

Is the Market Ready for Milk from Cloned Cows ?



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OUTLINE

■ What is a clone ?

- Embryo splitting
- Nuclear transfer
 - Embryo
 - Adult



■ What are the concerns ?

- Food Safety
- Animal Welfare and Ethical Issues

■ Public Opinion



What is a clone ?



- Cloning, in horticulture and biology, any organism whose genetic information is identical to that of a "mother organism" from which it was created.
- Food from clones has been a part of our diet for years. Many common fruits (e.g., pears, apples, oranges and lemons) and several vegetables (e.g., potatoes and truffles) are clones.



What about cloned animals?

- Holstein Association USA (Brattleboro, VT) first registered clones from embryo splitting (ETS) in 1982 and clones from embryo nuclear transfer (ETN) in 1989.
- Most of us have probably ingested meat and dairy products from livestock cloned by natural reproduction (monozygotic siblings), mechanical embryo-splitting, or even nuclear transfer from an embryonic donor cell into an enucleated oocyte.



Cloning by “natural reproduction” (monzygotic twins)

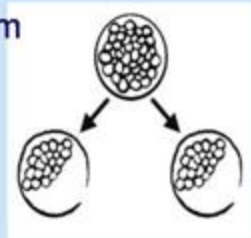




Mechanical embryo splitting

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



Sheep gives birth to identical twins

The Holstein association of America has registered 2319 embryo split clones (ETS) through October 2002 – probably the most widely recognized were **DUPLICATE** and **DIVIDE**.



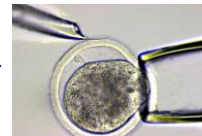
Nuclear transfer from an embryonic donor cell into an enucleated oocyte.

Embryo Transfer Laboratory

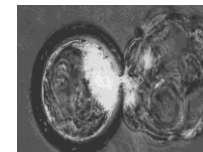
Donor Embryo



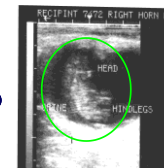
Transfer at **UCDAVIS**



Donor cell nucleus is transferred to recipient egg



Cloned embryo is transferred to surrogate mother



Pregnancy is monitored by ultrasound

Holstein Association USA first registered clones from nuclear transfer in 1989



Cattle clones have been in US population since early 80s*

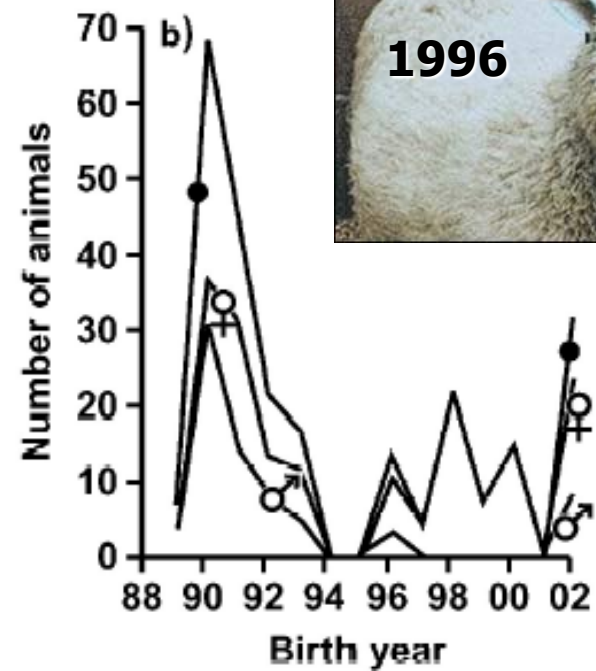
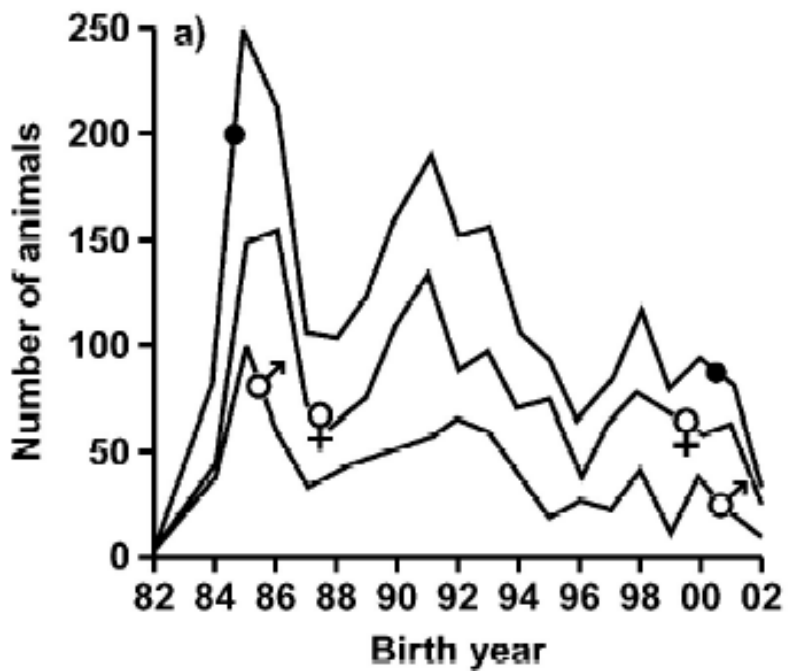
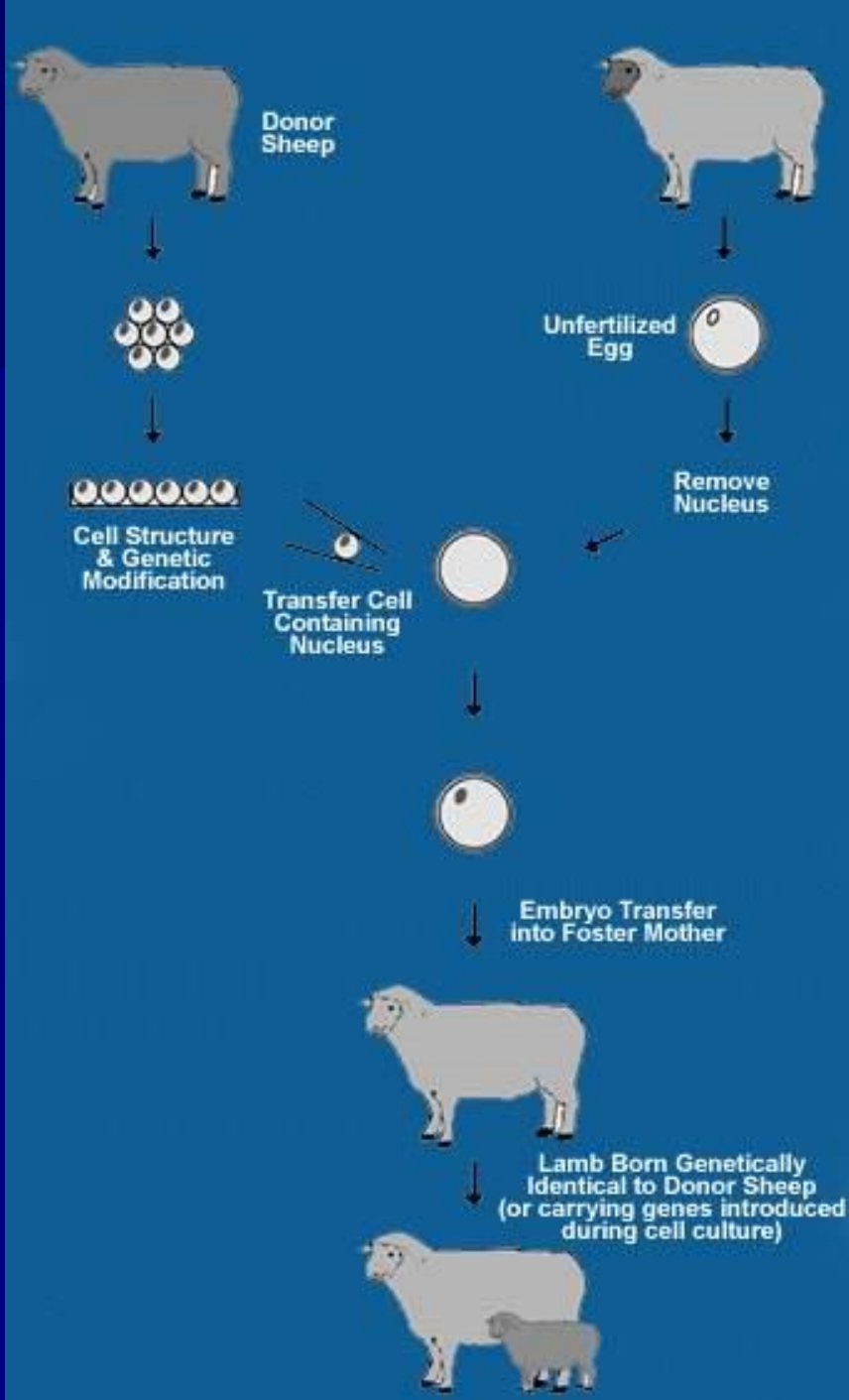


Figure 1. Numbers of registered US Holsteins resulting from a) embryo splitting or b) nuclear transfer by gender (all animals: ●, males: ♂, females: ♀) and birth year.

*Norman et al. Performance of Holstein Clones in the United States
J. Dairy Sci. 2004. 87:729-738



Dolly (1996), the first adult somatic cell nuclear transfer (SCNT) clone





Cloning 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 razzed scientists.

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





News

Cloning opens door to 'farmyard freaks'

By SEAN POULTER - [More by this author »](#)

Last updated at 08:35am on 11th January 2007

[Comments \(38\)](#)

Moves to clone and genetically modify farm livestock have opened the door to the creation of "Farmyard Freaks", experts have warned.

News that the daughter of a US clone cow has been born on a British farm has moved the issue from science fiction to consumer reality.

A former government adviser has painted a nightmarish picture of "zombie" and fast-growing supersize animals.

Professor Ben Mephram, of Nottingham University, said the impact of bio-engineering, creating GM and cloned animals, is huge.

Factory farming techniques, most commonly used with pigs and chicken, often involve keeping animals confined in cramped conditions.

For pigs, who are highly intelligent, these conditions can lead to stress and aggression.

However, GM scientists are actively investigating ways to remove the stress and aggression gene from animals, effectively turning them into complacent zombies.

The professor said it might become technically possible to produce "animal vegetables" - beasts which are "highly



The cloned cow Dundee Paradise

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Femail



Coleen's fashion gaffes exposed

When Coleen McLoughlin announced she was writing a style manual, cynics questioned whether she was ideally placed to dispense advice. Now the Wag has been exposed as ignoring her own advice

Women messy? What rubbish!



This week the Mail's Martin Newland berated women for their

untidiness. Now his wife Benedicte gets her revenge in a stinging rebuke

Kate admits she, too, has gone to drastic measures to lose weight



She has boasted of being proud of her curves and scorned

faddish diets. But now Oscar hopeful Kate Winslet has admitted she was once

True
NAUGHTY OR NICE?



I AM:

☐ Female
☐ Male

SEEKING:

☐ Female
☐ Male

FROM:

18

TO:

35

ZIP CODE:

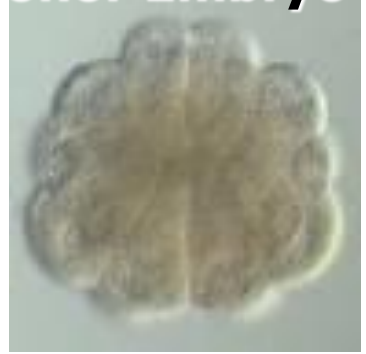
[GO!](#)



Nuclear transfer from an enucleated donor cell into an enucleated oocyte.

Embryo Transfer Laboratory

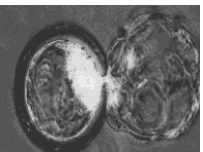
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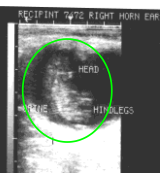
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"Alicia"

An International Star



Winner at the prestigious International Dairy Show in Madison, WI and at the Royal Winter Fair in Canada, Shoremar S Alicia was cloned in 2001. The clone calf, born in winter of 2002, was one of the favorites when she was at Cyagra. Using the merchandising options that cloning creates, Alicia's owners sold Alicia's Clone before it was born for \$100,000 in October of 2002.

Shoremar S Alicia 3E-97

6-10 2x 365d 35,760 4.3 1541 3.2 1147

All-American Age Cow 2003

All-American & All-Canadian 5-Year Old 2000

All-American People's Choice Winner 2000

Holstien International Cow of the Year 2000

All-Canadian 4-Year Old 1999

All-Canadian Jr. 2 Year Old 1997

Nominated for QII – Queen of the Breed 2004



Shoremar BKB S Alicia 2-ETN VG - 88 (VG-MS)

She is working on her 2 Year Old Record



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



Are the milk and meat from SCNT clones safe for human consumption?

1. All studies have shown that food products derived from clones fall within normal industry standards or previously reported values for milk and meat.
2. Sample sizes are small in all studies – although there are an increasing number of studies published

FDA ASSESSMENT OF ANIMAL CLONING

“food products derived from animal clones and their offspring are likely to be as safe to eat as food from their non-clone counterparts, based on all the evidence available.”



“Birth of cloned calf poses test for Europe's food safety regulations”

January 2007: The Food Standards Agency is seeking urgent legal advice after farmers announced the birth of a calf whose genetic mother is the clone of an American prizewinning dairy cow.

“Paradise”
A Supreme Champion



Cloning gives you the ability to realize the value of a truly great cow both from the breeding and merchandizing standpoint

Vandyk-K Integrity Paradise, the two time Supreme Champion at the World Dairy Expo, was an easy choice for her owners to clone. When you have an individual this good you need to have more copies of her to realize her true value. Cashing in on her value is just what they did when they sold a Paradise clone for \$50,000. The merchandising options you get from cloning are just fantastic, because you still have the genetic material to work with.

Paradise's Clone Wins!!!

**Paradise 2 Selected
All-American Sr. 2 Year Old**



What clones will be banned?

"Reacting to reports that a cloned cow from the United States has birthed a calf on a British farm, virtually all major British grocery chains have pledged to boycott meat from clones or their offspring.

Tesco, Wal-Mart's Asda chain, Morrisons and Marks & Spencer were among the chains participating in the boycott, which would include meat, milk or "anything else from clones or their offspring," according to an Asda spokesperson."

How can you test/trace/verify an identical copy?



Question to processors who are banning clones.....

Do you plan to monitor and prevent the milk and meat from clones created by embryo splitting and embryonic cell nuclear transfer from entering your processing chain? Records indicate that there are a number of these clones currently in production and the food chain. There were 1,536 cows and 783 bulls created by embryo splitting registered by the Holstein Association USA, Brattleboro, VT, USA between 1982 and October 2002; and approximately 1,200–1,500 cows and bulls produced by embryonic cell nuclear transfer in North America in the 1980s and 1990s. Estimates for the prevalence of these clones currently in the food supply are difficult to find as these animals are not specifically tracked in any way. **If you plan to exempt these clones from your ban, then has better be more specific in your language and limit your claim to prohibiting only "adult somatic cell nuclear transfer" clones. The term "clone" encompasses more than that specific subset, and it may in fact include animals that are currently being used in your supply chain.**



Animal Welfare Concerns

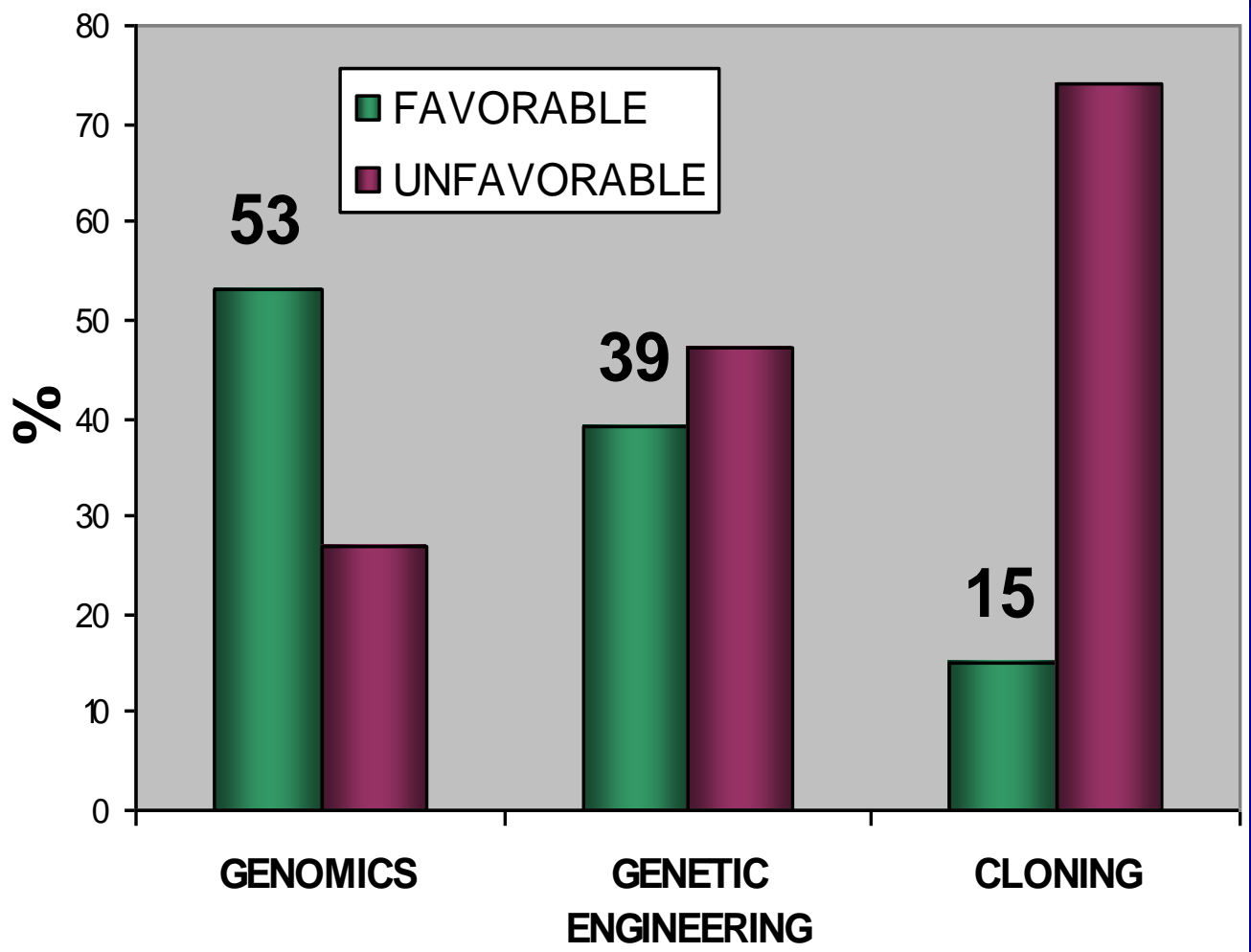
- Large calf syndrome
- Under-developed respiratory, cardiovascular, and renal systems

FDA ASSESSMENT OF ANIMAL CLONING

“Cloning technology does not present any type of risk that is not present with other forms of reproduction. However, the adverse outcomes may occur at a higher frequency with cloning than with other assisted reproductive technologies now in common use, such as *in vitro* fertilization or embryo transfer.”

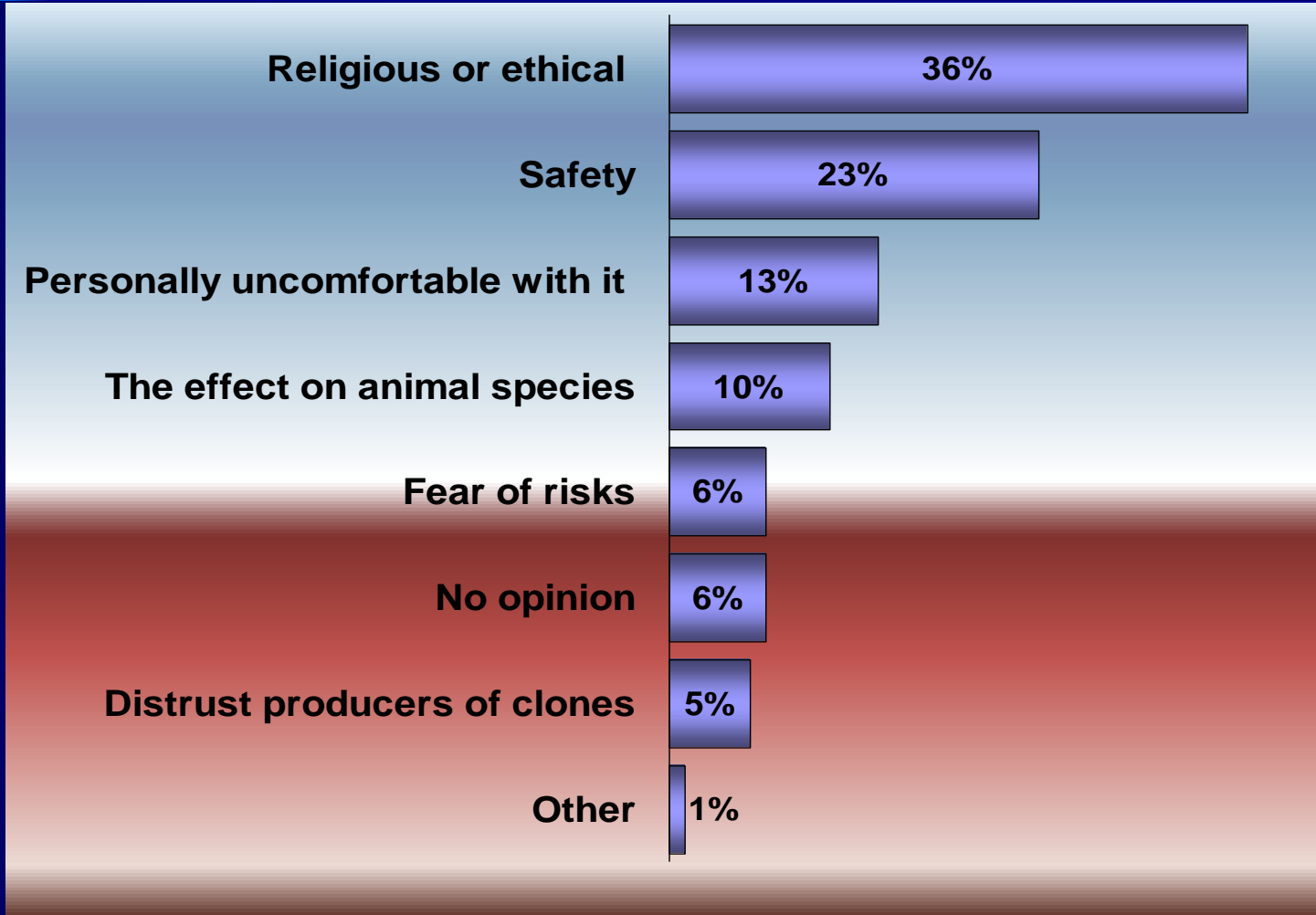


Public Attitudes Towards Specific “Animal Biotechnologies” (IFIC, 2005)





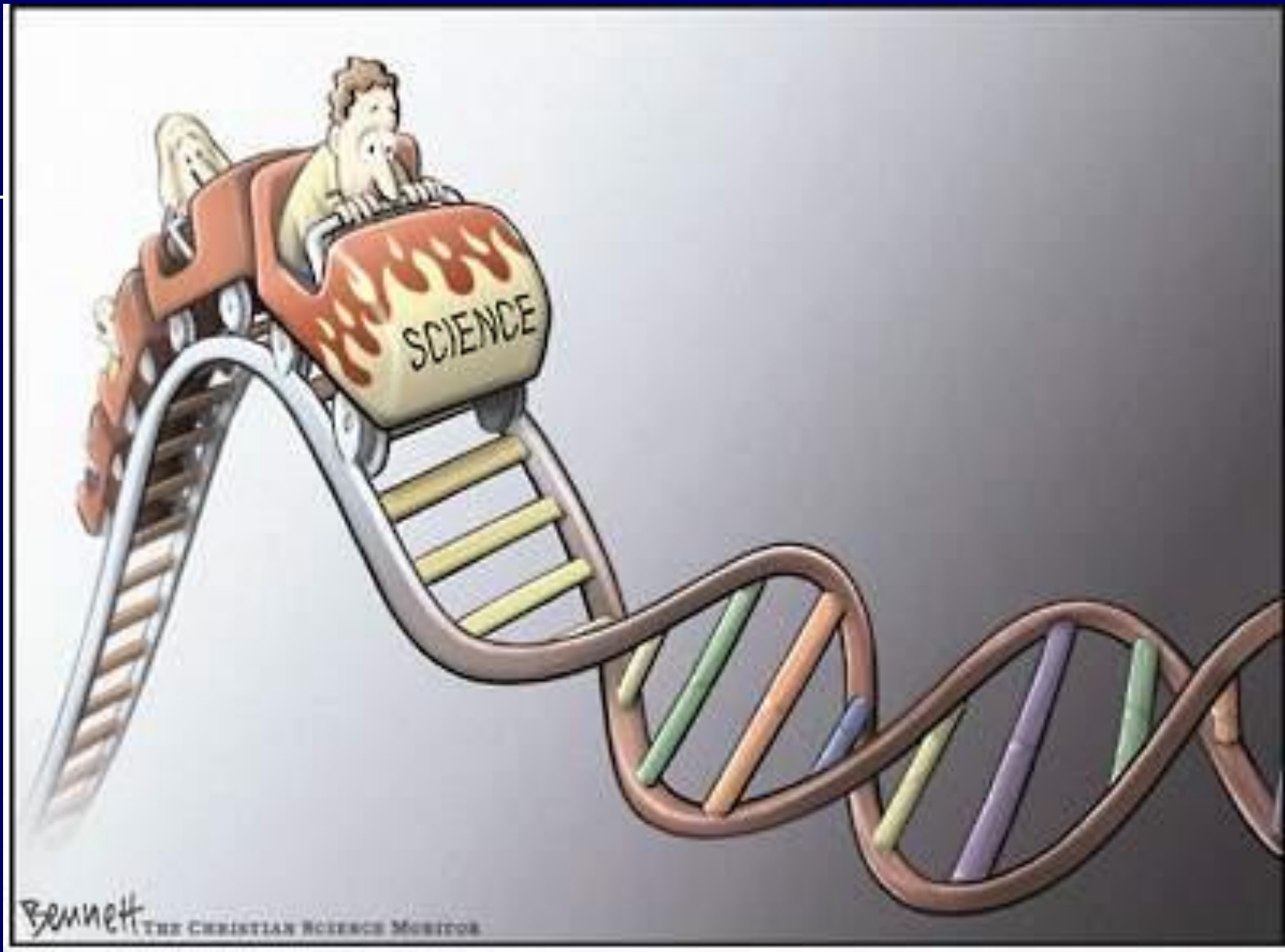
Of the Americans who are uncomfortable or unsure about animal cloning; their primary concern is:





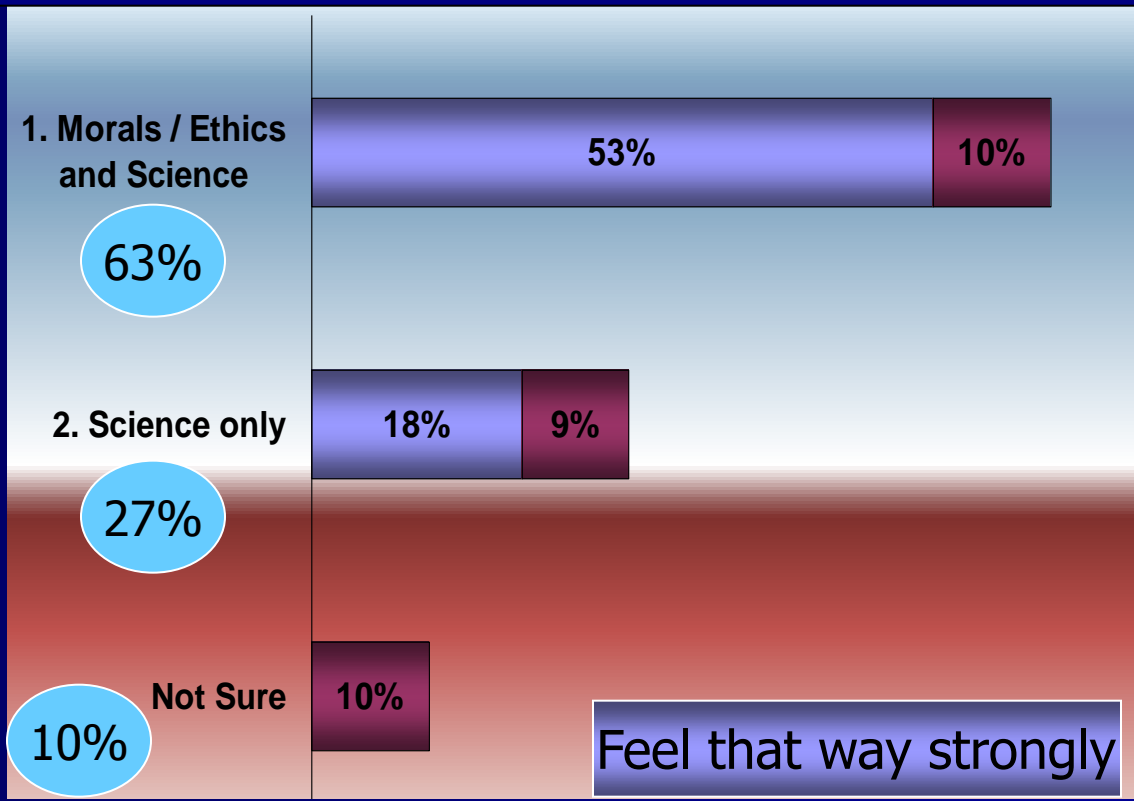
SUMMARY

- Embryo split and embryo nuclear transfer “clones” have been in the food supply for over 20 years.
- Unlikely that somatic cell nuclear transfer (SCNT) clones will be produced in large numbers for commercial agricultural purposes.
- A voluntary moratorium on marketing products from adult SCNT clones and their progeny has been in effect for over 6 years despite the finding that clones and their progeny are as safe to eat as food from non-clones.
- Ethical and animal welfare concerns dominate the public discussion about cloned animals.





1. Government regulators should include ethical and moral considerations, in addition to scientific evaluation of risks and benefits, when making regulatory decisions about cloning or genetically modifying animals.
2. Though ethical and moral considerations are important, government regulators should consider only scientific evaluation of risks and benefits when making regulatory decisions about cloning and genetically modifying animals.





Some of the animal species have been cloned from adult cells

