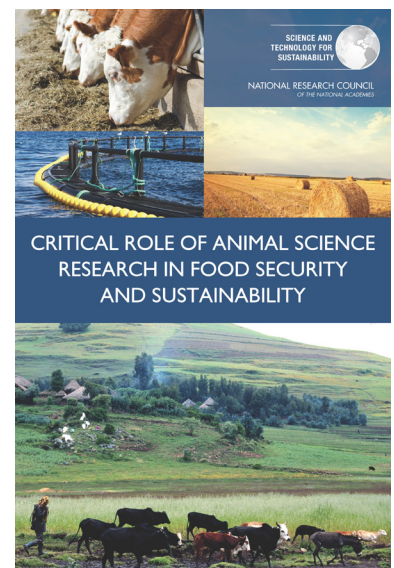
By 2050 the world's population is projected to grow by one-third, reaching between 9 and 10 billion people. Because of this growth and the increasing urbanization and affluence expected in many developing countries, worldwide consumption of animal food products – meat, fish, dairy and eggs – is expected to increase dramatically by 2050. This growth is occurring at the same time the world is facing an array of sustainability challenges, including global climate change.

If the growing demand for animal protein is to be met in a sustainable way, animal science research must be reinvigorated, says *The Critical Role of Animal Science Research in Food Security and Sustainability*, a new report from the National Research Council. The report identifies priority research areas, including breeding technology and genetics, interactions between animal agriculture and the environment, and animal welfare, among other areas. It urges both governments and the private sector to increase their funding for animal science research.

### GROWING DEMAND, GROWING CHALLENGES

The demand for food from animal agriculture is expected to increase substantially by 2050, due in part to growth of the world's population. Per capita meat consumption is also expected to rise in developing countries because of increasing urbanization and rising incomes. While North America and Europe will see little growth in per capita consumption of animal protein, consumption in Asia and Africa will more than double. Latin America and the Caribbean will see significant increases as well.

This growth in global demand is expected at a time when agriculture is facing environmental challenges, including pressure on the availability of land and water as well as climate change, along with the growing threat of disease transmission to and from agricultural animals. Moreover, there is a high likelihood of a major threat to animal agriculture that no one currently predicts, and for which a vibrant animal research enterprise will be needed to respond.



Given the challenges ahead, a new roadmap for animal science research is needed that focuses on animal production in a way that is informed by advances in biological sciences and by the broader socioeconomic and environmental conditions of the new century. Animal agriculture and animal protein production will substantially increase in coming decades, but it must do so in the context of sustainability.

## **STRENGTHENING U.S. RESEARCH**

In the past two decades, public funding of animal science research in the U.S. has been stagnant, essentially declining in terms of real dollars, and it has not kept up with the rising costs of conducting research. While industry support for research has increased, it has tended to focus on applied areas that can be commercialized in the short term. **Public support for animal science research -- especially basic research -- should be restored to at least past levels of real dollars and maintained at a rate that meets or exceeds the annual rate of research inflation.**

Achieving a sustainable, affordable and secure supply of animal protein will require increasing the efficiency of animal protein production while reducing its environmental impact and cost. Three criteria of sustainability should guide funding decisions about animal science research and technology development: reducing animal agriculture's environmental footprint, reducing the financial cost per unit of animal protein produced, and recognizing societal values and impacts as an essential component in defining sustainable global animal agriculture. Research efforts should take a holistic approach, integrating various components of the food chain rather than treating them separately.

In addition, research infrastructure – both human resources and physical infrastructure – needs to be revitalized. In the United States, USDA and the newly created Foundation for Food and Agricultural Research should form a broad-based coalition to develop a U.S. Animal Science Strategic Plan or Roadmap for building research capacity and infrastructure through 2050. The coalition should include federal agencies, colleges and universities with relevant research and teaching programs, NGOs, the private sector, and other stakeholders.

The following specific research areas are of high priority for reinvigorating the science of animal agriculture and its infrastructure in the United States:

**Breeding and genetic technologies.** These have been the major contributors to past increases in animal productivity, efficiency and environmental and economic advances. Further development of these approaches is needed to meet future demand. Research should be conducted to understand societal concerns about the adoption of these technologies and the most effective methods to respectfully engage and communicate with the public.

**Nutritional requirements.** Past research in this area has led to technological innovations such as production of individual amino acids to help provide a diet that more closely resembles the animal's requirements, resulting in improved efficiency, better animal health, and environmental gains, as well as lower costs. However, much more can be realized with additional research. Research should continue to develop a better understanding of how animals metabolize and use nutrients and the effects of those nutrients on gene expression. Of particular importance is basic and applied research in keeping knowledge about animals' nutrient requirements current.

**Feed technology.** Potential waste products from the production of animal food, biofuel, or industrial production streams can and are being converted to economical, high-value feed for animals. Alternative feed ingredients are important in replacing high value and unsustainable ingredients or those that may otherwise compete directly with human consumption. Research should continue to identify alternative ingredients for animal feed that are inedible to humans and will reduce the cost of animal protein production while improving the environmental footprint. This research should also assess the possible impact of changes in the protein product on the health of the animal, the human consumer, and the environment.

**Environmental changes, including climate change.** These changes will impact animal agriculture in diverse ways, from affecting the quality and quantity of feed to causing environmental stress in animals. Animal agricultural production affects and is affected by climate change, and adaptations will be necessary. Strategies to adapt animal agriculture to climate change and to mitigate its

effects on climate change are often interrelated and should be considered together. Research should also explore how to more precisely quantify greenhouse gas emissions and pollutants from agriculture and the economic and social viability of mitigation strategies. Economic modeling of animal agriculture's impacts on the environment could help guide decision makers' technical and policy responses, the report notes; for example, reducing the greenhouse gas emissions of beef cattle through investments in technology could improve both the bottom lines of ranchers and the economic sustainability of the industry.

**Animal health.** Sub-therapeutic use of medically important antibiotics in animal production practices is being phased out and may be eliminated in the United States in an effort to combat the rise of antibiotic resistance in humans consuming the animal protein. Research should explore alternatives to these antibiotics that provide the same or greater benefits in terms of improved feed efficiency, disease prevention, and overall animal health.

**Animal welfare.** Compared with Europe, less research currently focuses on animal welfare in agricultural production systems in the United States, and funding for this research should increase. Research should be focused on current and emerging housing systems, management, and production practices for food animals in the United States. FFAR, USDA-AFRI, and USDA-ARS should carry out a process for prioritizing research on animal welfare that incorporates relevant stakeholders and mechanisms for building research capacity in this area.

**Socioeconomic considerations.** Although socioeconomic research is critical to the successful adoption of new technologies in animal agriculture, insufficient attention has been directed to this research, and few animal science departments in the U.S. have social sciences or bioethics faculty in their departments who can conduct it. Socioeconomic and animal science should be integrated so that researchers, administrators, and decision makers can be informed in conducting and funding effective and productive research and technology transfer.

**Communications.** A broad communications gap related to animal agriculture research and its objectives exists between the animal science community and the consumer, a gap that must be bridged if animal protein needs of 2050 are to be met. This will require research to better understand the knowledge, opinions, and values of the public and of food system stakeholders, as well as the development of effective and mutually respectful communication strategies. A coalition representing universities, federal agencies, industry, and the public should be formed to focus on communications research.

## **PRIORITIES FOR GLOBAL RESEARCH**

To sustainably meet increasing demands for animal protein in developing countries, stakeholders at the national level should be involved in establishing animal science research priorities. Research should be devoted to understanding barriers to the adoption of new technologies, such as lack of access to credit, production resources, markets, information, and training and strategies to overcome them. Efforts should focus on the education and communication role of local extension personnel in supporting successful adoption of the technology, with particular emphasis on the training of women. Research is also needed to alleviate the problems of animal and zoonotic diseases that result in enormous losses in animal health, livelihoods, national and regional economies, and human health.

Many, if not most, smallholder animal producers in developing countries worry more on a day-to-day basis about survival than about increasing the productivity and profitability of their animal products. Research needs to be directed toward the successful development of locally relevant technologies that require minimal risk to adopt and thereby augment livestock use as a source of wealth and a means of survival during lean times. Financial support for research to help developing countries achieve these goals should take community welfare into consideration.

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**For More Information . . .** This Report Highlights was prepared by the Science and Technology for Sustainability Program based on the report *Critical Role of Animal Science Research in Food Security and Sustainability*. The study was sponsored by the Association of American Veterinary Medical Colleges, Bill & Melinda Gates Foundation, Innovation Center for U.S. Dairy, National Cattlemen's Beef Association, National Pork Board, Tyson Foods, Inc., U.S. Department of Agriculture, and the U.S. Poultry & Egg Association. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authoring committee and do not necessarily reflect those of the sponsors. Copies of the report are available from the National Academies Press, (800) 624-6242; <http://www.nap.edu>.

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