



Council for Agricultural Science and Technology

**John M. Bonner, Ph.D.
Executive Vice President, CEO**



The Science Source for Food,
Agricultural, and Environmental Issues

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CAST assembles, interprets, and communicates credible, science-based information regionally, nationally, and internationally to legislators, regulators, policymakers, the media, the private sector, and the public

- **CAST is a nonprofit organization composed of scientific societies and many individual, student, company, nonprofit, and associate society members**
- **CAST uses volunteer key scientific authors and reviewers**
- **CAST provides credible, understandable science-based information to your staff and to the public**

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The Science Source for Food,
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- The wide distribution of CAST publications to nonscientists enhances the education and understanding of the general public

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Getting Accurate Scientific Information on the Current H1N1 Influenza Outbreak

Only three letters need to be removed from the word "PANDEMIC" to create "PANIC," but those "missing pieces" profoundly impact the result. Likewise, there also are critical "missing pieces" in some of the information currently circulating on the recent outbreak of H1N1 Influenza. (Click on "News Release" for full article.)
[News Release](#)

SCIENTIFIC ASSESSMENT OF THE WELFARE OF DRY SOWS KEPT IN INDIVIDUAL ACCOMMODATIONS

The use of individual gestation accommodations (IGAs) for dry sows in commercial pork production is an issue that has generated intense public debate. In an effort to provide objective, scientific information on the subject, CAST is releasing this new Issue Paper, *Scientific Assessment of the Welfare of Dry Sows Kept in Individual Accommodations*. The international Task Force provides an authoritative review of the available scientific literature as well as expert opinion on the topic of overall humaneness of IGAs. (March 2009) [News Release](#)

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Friday Notes

CAST FRIDAY NOTES

The Science Source for Food,
Agricultural, and Environmental Issues

weekly e-newsletter



The Council for Agricultural Science and Technology
Communicating Credible Science to "A World Supported by Plants and Animals"

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Friday Notes will not be published next week
(July 3) because of the Independence Day holiday. The Notes will
resume their regular schedule on Friday, July 10.



June 26, 2009

Agriculture May Be As American As
Apple Pie, But It's Getting to Be a
Smaller and Smaller Slice



Agriculture in America: Then and Now

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515-292-2125.

Americans celebrating Independence Day next week wouldn't have much to celebrate about—or to celebrate with—without agriculture. But food, clothing, and clean water don't just come out of thin air (although agriculture has some good solutions for that, too). Creating, adapting, and maintaining critical agricultural technologies and production require serious priority-setting and long-term commitments to research and development. No matter which side of the many agricultural advocacy fences we're standing on, we're all standing on a world supported by plants and animals. It's part of our heritage and will determine our future.

- Published 48 times each year
- More than 60 current agricultural news items-- gleaned from 100+ sources
- News articles are categorized in areas of emphasis that parallel the three CAST work groups, and the "page 1" stories often feature CAST activities
- Washington, D.C. congressional updates from Meyers and Associates

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Ethical Implications of Animal Biotechnology: Considerations for Animal Welfare Decision Making



*Animal Agriculture's
Future through Biotechnology, Part 9*



CAST Issue Paper 46
June 2010

Issue Paper Authors

- **Paul B. Thompson (Chair)**
 - Department of Philosophy
 - Michigan State University, East Lansing
- **Fuller W. Bazer**
 - Department of Animal Science
 - Texas A & M University, College Station
- **Edna F. Einsiedel**
 - Communications Studies
 - University of Calgary, Calgary, Alberta, Canada
- **Margaret Foster Riley**
 - University of Virginia School of Law, Charlottesville

Issue Paper Reviewers and CAST Liaison

Issue Paper Reviewers

- **Jeffrey Burkhardt**
 - Department of Food and Resource Economics
 - University of Florida, Gainesville
- **Gail C. Golab**
 - Animal Welfare Division
 - American Veterinary Medical Association, Schaumburg, Illinois
- **Carol Keefer**
 - Department of Animal and Avian Sciences
 - University of Maryland, College Park
- **George Seidel, Jr.**
 - Department of Biomedical Sciences
 - Colorado State University, Fort Collins

CAST Liaison

- **A. David Scarfe**
 - American Veterinary Medical Association, Schaumburg, Illinois

What is animal biotechnology?

- **Genetic engineering**
 - Use of rDNA tools to introduce genes into the genome of an animal
 - “Transgenic animal”: genes have been derived from the gene pool of a different species
- **Adult-cell cloning**
 - Creation of a new embryo from the cells of an adult
 - Duplicates the genome of the adult in clone

What is animal biotechnology?

- Focus of the CAST report
 - Applications for food and fiber production (e.g., animal agriculture)
 - Applications using traditional agricultural species (cows, pigs, goats, poultry), even when modification is not for food and fiber

What is animal biotechnology?

- Focus of the CAST report
 - Applications for food and fiber production (e.g., animal agriculture)

EXAMPLE: The “enviro-pig”: A pig that has been genetically modified to produce phytase in its saliva

PURPOSE: Pigs have less phosphorus in their manure, an environmental benefit

What is animal biotechnology?

- Focus of the CAST report
 - Applications for food and fiber production (e.g., animal agriculture)

EXAMPLE: Cow genetically modified to have higher resistance to mastitis (an inflammatory disease of the udder)

PURPOSE: Reduce costs that producers incur from reduced production and treating this condition

What is animal biotechnology?

- Focus of the CAST report
 - Applications for food and fiber production (e.g., animal agriculture)

EXAMPLE: Cloning of high-producing dairy COWS

PURPOSE: Allows producers extra opportunities to preserve and pass on the genetics of high-producing animals

What is animal biotechnology?

- Focus of the CAST report
 - Applications using traditional agricultural species (cows, pigs, goats, poultry), even when modification is not for food and fiber

EXAMPLE: Cattle that have been genetically modified to produce human antibodies in blood or milk

PURPOSE: Produce high-quality drugs for human medicine using traditional animal husbandry

Chart courtesy Alison Van Eenennaam, UC Davis

<u>ENVIRONMENTAL</u>	<u>Species</u>	<u>Gene</u>	<u>Approach</u>
Decreased P in manure	Swine	Phytase	Transgene overexpression
<u>DISEASE RESISTANCE</u>			
Mastitis resistance	Cattle	Lysostaphin	Transgene expression
BSE resistance	Goat, Cattle	Prion	RNAi transgene; knockout
Visna virus resistance	Sheep	Visna virus envelope gene	Transgene expression
Mastitis resistance	Goats	Lysozyme	Transgene expression
GCH virus resistance	Grass Carp	Lactoferrin	Transgene expression
Bacterial resistance	Channel Catfish	Cecropin B gene	Transgene expression
<u>PRODUCT QUALITY</u>			
Increased ω -3 fatty acids in meat	Swine	n-3 fatty acid desaturase	Clone/Transgene expression
Increase cheese yield from milk	Cattle	β -casein, κ -casein	Clone/Transgene expression
<u>PRODUCTIVITY</u>			
Enhanced growth rate	Many fish species	Growth Hormone	Transgene expression
Enhanced milk production	Swine	α -lactalbumin	Transgene expression
Enhanced growth rate	Swine	Growth hormone	Transgene expression
Enhanced growth rate	Swine	Insulin-like-growth factor	Transgene expression

Envisioned GE livestock applications

Chart courtesy Alison Van Eenennaam, UC Davis

<u>ENVISIONED APPLICATIONS</u>	<u>Species</u>	<u>Proposed Approach</u>
Suppressing infectious pathogens (e.g. foot-and-mouth disease resistance)	Various	RNAi (Lentivirus)
Avian flu resistance	Poultry	RNAi (Lentivirus)
Coronavirus-resistance	Swine	RNAi /Knockout
Low lactose milk	Cattle	Transgene expression
Low lactose milk	Cattle	RNAi /Knockout
Increased ovulation rate	Sheep	RNAi /Knockout
High omega-3 fatty acid milk	Cattle	Transgene expression
Resistance to Brucellosis	Cattle	Transgene expression
Decreased P in manure	Poultry	Transgene expression
Increased lean-muscle growth	Cattle	RNAi /Knockout
Increased post-natal growth	Various	RNAi /Knockout
Enhanced mammary gland development	Various	RNAi /Knockout

Animal biotechnology: What are the ethical issues?

- ① **Harm to animals:** What is it? How should it be balanced against human benefit?
- ② **Relationships with animals:** Apart from harm to individuals, does biotechnology alter our relationship to animals in a morally significant way?
- ③ **Procedural issues:** How do we as a society cope with different views on the ethics of animal biotechnology?

① Harm to Animals

Cognitive Measures:
Pain, Suffering,
Experiential
Frustration or
Satisfaction

Species Typical
Behaviors:
Nesting, Wing
Flapping,
Dust Bathing,
Perching

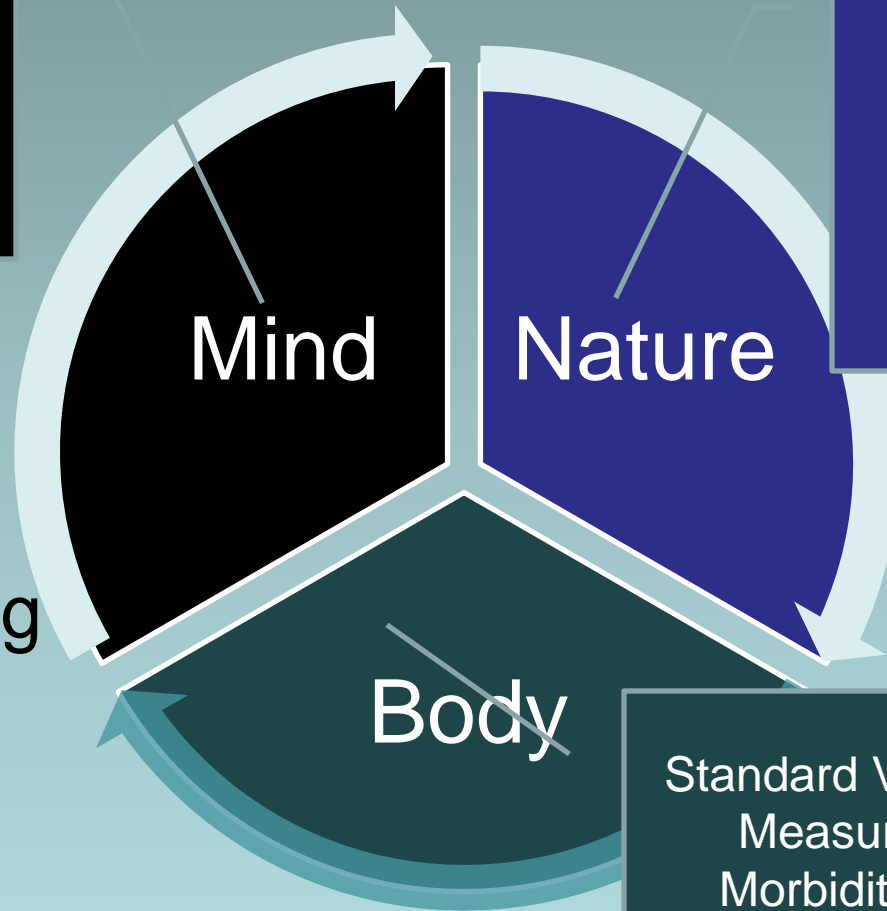
Mind

Nature

Body

Understanding
Animal
Welfare

Standard Veterinary Health
Measures: Mortality,
Morbidity, Growth and
Development



① Harm to Animals

Cognitive Measures:
Pain, Suffering,
Experiential
Frustration or
Satisfaction

Option 1: Species typical behaviors are important *to the extent that* they effect cognitive or veterinary well-being

Species Typical Behaviors:
Nesting, Wing Flapping,
Dust Bathing,
Perching

Mind

Nature

The
Philosophical
Problem:
How to understand
animal natures?

Body

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Me
Morbidity, Growth and
Development

Option 2:
Species typical behaviors are *constitutive* of well-being

① Harm to Animals

Cognitive Measures:
Pain, Suffering,
Experiential
Frustration or
Satisfaction

Option 1: Species typical behaviors are important *to the extent that* they effect cognitive or veterinary well-being

Species Typical Behaviors:
Nesting, Wing Flapping,
Dust Bathing,
Perching

Mind

Nature

The Practical Problem:
This philosophical tension is reflected in the public's ethical attitudes toward animals, especially in agriculture

Body

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Morbidity, Growth and
Development

Option 2:
Species typical behaviors are *constitutive* of well-being

Relationships with animals

- Apart from harm to individuals, does biotechnology alter our relationship to animals in a morally significant way?

EXAMPLE: Animals as machines vs. animals as living beings

Relationships with animals

- Apart from harm to individuals, does biotechnology alter our relationship to animals in a morally significant way?
- The ethical concern: Genetic modification is part of a trend to see animals entirely in terms of the use that humans make of them
- It is exploitative of animal life

Relationships with animals

- Apart from harm to individuals, does biotechnology alter our relationship to animals in a morally significant way?
- The ethical concern: Genetic modification is part of a trend to see animals entirely in terms of the use that humans make of them

The Case of G M to Address Production Issues

The animal is better off (suffers less harm), but this might have been done changing the production system

Relationships with animals

- Apart from harm to individuals, does biotechnology alter our relationship to animals in a morally significant way?
- **ANIMAL PATENTING:** Is it ethically appropriate to exert an ownership claim on *all* progeny of a transgenic animal?

Relationships with animals

- Apart from harm to individuals, does biotechnology alter our relationship to animals in a morally significant way?
- ANIMAL PATENTING: Is it ethically appropriate to exert an ownership claim on *all* progeny of a transgenic animal?
- Does patenting of life process represent a change in how we see animal life?

Procedural issues

- How do we as a society cope with different views on the ethics of animal biotechnology?
 - EXAMPLE: Should products of biotechnology be labeled?
 - NO: Labels would alarm needlessly and mislead consumers (an outcome standard)
 - YES: Labels provide the “opt out” necessary to protect rights and preserve the integrity of the process

Procedural issues

- How do we as a society cope with different views on the ethics of animal biotechnology?

EXAMPLE: What role should ethical issues play in the regulatory process?



....leads into discussion of religious views, public opinion, and regulation...

Western religions

Judaism, Christianity, and Islam

- Animal biotechnology is permitted because animals can be used by humans to achieve their own development, subject mainly to constraints based on human treatment
- Animal biotechnology should be opposed
 - Usurps the Creator
 - Threatens ecological balance
 - May constitute a turn toward dominance of economic values
 - Opposition to patenting animals

No
consensus
among
religious
leaders or
laity

Eastern religions

Hinduism, Buddhism, and Confucianism

- Animals are seen as of almost equal moral status as humans
 - Biotechnology could be used only if it were in the interests of the animal itself to do so
 - Biotechnology could possibly be used for preserving human life, but not for pleasure
- But these religious traditions do not generally address the permissibility of any technical practice
- They stress how a practitioner should integrate technology in other rules and practices

Public perception

- Two factors seem to most sharply influence attitudes toward the ethical acceptability of animal biotechnology:
 - For what purpose is it being done?
 - What precautions are taken by those doing it?

Applications of animal biotechnology that are intended to address compelling human health needs tend to be found more acceptable

Public perception

Table 1. Acceptance of plant-based and animal-based genetic modification, by gender, age, and education (adapted from Hallman et al. 2002)¹

	Approve (percentage)		Disapprove (percentage)		Unsure (percentage)	
	Plant	Animal	Plant	Animal	Plant	Animal
Sex						
Male	65	36	32	59	4	5
Female	53	21	40	74	7	5
Age						
< 35	63	31	34	65	3	4
35–54	56	27	38	67	6	6
55+	55	21	37	71	8	8
Education						
High school graduation or less	51	24	43	73	6	3
Some college	65	27	31	66	4	8
College graduation	64	36	29	59	7	5

¹Note: “Approve” includes those who “strongly” and “somewhat approve”; “Disapprove” includes those who “somewhat” and “strongly disapprove.” N=1203. Question: “In general, do you approve or disapprove of creating hybrid (plants) animals using genetic modification?”

Public perception

Table 2. Americans' awareness of plant and animal biotechnology (IFIC 2007)

	Plant Biotechnology (Percentage)	Animal Biotechnology (Percentage)
Heard or read about		
Some—A lot	37	22
Little or nothing	63	78
Overall impression		
Somewhat—Very favorable	33	24
Neither favorable nor unfavorable	30	26
Not very—Not at all favorable	18	23
Don't know	19	27

Public perception

- Two factors seem to most sharply influence attitudes toward the ethical acceptability of animal biotechnology:
 - For what purpose is it being done?
 - What precautions are taken by those doing it?

Research using animal biotechnology and the Institutional Animal Care and Use Committee (IACUC) process

Regulation and ethics

- The U.S. regulatory approach does not single out genetic engineering or cloning for special regulatory treatment. Products of biotechnology are regulated under a suite of laws intended to address food safety and environmental risks of any new food or agricultural product

Regulation and ethics

- Research and the IACUC process
- Under the Animal Welfare Act, animals used in research are regulated
 - Researchers must submit a detailed protocol
 - Research must:
 - Reduce: Limit the number of animals used to a minimum

Regulation and ethics

- Research and the IACUC process
- Under the Animal Welfare Act, animals used in research are regulated
 - Researchers must submit a detailed protocol
 - Research must:
 - Replace: Do not use animals when other methods (such as microorganisms or cell cultures) are feasible

Regulation and ethics

- Research and the IACUC process
- Under the Animal Welfare Act, animals used in research are regulated
 - Researchers must submit a detailed protocol
 - Research must:
 - Refine: Use research techniques with well defined goals; use analgesics when pain occurs; euthanize suffering animals when research design indicates

Regulation and ethics

- Research and the IACUC process
- Under the Animal Welfare Act, animals used in research are regulated
 - Researchers must submit a detailed protocol
 - Research must:
 - Reduce, Replace, and Refine: For biotechnology research, animal suffering is minimized by following IACUC review and protocol specifications

Regulation a

- The U.S. Regulatory a
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special regulatory trea

These laws do not permit regulatory agencies to review or reflect “ethical considerations” in their decision making or in their product approval process

The European Union has created the European Group on Ethics which may conduct an ethical review, though they do not have decision making authority

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Questions/Discussion

CAST® Issue Paper

Number 46
June 2010

Ethical Implications of Animal Biotechnology: Considerations for Animal Welfare Decision Making

Animal Agriculture's Future through Biotechnology, Part 9

ABSTRACT

Animal biotechnology—which includes both genetic engineering and mammalian cloning—has expanded rapidly in recent decades. These technologies already have been applied in biomedical research and now are nearing application within the food system. Both the U.S. Food and Drug Administration (FDA) and the European Food Safety Authority recently have concluded that meat and milk from cloned animals are safe, but public perceptions will continue to have a significant impact on the development and commercialization of animal biotechnology applications.

Public opinion studies regarding animal biotechnology reveal that people are concerned about the purpose of the applications, the methods of research, and the objects of manipulation. Additional public concerns include the moral status of animals, the boundary between what is considered “natural” and “unnatural,” and the consequences of genetic modification, particularly the long-term impacts on human health and the environment.

Three broad categories of ethical issues are associated with animal biotechnology: (1) the technology's impact on the animals themselves, (2) the institutions and procedures that govern the research and applications within the agrifood system, and (3) the relationships between humans and other animals.

Among the world's largest religions, there are very few clear-cut taboos prohibiting animal biotechnology, although ethical implications can be drawn from the general role



Animal behavior scientists are working to identify and reduce excessive animal stress on the farm to improve health and productivity. (Photo courtesy of the USDA Agricultural Research Service.)

This material is based upon work supported by the U.S. Department of Agriculture's (USDA) National Institute for Food and Agriculture (NIFA) (formerly Cooperative State Research, Education, and Extension Service) Grants No. 2009-38902-20041, No. 2008-38902-19327, and No. 2007-31100-06019/Iowa State University (ISU) Project No. 413-40-02, and USDA's Agricultural Research Service (ARS) Agreement No. 59-0202-7-144. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of USDA, NIFA, ISU, or ARS.

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To contact
Task Force Chair:
Paul B. Thompson
thomp649@msu.edu