

NIH-USDA Collaboration: Dual-Purpose Models

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Economic and Socioeconomic Value of Livestock

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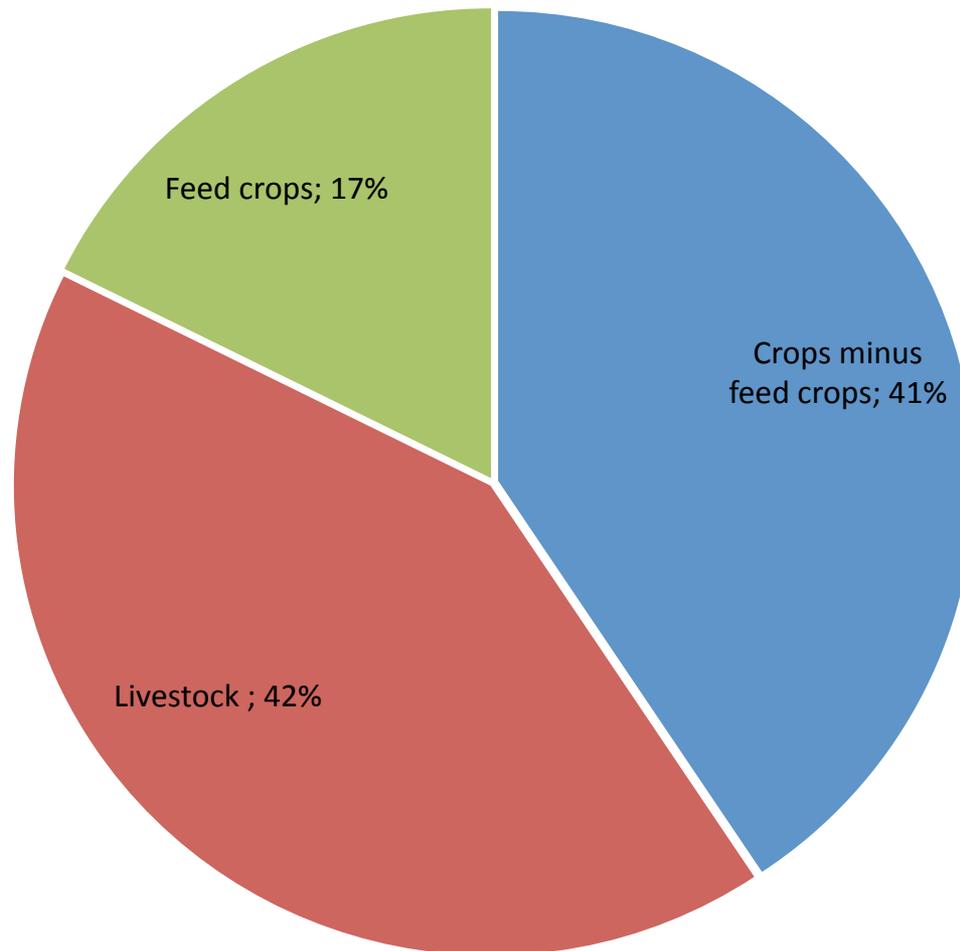
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Livestock in Research*

- Even though annual economic value of livestock is \$166 billion in the U.S., and despite the socioeconomic value of livestock and their products:
 - Only about 0.04% (\$32.15 million) of the \$88 billion Department of Agriculture (USDA) budget in fiscal year 2007 was allocated to its competitive grants program (AFRI – Agriculture and Food Research Institute) for research that directly involves agriculturally important domestic animals
- By contrast, the Department of Health and Human Services (DHHS) apportioned 4.1% (\$29.5 billion) of its \$716 billion budget in fiscal year 2008 to the National Institutes of Health (NIH) of which ~80% supported extramural research

Livestock in Biome

-  Seventeen such as cat research models
-  Numerous models relevant to
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FARM ANIMALS AS BIOMEDICAL MODELS

- | | |
|---------------------------|----------------|
| Obesity | Ovarian cancer |
| Diabetes | Nutrition |
| Aging | Immunology |
| Cardiovascular disorders | Genomics |
| Infectious disease | Therapeutics |
| Neurobiology | Ophthalmology |
| Epigenetics & environment | Reproduction |

Research areas that could potentially be advanced by using farm animals as biomedical models. For appropriate farm animal models for specific diseases and references, see www.adsbm.msu.edu.

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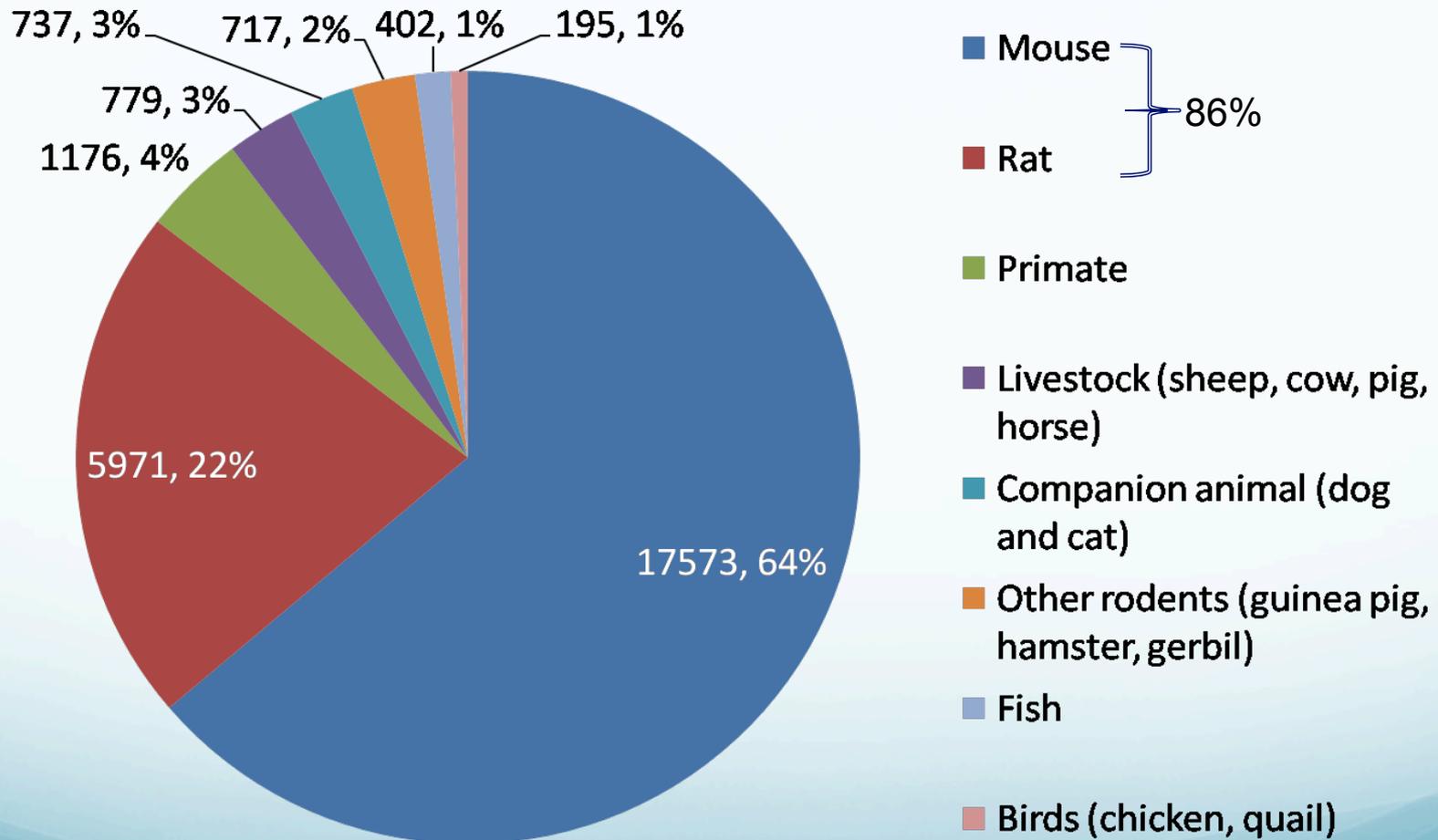
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NIH Research Portfolio - 27,550 funded grants, 2007

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*NIH RePORTER (<http://projectreporter.nih.gov/reporter.cfm>), search for species, 2007, Lawrence P. Reynolds

Additional Concerns*

-  Based on their own data base (NIH RePORTER), the small percentage of funded grants using farm animals declined by 30% from 2002 to 2006

-  For land-grant universities:
 -  Numbers of faculty and graduate student enrollment are declining in animal and veterinary sciences departments
 -  Farm animal species and numbers also are declining

-  Thus, ability to maintain top-quality science and scientists in land-grant institutions and to conduct state-of-the-art research relevant to animal agriculture and human health is clearly at risk now and in the future!

Livestock as Dual-Use Models in Agricultural & Biomedical Research*

- In 2004 and 2007, a group led by Dr. Jim Ireland at Michigan State convened workshops on this topic
- Supported by 5 NIH institutes/centers and USDA-NRI (now USDA-NIFA-AFRI) and involved program leaders from these federal programs
- The last workshop, in 2007:
 - Included speakers that utilized domestic species in:
 - Reproduction & Developmental Biology research
 - Developmental Origins of Health & Disease research
 - Metabolism research
 - Infectious Diseases research

Livestock as Dual-Use Models in Agricultural & Biomedical Research*

- Recommendations from the last workshop, in 2007
 - NIH-USDA joint funding program & opportunities
 - Strengthen review practices at NIH Center for Scientific Review:
 - Ensure members on study sections that understand domestic animal models
 - Educate study section members on advantages of domestic animal models
 - Flag applications with domestic animals as potentially having “important advantages”
 - Reorganize land-grant mission to include dual-use of domestic animal models, facilitate collaboration among biomedical and animal scientists, publish articles that highlight strength of domestic animal models

Livestock as Dual-Use Models in Agricultural & Biomedical Research*

Implementation of recommendations:

-  PAR-10-276, “Dual Purpose with Dual Benefit: Research in Biomedicine and Agriculture Using Agriculturally Important Domestic Species (R01)”
-  Released Sept 2010, now in its 3rd year (proposals were due 20 Sept of this year)
-  In first 2 years:
 - 7 projects funded by NIH
 - 3 projects funded by USDA-AFRI – 2 additional (animal health and food-borne pathogens) and possibly one other not yet funded*
 - That is, total of up to 13 projects in 2 rounds
-  Numerous articles published that ‘highlight strength of domestic animal models:’

*NIH RePORTER (<http://projectreporter.nih.gov/reporter.cfm>), search for ‘PAR-10-276, 27-Sep-12; Personal communication, Dr. Mark Mirando, National Program Leader, Animal Programs, USDA-NIFA- AFRI, 28-Sep-12.

Livestock as Dual-Use Models in Agricultural & Biomedical Research*

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RESEARCH PRIORITIES

Farm Animal Research in Crisis

R. M. Roberts,¹ G. W. Smith,² F. W. Bazer,³ J. Cibelli,² G. E. Seidel Jr.,⁴ D. E. Bauman,⁵
L. P. Reynolds,⁶ J. J. Ireland^{2*}

The annual economic value of livestock and poultry sales in the United States currently exceeds \$132 billion (1), yet only about 0.04% (\$32.15 million) (2) of the \$88 billion Department of Agriculture (USDA) budget in fiscal year 2007 (3) was allocated

As time has passed, however, Hatch funds and other research formula funds, even with the help of matching dollars from states, have declined markedly in constant dollars and have been insufficient to maintain research farms and other infrastructure—let alone the research pro-

Inadequate funding threatens vital agricultural and biomedical research with farm animals.

runner of the present-day competitive USDA grants program grew out of the NRC report and has funded many notable advances in agricultural practices for increased food safety, reproductive efficiencies, and diets to meet specific animal production systems. Since

mishap Sept. 25

Once in need, large-animal vets now searching for jobs

Beginning farmers get boost in

ened due to budgetary erosion. This funding decline is well with breakthroughs in each fostering the work in the others

Michigan Correspondent

WASHINGTON, D.C. — A report published last April in Science magazine decries the lack of funding for research involving the use of farm animals as well as other related problems in the world of animal science.

*Advantages of Domestic Species as Dual-Purpose Models that Benefit Agricultural and Biomedical Research (<http://adsbm.msu.edu>)

Livestock as Dual-Use Models in Agricultural & Biomedical Research

Implementation of recommendations:

However, at NIH:

-  Little or no effort to ‘educate’ study section members or ‘ensure’ they have an understanding of advantages of domestic animal models
-  Little or no effort to ‘flag’ applications with domestic animals as potentially having ‘important advantages’

At land-grants:

-  Little effort to ‘reorganize’ land-grant mission to include dual-use of domestic animal models
-  Little effort to ‘facilitate’ collaboration among biomedical and animal scientists

Where To? Livestock Models in Agricultural & Biomedical Research

- 🐄 NRC study panel and report to Congress?
 - 🔍 Barriers?
 - 🔍 Outcomes?
- 🐄 Implementation of recommendations to NIH concerning ‘educating’ study section members and ‘flagging’ proposals?
- 🐄 Increase in, or at least continuation of, funding for NIH-USDA Dual-Use program?
- 🐄 Increase in funding for USDA-AFRI (\$264M in FY2012 – NIH now over \$30B, or >100X of AFRI)?
- 🐄 Implementation of effort to ‘reorganize’ land-grant mission and to ‘facilitate’ collaborations among biomedical and agricultural scientists?

Where To? Livestock Models in Agricultural & Biomedical Research

- Implementation of effort to ‘reorganize’ land-grant mission and to ‘facilitate’ collaborations among biomedical and agricultural scientists
- Need to ‘integrate’ food sciences and animal sciences into ‘health sciences:’
 - So-called NDCs (non-communicable diseases like the metabolic syndrome, cancer, dementias including Alzheimer’s, etc.) now account for 60% of deaths worldwide, and and 80% of deaths in low- and middle-income countries!*
 - Importance of Developmental Programming (that is pregnancy and infancy) in incidence of NCDs
 - e.g., low intake during pregnancy results in low birth weight and a 2- to 7-fold increase in ‘risk’ for all NCDs – well documented in humans, verified by controlled studies in various animal models.

*Ash et al., Disease Prevention Special Section, Science 2012; 337:1467-1503.



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GLOBAL HEALTH

Global Indicators and Targets for Noncommunicable Diseases

Measurable, ambitious, and achievable indicators with targets are critical, but political commitment to achieve them is the main determinant of outcomes.

S. Y. Angell,* I. Danel, K. M. DeCock

In September 2011, the United Nations (UN) convened a High Level Meeting (HLM) of member states to address a largely neglected, global reality: Noncommunicable diseases (NCDs)—including heart disease, stroke, cancer, diabetes, and chronic lung diseases—kill more people than other causes, health and non-health related, and the world is ill-prepared to respond. This was only the second such UN

Technical Criteria and Selection Process

The creation of indicators, measurable characteristics that describe an aspect of health, and targets, specific time-bound changes in indicators expected to be achieved, is not new to global health and development (4). In addition to providing an objective means to assess progress and impact, indicators and targets express a collective commitment to act, which can spark coordinated action and the

Determinants of NCDs go well beyond the traditional domains of public health. Yet the process of indicator and target setting is headed by the UN specialized health agency, WHO, with technical input largely from health experts and member state consultations dominated by ministries of health. It is thus no surprise that proposed indicators with targets seem to focus on health measures. Proposed indicators include tobacco use, raised

communities that are increasingly plagued by noncommunicable diseases, including cancer, type 2 diabetes, and Alzheimer's disease. Addressing this huge prospective burden of long-term disease is a priority in the design of **a new generation of preventative strategies, including healthier eating.**

See our special section beginning on page [1466](#). Image: [Mike Kemp/Getty Images](#)

Where To? Livestock Models in Agricultural & Biomedical Research

- Implementation of effort to ‘reorganize’ land-grant mission and to ‘facilitate’ collaborations among biomedical and agricultural scientists
- Need to ‘integrate’ food sciences and animal sciences into ‘health sciences:’
- Livestock an important source of nutritious foods (e.g., B vitamins, iron, amino acids, etc.).**
- Animal models as ‘healthy lifestyle’ models; e.g., duodenal infusion of dietary compounds to influence metabolic rate or to alter epigenetic status (folate, B12, choline)
- Health benefits of livestock products for humans - Human nutrition research centers? Clinical trials involving animal & biomed scientists?

**Randolph TF et al. Invited Review: Role of livestock in human nutrition and health for poverty reduction in developing countries. J Anim Sci 85:2788-2800,



DIETARY FACTORS



LONG-TERM CONSEQUENCES



HEALTH

MAY 14-16, 2012

KEYNOTE SPEAKERS:

Kalidas Shetty, *University of Massachusetts Amherst*
Kent Thornburg, *Oregon Health Sciences University*
Ah-Ng Tony Kong, *Rutgers University*

Visit www.ndsu.edu/scimath to register and view the agenda.

Sponsored by the College of Science and Mathematics
Co-sponsored by the College of Human Development and Education;
College of Agriculture, Food Systems, and Natural Resources;
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and North Dakota Agricultural Experiment Station

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-  **Challenge:** to ‘integrate’ food sciences and animal sciences into ‘health sciences’
 - Use animal models of ‘healthy lifestyle’ with focus on non-communicable diseases
 - Livestock products as part of healthy lifestyle

-  **Opportunity:** to return public appreciation of livestock products as part of a healthy lifestyle – this will take a concerted effort among scientists, funding entities, and policy-makers!

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Dr. Kimberly Vonnahme – Animal Physiology, NDSU

Collaborators

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International:

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Drs. Marek Bienko & Radislaw Radzki – Univ. of Lublin, Poland

Drs. Lino Loi et al. – Univ. Teramo, Italy

Drs. Luciano Silva & Flavio Meirelles – Univ. of Sao Paulo, Brazil

Dr. Jacqueline Wallace et al. – Rowett Inst., Scotland

Questions?



Center for **N**utrition and **P**regnancy



“Healthy Offspring through Optimal Nutrition”