

Cloning and its discontents— a Canadian perspective

Public attitudes to Dolly the sheep may mirror the perception of biotechnology as a whole.

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A recent survey of the Canadian public reveals a strong association between attitudes toward cloning and attitudes toward biotechnology. The data also provide insights into the factors that contribute to public ambivalence to new technology and some surprising information on the effect of scientific literacy on the acceptability of cloning applications.



Second, a series of questions probing attitudes toward cloning was used to elucidate some of the images and expectations associated with cloning. And third, to better understand the underlying basis for overall judgments encouraging or discouraging cloning, respondents were asked to consider the pros and cons of a particular example of cloning (i.e., “cloning animals such as sheep for the production of vaccines”).

Awareness and attitudes

The survey revealed significant changes in public awareness of cloning over the past three years. In 1997, only 33% of the respondents volunteered a top-of-mind response when queried what the terms “biotechnology” or “genetic engineering” brought to mind. Of this number, only 1 in 10 mentioned “cloning.” This means that of the 1,000 respondents, only 3% even made reference to cloning.

In contrast, close to 80% of the respondents in the 2000 survey volunteered a response and, of this number, 14% mentioned “cloning,” with another 13% giving “cloning” as a second response. Thus, cloning is one of the top three associations mentioned in the current survey, and it is the only specific association mentioned. (The other two were responses regarding “finding a cure for disease” and a general evaluative negative statement, such as “I’m against biotechnology or genetic engineering” or “I’m fearful of these.”)

To explore public attitudes to a particular cloning application, respondents were also asked to evaluate “cloning animals, such as sheep, whose milk can be used to make drugs and vaccines” on the basis of usefulness, risk, and moral acceptability.

As indicated in Figure 1, over half agreed that this type of cloning is “useful.” However, 6 in 10 also thought this application “risky,” and fewer than half said this is “morally acceptable.” There was an even split between those who maintain that this application ought to be “encouraged” and those who feel it should be discouraged (45% and 44%, respectively).

Further analysis reveals the role that each of the factors of usefulness, risk, and moral acceptability play in predicting an individ-

ual’s overall position on the encouragement of this application of cloning. Using multiple regression analysis, data indicate that all of these factors play a significant predictive role (the β -weights are 0.34 for usefulness, -0.09 for risk, and 0.52 for moral acceptability, $P < .05$). The relative influence of these factors also demonstrates that “moral acceptability” is the most important explanatory factor, accounting for over half of the variation in encouragement/discouragement of cloning sheep for vaccine production.

Digging deeper

To determine in more detail the variables that affect public attitudes to cloning, it was also important to investigate the contribution of three variables: extent of understanding of basic information on genes (“genetic knowledge”), general attitudes toward cloning, and issue attentiveness.

A measure of a respondent’s “genetic understanding” was created by asking the individual to gauge the veracity of six simple statements: (1) “Ordinary tomatoes do not contain genes while genetically modified tomatoes do”; (2) “The cloning of living things produces genetically identical offspring”; (3) “It is the father’s genes that determine whether a child is a boy or a girl”; (4) “It is possible to find out in the first few months of pregnancy whether a child will have Down’s Syndrome”; (5) “More than half of human genetic make-up is identical to that of chimpanzees”; and (6) “Animal genes cannot be transferred into plants.”

General attitudes toward cloning were assessed by combining the data from Table 1. Issue attentiveness of respondents was based on combined responses to the questions concerning the appearance in the media of cloning

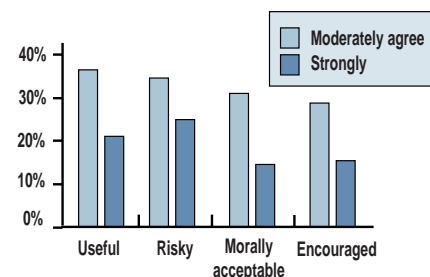


Figure 1. Perceptions of cloning sheep for vaccine production.

The Dolly phenomenon

In February 1997, the announcement of the cloning of Dolly the sheep¹, the first mammal to be cloned from an adult cell, reverberated across the world. Three years later, cloning efforts now seem to be the stuff of ordinary science; Dolly has had several offspring through normal births; and nuclear transfer has been extended to cows², mice³, and more recently pigs (*Nat. Biotechnol.* 18, 365, 2000).

The unprecedented media coverage of Dolly’s birth has been described in the policy literature as a “focusing event.” Such events are characterized by their suddenness, exceptional nature, potential to be harmful or reveal the possibility of potential significant harm in the future, and simultaneous impact on policymakers and public alike⁴. In that many other applications of biotechnology have a similar potential to become focusing events, public attitudes to cloning may be useful for exploring public perceptions of biotechnology as a whole.

In February 2000, a telephone survey of a random sample of 1,000 adult Canadians was conducted to investigate public attitudes to cloning. The survey was designed in three stages. First, respondents were asked, “what comes to mind when you hear the term ‘biotechnology,’ including ‘genetic engineering?’” to see how frequently cloning appears as a top-of-mind association with biotechnology. This was compared with the results of a similar biotechnology survey of 1,000 adult Canadians carried out in 1997 (pre-Dolly).

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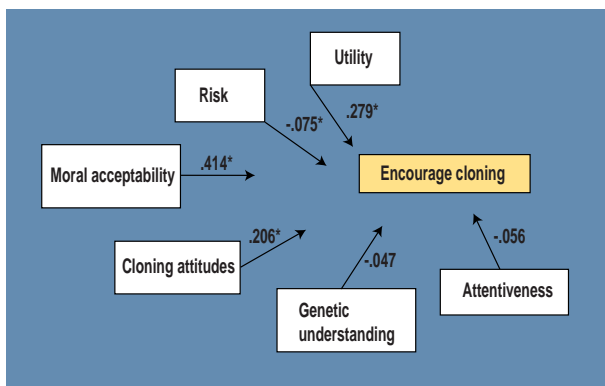


Figure 2. Factors that explain encouragement of cloning. Figures reported here are β -weights. Those with asterisks are significant at $P < .05$. These factors account for two-thirds of the total variance of position on cloning ($R^2 = .67$).

stories and talking to others about the subject of biotechnology. Respondents were asked these two questions: "Have you seen or read anything about biotechnology in newspapers, radio, or television in the last three months?" and "Before today, have you ever talked about modern biotechnology with anyone?"

These three variables, together with perceived usefulness, risk, and moral acceptability, were then given relative weights as factors for predicting support for the encouragement of cloning of animals to produce medicines and vaccines. As Figure 2 demonstrates, all these factors, with the exception of genetic understanding, help to explain the encouragement (or rejection) of this specific type of cloning.

Thus, attributes of perceived utility, risk, moral acceptability, and general attitudes toward cloning help to explain one's position on cloning, with moral acceptability remaining as the strongest predictor. Genetic understanding in this case has no relationship to whether or not cloning is encouraged.

Conclusions

Although media coverage of biotechnology stories generally has increased over the past three years, the dramatic rise in the public's

association of cloning with biotechnology/genetic engineering is likely to be due to the increased attention to cloning relative to other stories on biotechnology in the national media. In Canada's national newspaper, the *Globe and Mail*, only 3% of the biotechnology stories (over 300 words in length) focused on cloning in 1996 (pre-Dolly), whereas 13% and 9% of the stories were on cloning in 1998 and 1999, respectively. Although it is tempting to simplify the impact of media coverage, stories on Dolly drew heavily on images, metaphors, and representations from popular culture already resonant with audiences, such as "Brave New World," "Jurassic Park," "armies of clones," Ira Levin's "Boys from Brazil," and Frankenstein.

In terms of attitudes toward cloning, it is evident that concerns arise from the strongly held belief that this is "against nature," from a preference for traditional breeding methods, and from the fear that, if anything went wrong, a "global disaster" would ensue. The use of a moral frame as the primary metric for judging cloning underscores the fact that despite a perception of usefulness, the moral dimension of this application raises sufficient questions to encourage rejection.

There is controversy over the role that "scientific literacy" plays in judgments about science and technology; some claim that it leads to positive judgments⁵, whereas others suggest the contrary⁶. The results of this study suggest that possession of genetic understanding does not even enter into this calculus—an important point to bear in mind in the context of a common belief that raising literacy will garner support.

One implication of these findings is that they illustrate the difficulty that policy institutions have in dealing with public concerns

about certain biotechnology applications. In relying on a narrowly conceived "science-based risk assessment," existing regulatory institutions tend to dismiss peremptorily these broader public concerns and/or encounter difficulties addressing them when they arise.

Although it is tempting to dismiss the public's fears and concerns about cloning, they can be viewed as indications that cloning may be paradigmatic of the dark side of biotechnology for some members of the public. They are reminders of the public's ambivalence, if not unease, over the relationship between technology and society. Dramatic focusing events such as the cloning of Dolly tend to highlight this ambivalence because, as Nelkin and Lindee⁷ point out, they "provide a window on popular beliefs about human nature and the social order, on public fears of science and its power in society, and on concerns about the human future in the biotechnology age" (see also ref. 8). Scientists and policymakers ignore these indications of public disquiet at their peril⁹. In fact, they afford opportunities to reflect on more innovative ways of involving the public in policy decisions from which they have so far been excluded.

Public concerns for related areas of genetic research that feature ethical conundrums and are already starting to generate controversy may also take a similar form to those reported here. Such applications include, for example, the use of human stem cells derived from embryos to generate replacement tissues to treat certain diseases or the genetic engineering of animals, such as pigs, to generate organs for xenotransplants. It will be important to take on board the lessons from our experience with cloning to deal with these similar controversial areas.

Acknowledgments

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Table 1. Canadian public attitudes to cloning

Statements	Strongly agree	Moderately agree
Cloning animals will bring benefits to a lot of people.	13.3%	30.7%
Deciding on the issue of cloning is so complex that public consultation is a waste of time.	12.7%	15.3%
The risks from cloning are acceptable.	6.4%	26.7%
Even though cloning has benefits, it is fundamentally unnatural.	43.8%	26.9%
If anything went wrong with cloning, it would be a global disaster.	28.9%	21.3%
Current regulations are sufficient to protect people from any risks linked to cloning.	8.8%	20.4%
Only traditional breeding methods should be used rather than changing the characteristics of plants and animals through modern biotechnology.	35.5%	26.3%

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