



What About Engineering Animals How, What and Why?

Alison Van Eenennaam, Ph.D.

Cooperative Extension Specialist
Animal Biotechnology and Genomics

alvaneenennaam@ucdavis.edu

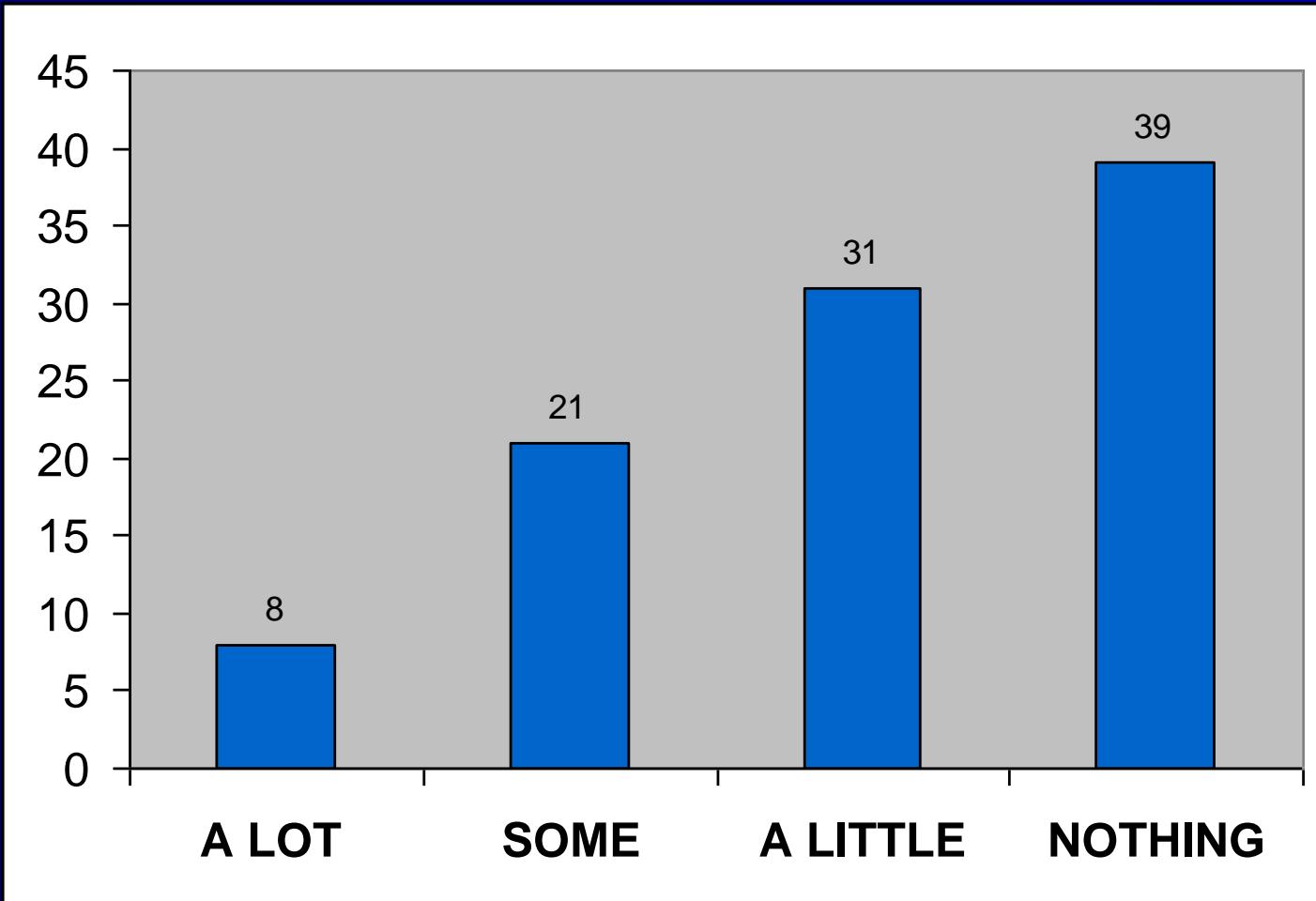


<http://animalscience.ucdavis.edu/animalbiotech/>



Public Attitude Towards Biotechnology

How much have you heard about animal biotechnology ? (IFIC, 2004)





"The public opposes animal biotechnology.."

- The majority (55%) of Americans believe that the genetic modification of animals is morally objectionable.

Schilling, B. J., Hallman, W. K., Adelaja, A. O., and Marxen, L. J. 2002. *Consumer Knowledge of Food Biotechnology: A Descriptive Study of U. S. Residents*. Food Policy Institute, Cook College, Rutgers - The State University of New Jersey. 25p.

- It should be noted that in this same study, consumer acceptance of traditional animal crossbreeding techniques was only 31 %, with 50% of respondents finding such practices morally wrong





What have you heard/read about animal biotechnology ?

Cloning	17 %
Faster Growth/Bigger Animals/More Meat, Milk, Eggs	9 %
Hormones	8 %
Nothing Specific	6%
Genetic Engineering	5 %
Disease Resistance/Healthier Animals/Safer Food	4 %
Changes to Animal Feed	4 %
Better Quality Meat	3 %
Concerns about effects/Testing needed	3 %
Steroids	3 %
Testing on Animals/Raised in Labs	2 %
What is Fed to Animals/ How animals Fed	2 %
Breeding/AI	2 %
Mad Cow	2 %
Other	11 %
Don't Know/Refused	39 %



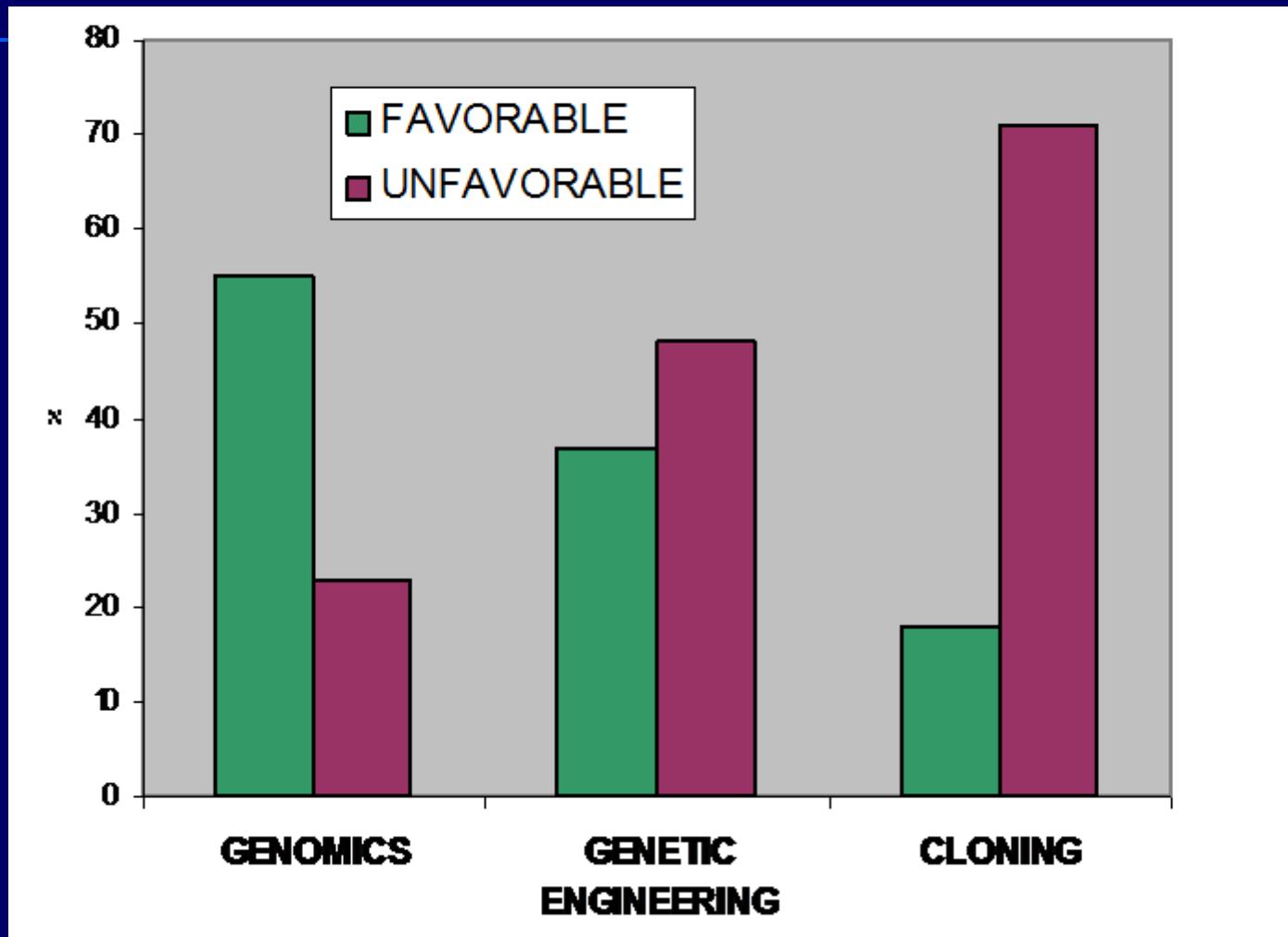
Animal biotechnology

- Artificial selection (breeding programs)
- Artificial Insemination
- Embryo transfer
- Using DNA information for the marker-assisted selection of superior animals
- Cloning
- Genetic engineering





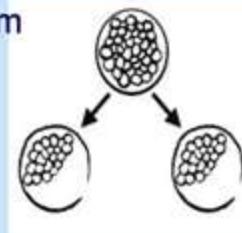
Public Attitudes Towards Different “Animal Biotechnologies” (IFIC, 2004)





Cloning by embryo splitting

Embryo is split to form two half-embryos



Embryos are transferred to an unrelated surrogate mother



Pregnancy is monitored by ultrasound

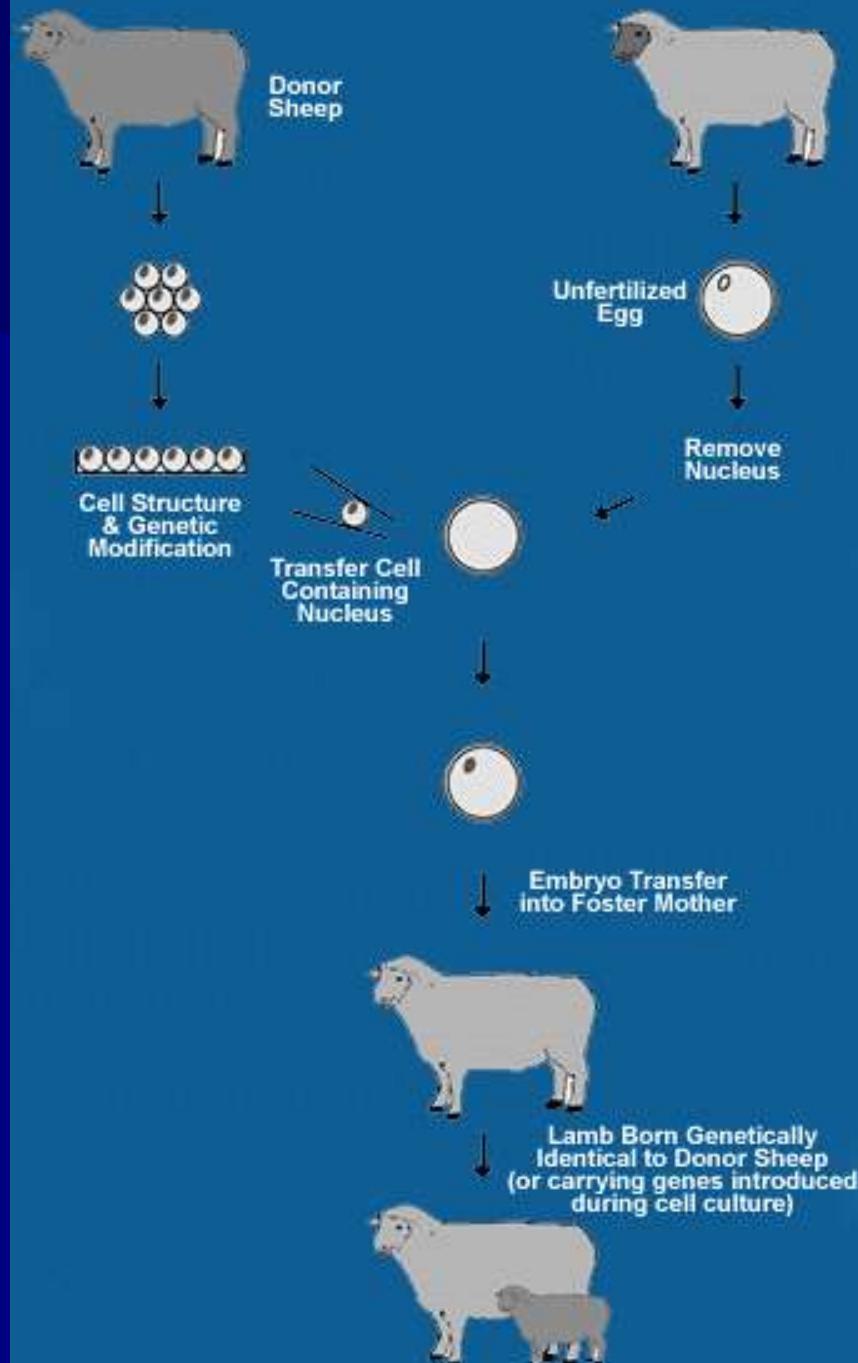
Cloning by Embryo Splitting



Sheep gives birth to identical twins



Dolly (1996), the first adult SCNT clone





Dolly rapidly became entangled with the debate over human cloning

Ensuing discussion failed to elaborate on the reasons as to why cloning was developed

Dolly the cloned sheep kills a lamb — and EATS it!

By MIKE FOSTER / Weekly World News

EDINBURGH, Scotland — A frightened scientist says Dolly the cloned sheep has killed a young lamb — and eaten it!

What's more, the world's first cloned mammal has exhibited other strange behavior, such as chasing a young child, biting a keeper and staring menacingly at razzled scientists.

"When you do something to anger her, she looks at you with those big

eyes full of hate," said a researcher involved in the cloning project.

Dolly's eerie antics — including the "cannibalism" episode

two months ago. "A keeper was giving her a bath, which she doesn't seem to enjoy very much," recalled the researcher. "When his back was turned, she bowled him over, then nipped his face, drawing blood.

"Another time I brought my 8-year-old daughter to see Dolly in her pen. She was thrilled and was looking forward to



Many animal species have been since been cloned from adult cells





Who's Buying?

\$20,000

Regancrest Emory Derry died unexpectedly.





Who's Buying?

- Full Flush

Unable to supply market demand for his semen

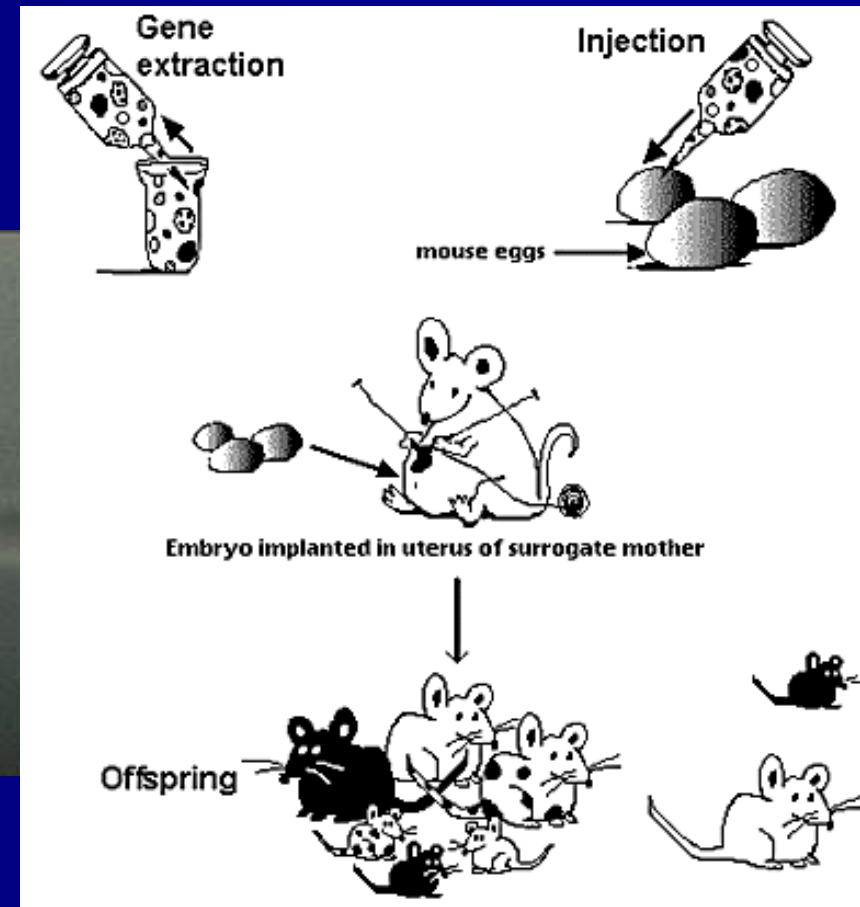




The FDA continues to call for a voluntary prohibition of the marketing of milk or meat from SCNT clones and their offspring

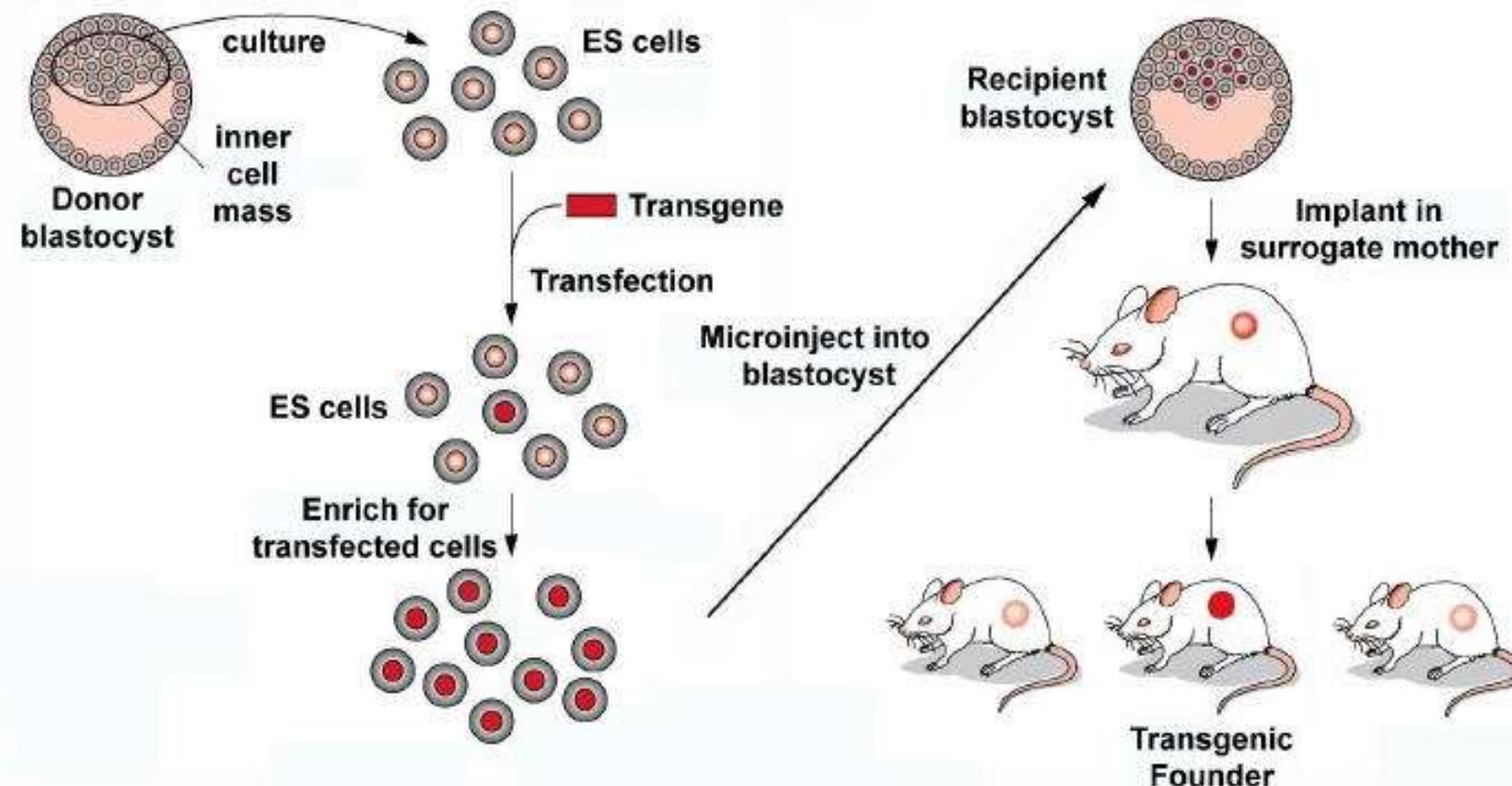


"A genetically engineered animal carries heterologous DNA stably integrated into its genome."



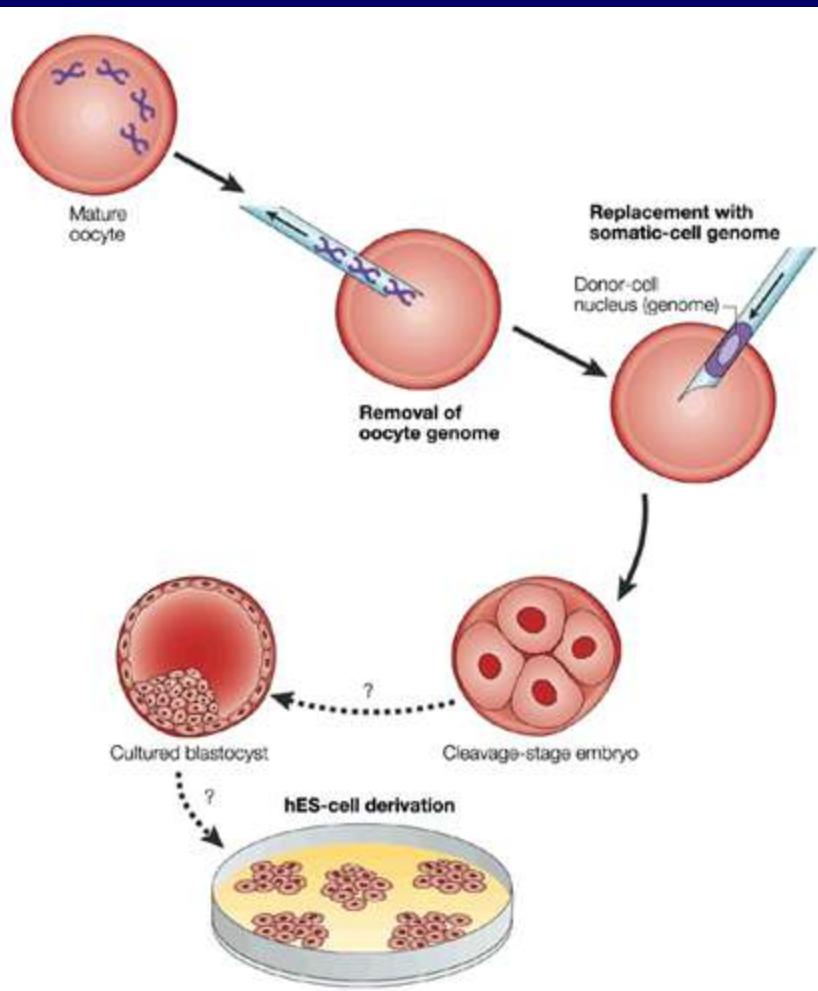


2. Transfer of genetically-engineered embryonic stem cells into blastocysts





The difficulty of getting ES cells from organisms other than the mouse – led to Dolly - and the human cloning debate



Nature Reviews | Immunology





GTC biotherapeutics

- recombinant form of human antithrombin
- a recombinant human serum albumin
- a malaria vaccine
- a CD137 antibody to solid tumors.
[\(http://www.transgenics.com/about.html\)](http://www.transgenics.com/about.html)





“Transplantation-friendly” miniature GE pigs....



Courtesy of the University of Missouri's Office of Extension and Agriculture!

**lack the allergenic proteins that cause the
rejection of animal organs when used in
human xenotransplantation surgeries**



Are there any genetically engineered food animals?





Aqua bounty growth-enhanced salmon

<http://www.aquabounty.com/>





Environmental issues are the greatest science-based concern

- The ability of genetically engineered organisms, particularly fish and insects, to escape confinement and become feral was considered to be the greatest science-based concern facing the animal biotechnology industry (NRC 2002)
- The actual environmental risk posed will be unique to each species/transgene combination



Enviropig™ (Low-phosphorus manure)

<http://www.uoguelph.ca/enviropig/>



Nature Biotechnology, 19, 741 - 745, (2001).



BSE (mad cow) "immune" cows...

abc.net.au/news/newsitems/s1010090.htm

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Scientists clone mad cow resistant calves

A group of South Korean scientists have cloned cows they believe are resistant to the deadly mad cow disease and will test the animals in Japan for five years, the leader of the research team said.

Professor Hwang Woo-suk at Seoul National University, who led the team, told *Reuters* the group had duplicated with cows an experiment conducted in creating genetically altered mice with resistance to bovine spongiform encephalopathy (BSE).

BSE, or mad cow disease, is thought to spread when cattle are fed meat-and-bone meal containing brains, spines and other materials from cattle that contain an infectious version of a protein called a variant prion.

Hwang said a South Korean-led group of 130 researchers at teams in his country, Japan and the United States had cloned four calves with high levels of prions, making them resistant to BSE.

"The calves were cloned by inserting certain somatic cells with an abnormally high number of prions into a cow's eggs, whose nuclei had already been removed, and by cultivating the eggs in surrogate cows," he said in an interview in Seoul.

Previous overseas studies had so far proved mice with abnormally high levels of prions were resistant to BSE.

To test the possible breakthrough, and confirm the cows are actually resistant to mad cow disease, the cloned calves would undergo "in vivo challenge testing" at research facilities in Tsukuba, Japan. Hwang

ABC Top Stories

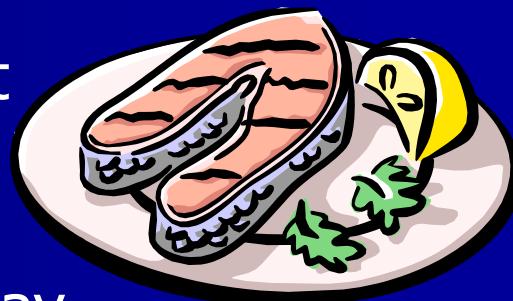
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- NASA shows off postcard from Mars



ω3 mouse model



- Omega-3 ($\omega 3$) polyunsaturated fatty acids (PUFA) are well documented for their beneficial health effects
- The average intake of $\omega 3$ PUFA is about 1.6 grams/day in the United States. Nutrition scientists suggest the daily intake should be closer to 2.85 grams/day
- We have genetically engineered mice to produce $\omega 3$ PUFA in their milk.
- Develop sustainable dietary sources of land-based animal products rich in $\omega 3$ PUFA to produce functional foods for the enhancement of human health.





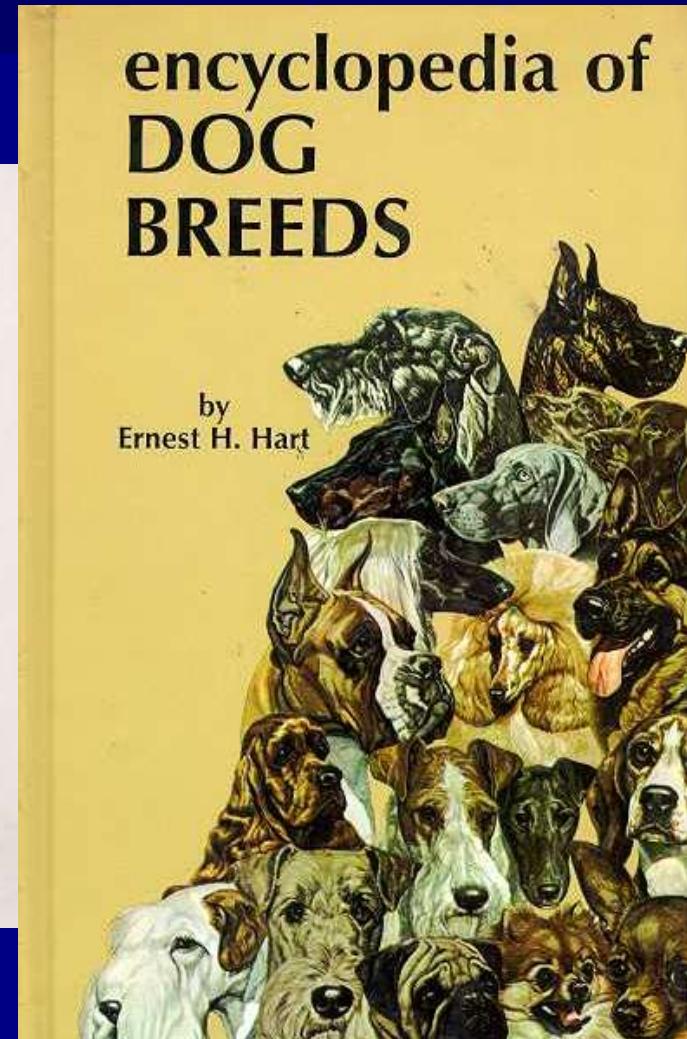
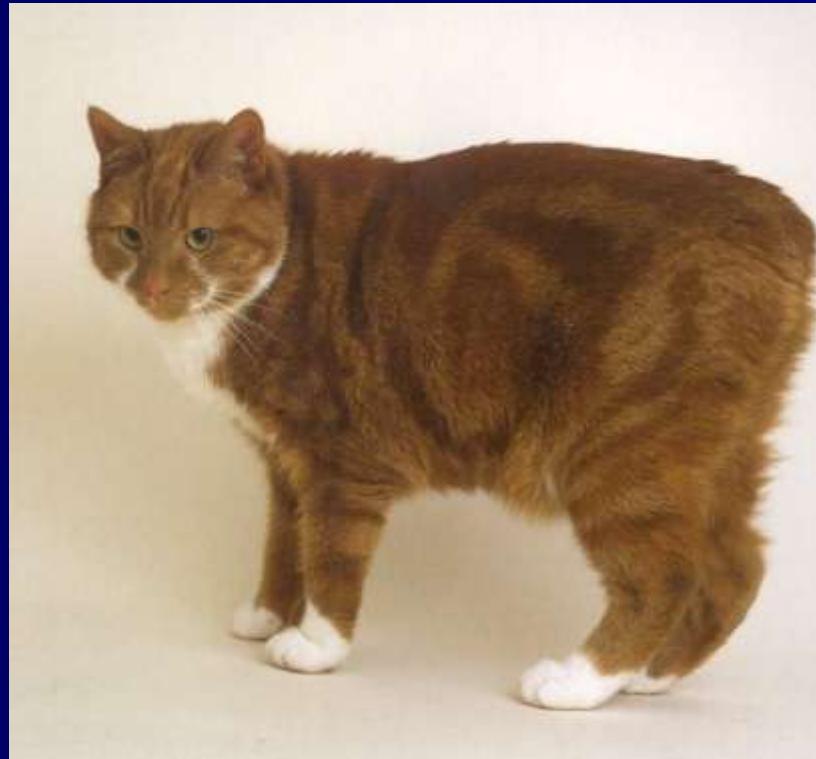
GE animals raise moral, ethical, and cultural questions

- Interfering with the integrity or *telos* of an animal
- Animal welfare
 - related to breeding goals
 - related to biotechnology





Interfering with the integrity or *telos* of an animal ?

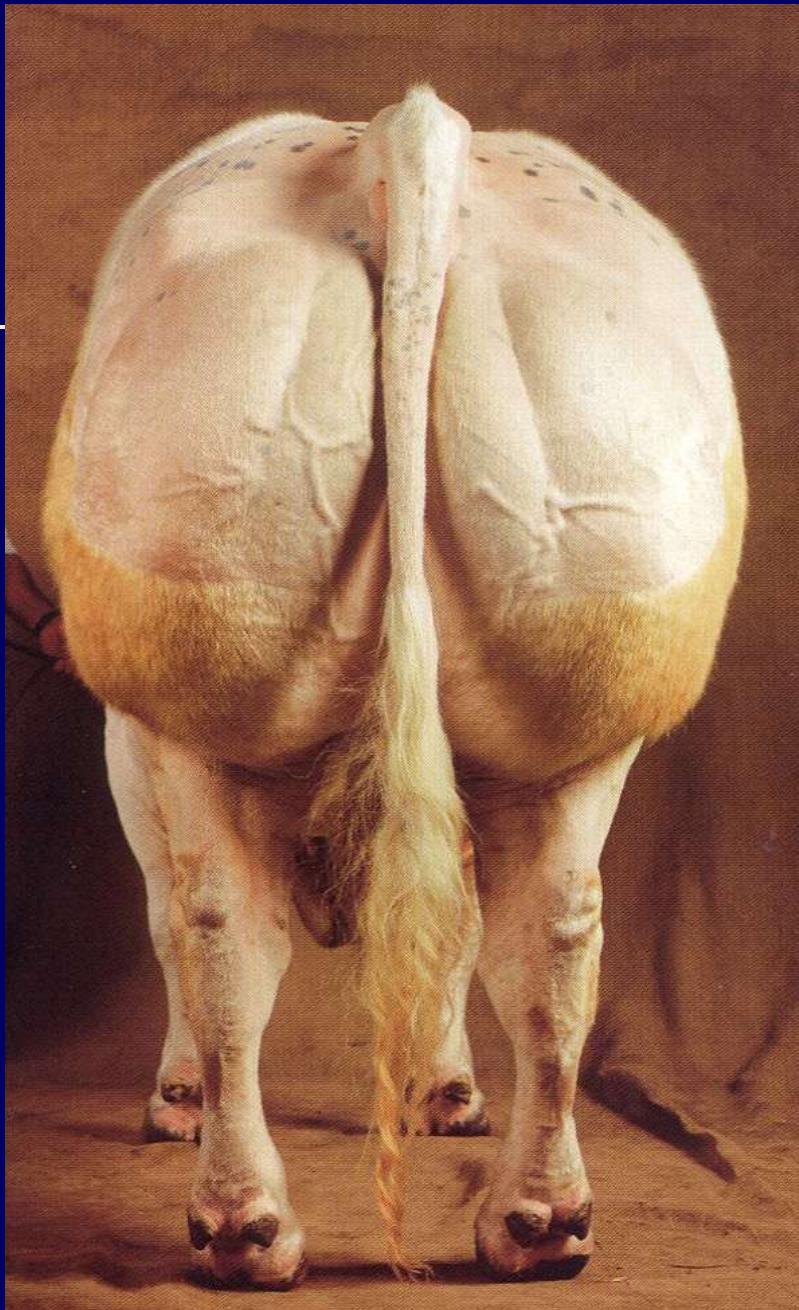




GE animals raise moral, ethical, and cultural questions

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**Double-muscled
cattle**

Munchkin cat



Tortie With White Munchkin
Photo © Chanan



Who's Buying?

GloFish™ – barred on ethical grounds in California - “just a pet”





"just a floral arrangement"





Who's Buying?

<http://www.savingsandclone.com/>



Little Gizmo, clone



NoPetCloning.org

CONTACT



Who We Are

Californians Against Pet Cloning (CAPC) is a coalition effort led by the [American Anti-Vivisection Society](#), [International Center for Technology Assessment](#), and [United Animal Nations](#).

What We Want to Accomplish

CAPC is sponsoring [AB 1428](#) (authored by California State Assemblymember Lloyd Levine (D-Van Nuys)) to ban the retail sale of cloned and genetically modified pets in California.

CAPC also seeks to inform California citizens about the facts of pet cloning, including concerns for [consumer protection](#), [animal welfare](#), and [ethics](#).



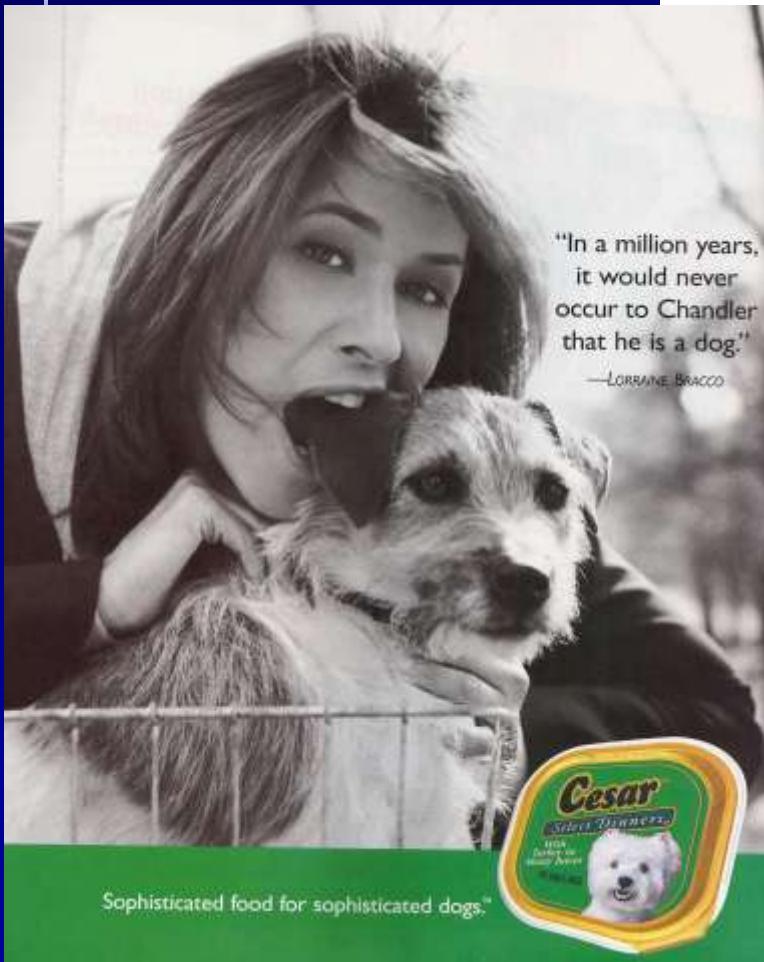
"I know it when I see it"

Of the 22% of people who say they know nothing about biotechnology, genetic engineering or genetic modification; almost half (46%) disapprove of the use of genetic modification to create plant-based foods, and 66% disapprove of animal-based genetic modification.

Hallman, W. K., Hebdon, W. C., Aquino, H.L., Cuite, C.L. and Lang, J.T. 2003. *Public Perceptions of Genetically Modified Foods: A National Study of American Knowledge and Opinion*. Rutgers - The State University of New Jersey.



Animals, especially pets, occupy a special place in our society. The public is often unaware of animal agricultural practices.





Farmer's Market – San Francisco Wharf (late 2004)





SUMMARY

- No GE or SCNT cloned food animals currently on the food market
- FDA regulates GE/cloned food animals
- Future uses of GE animals could be diverse and may address important societal needs
- Yet to see if the expense of the technology is commercially viable
- GE animals raise additional moral, ethical, and cultural questions

