2012 FAIR

Farm Animal Integrated Research SUMMARY

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By 2050, the world's population is projected to reach 9 billion. Along with population growth, increasing affluence of the middle class in developing countries is expected to result in a 73% increase in consumption of animal protein (meat and eggs), with a 58% increase in consumption of dairy products. **To meet increased global demand for meat, milk, and eggs, livestock and poultry producers will need to increase production efficiency in an environmentally sustainable and socially acceptable manner**. Public investments in agricultural research yield a return of at least 20 to 1; however, state and federal funding for agricultural research, including research with livestock and poultry, has been stagnant and has not kept pace with inflation over the last 20 years. To position the livestock industries to meet increasing global demands for animal protein, **research priorities must be defined to maximize return on investment and increase total amount and availability of federal research funding.**

FAIR 2012 was conducted in March to establish priorities for animal agricultural research, education, and extension activities. Participants reviewed past successes, examined current practices in livestock production, and focused on setting priorities for the future. It was clear from the discussion that an overarching principle needed to be set forth: **Development and adoption of new technologies is essential to meet the critical challenges in food production**.

New knowledge of genomics, physiological processes, nutrient utilization, and animal well-being will lead to new management practices that are economically, environmentally, and socially sustainable. Innovation, transformational research, effective outreach to disseminate timely information, and adoption of new technologies and practices will allow increased production efficiency with fewer inputs of natural resources and a smaller environmental impact. In the past 50 years, intense genetic selection for increased meat, milk, or egg production has resulted in large increases in productivity. High-quality, draft genome sequences are now available for cattle, pigs, and chickens. This information will allow farmers and ranchers to make more accurate and rapid genetic improvement by using genetically superior animals for breeding and by selecting for complex traits including disease resistance, well-being, and product quality. A better understanding of the temporal and spatial patterns of gene expression, the interaction of gene networks in biological systems, and the new area of epigenetics (heritable changes in gene expression without alterations in DNA sequences) may also play a role in enhancing animal production efficiencies.

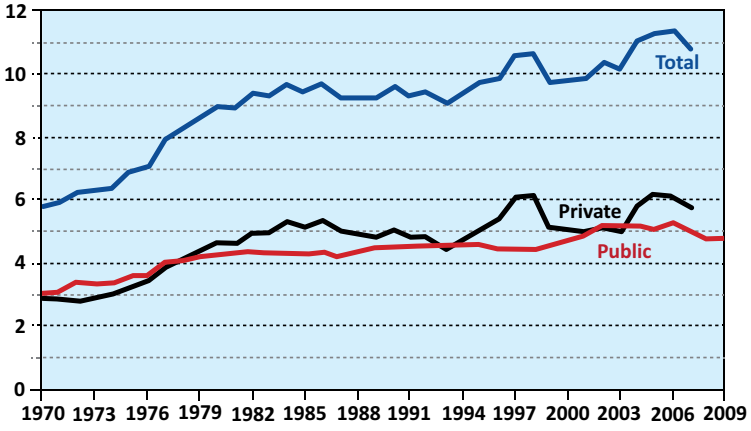
Relative to specific research priorities, participants at FAIR 2012 recommended that future research, education, and extension activities be focused in three areas: Food Security, One Health, and Stewardship.

FOOD SECURITY

Meeting increased global demand for meat, milk, and eggs within natural resource constraints will require substantial improvements in the efficient use of resources.

- ***Feed Efficiency:*** More than 60% of the cost of animal production is associated with the cost of feed. Research is needed to increase the digestibility of fiber; optimize feed processing to maximize nutrient utilization; understand energy needs in individual animals and match those needs to available energy in feedstuffs; utilize genome-enabled technologies to identify animals that are more efficient at converting feed to lean muscle mass, milk, or eggs; identify genetic markers and physiological mechanisms associated with feed efficiency and energy use in individual animals; and understand mechanisms that regulate expression of genes associated with efficient production of lean muscle mass, milk, and eggs.

Real food and agriculture R&D funding 1970–2009



Note: Data for 2008-09 are preliminary.
Source: USDA ERS based on data from National Science Foundation, USDA's Current Research Information Systems (CRIS), and various private sector data sources. Data are adjusted for inflation using an index for agricultural research spending developed by ERS.

FOOD SECURITY cont'd

- ***Reproductive Efficiency:*** A lack of fertility or the inability to conceive is often a limiting factor to production efficiency. Research is needed to understand and manage early embryonic loss in cattle; optimize the timing of artificial insemination in cattle and pigs; optimize birth weight and postnatal survival and growth in pigs; and enhance cryopreservation of gametes and embryos. Genome-enabled technologies will provide important methods to enhance reproductive efficiency in livestock and poultry systems.

ONE HEALTH

One Health addresses factors affecting animal health, human health, ecological health, and their interconnections using an interdisciplinary approach. Zoonoses (diseases passed from animals to humans and vice versa) account for 58% of the currently recognized human pathogens, and domestic animals account for approximately 20% of these events. The intersection of human and animal health has important implications for federal policies and regulations. **Healthy animals provide safe and wholesome products for human consumption. To promote animal health and optimize animal production efficiency, research is needed in the areas of:**

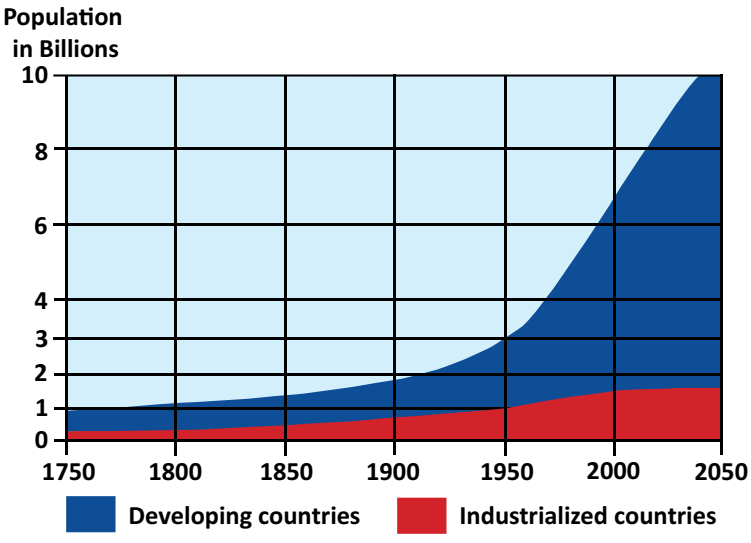
- ***Vaccines:*** New vaccines and new technologies are needed to protect against changing and emerging infectious disease agents.
- ***Zoonotic Diseases and Food Safety:*** Increased understanding of the mechanisms associated with the transfer of infectious agents and diseases between humans and animals is needed. Methods are needed for real-time identification and control of food-borne pathogens at all segments of the supply chain (pre-harvest, harvest, and post-harvest). Educational programs related to zoonotic diseases and food safety are needed for farmers, ranchers, processors, retailers, and consumers.
- ***Effects of Diet on Health:*** Research is needed to understand how components of the diet (e.g., specific nutrients, complex dietary components like fiber, probiotics, prebiotics, and enzymes) influence the gut and systemic immune system and how these immune interactions can help decrease or replace the sub-therapeutic use of antibiotics.

STEWARDSHIP

Increased animal production efficiencies must be made with an emphasis on sustainable stewardship of animals and natural resources.

- ***Stewardship of Animals:*** Research is needed to optimize well-being of livestock and poultry in various production systems and to optimize the production system to the well-being of the animal. Research is also needed to more effectively manage pain, transportation, and euthanasia in livestock and poultry.
- ***Stewardship of the Environment:*** Research is needed to examine and mitigate the effects of livestock and poultry production on water quantity/quality and increasing climate variability; estimate and decrease production of greenhouse gases; and understand the flow of nutrients and other potential pollutants from animal production systems.

World population growth



Source: FAO

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The final FAIR 2012 documents will be available on the FASS homepage www.fass.org.

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