

# THE TAO OF CLONING



How does the current level of scientific literacy in the United States limit possibilities offered by recent biotechnical advances? Following his "Monkeys, Sheep and Human Clones: Science, Technology and Bioethics" presentation to the Futures Discussion Group at the 18 April 1997 Futures Discussion Group, Dwayne Minton wrote the following analysis of the scientific, cultural and political implications of recent advances in cloning. In a handy appendix ("The Science of Cloning"), Minton responds to five common myths about cloning. Eleven endnotes contain important documentation and elaboration of issues and claims raised in Minton's article--v.k.p

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In the 27 February 1997 issue of the science journal *Nature*, scientists from Scotland, led by Dr. Ian Wilmut of the biotechnology research laboratory the Roslin Institute, revealed how they had successfully cloned<sup>1</sup> an adult sheep from a fully differentiated adult cell. The future ramifications of this research are astounding, and the news, which broke to the media approximately a week prior to its publication has led me to two revelations.

First, the ability to successfully clone an animal from an adult cell significantly enhances the chances of a biotechnical future. I have argued previously that the future survival of the human species is closely linked to the full realization of the Biotechnical Age, replete with genetically engineered animals, plants, and humans ("From the Forges of Fire to the Creation of Life: Persistence in the Biotechnical Age," *Manoa Journal*, #8 [November 1995], pages 1-17). The ability to clone organisms from fully differentiated adult cells is a critical step in successfully creating a multitude of bioengineered life forms. Cloning research, like that conducted by Dr. Ian Wilmut and his colleagues, places us closer to the threshold of the Biotechnical Age.

The second revelation, and to me much more disturbing, is that the Biotechnical Age is, in all likelihood, a long way off if worldwide political and public reaction to the cloning news is a meaningful indicator. Several nations, the United States included, have placed severe limitations on cloning research, though no nation has yet entirely banned it. The United Kingdom is trying to strengthen its already tough laws to stop all research associated with human cloning<sup>2</sup>. Spain, Denmark, Germany, and Australia all have regulations prohibiting human cloning research to some extent. Since the news of Dolly the cloned sheep went public, anti-cloning legislation has been proposed in Canada and introduced in the People's Republic of China.

Many opponents of cloning in the United States have pushed for a total ban, but the National Bioethics Advisory Commission<sup>3</sup> stopped short of a complete cloning ban and recommended allowing cloning research to proceed but not to allow human cloning. This news from the Commission is not federal law, but a guideline for how federal research money is to be used; it has no jurisdiction over private funds. Recognizing this, the commission has also recommended new federal laws banning the creation of humans by cloning. In the interim, the commission has requested that all scientists and private research organizations observe the 4 March 1997 moratorium placed by President Clinton on human cloning research. Several state legislatures (most notably California and New York) have attempted to make cloning research against state law.

Public reaction to the cloning news has been mixed, running the range from those who want to step into an automated home cloning unit to those who are pushing to make all cloning research a felony offense. General opinion, as express in an endless onslaught of polls, seems to weigh against cloning. Many feel cloning is morally wrong and goes against the laws of God. Others have taken a more scientific stance, arguing that cloning would be dangerous as it could potentially reduce the genetic diversity of the human species or could be used to recreate an abomination of history such as Adolf Hitler. Some have humorously argued that only

the most egotistical would even consider cloning themselves, and who needs more self-centered asses in the world.

The general reaction of much of the world to the cloning news is not surprising, however. Media sensationalism and a lack of public education has contributed to the knee-jerk reaction. Publications (in the United States at least, and to also to some extent in Europe) seemed eager more for copy than truth, and stories ranged from funny, to scary, to outrageous and even stupid, hitting on every possible scenario from Aldus Huxley's *Brave New World* to the *Boys From Brazil*. Even the scientific concerns raised evaporate in the light of our current biological knowledge. What is most disturbing is that the public embraced this menagerie of often blatant misinformation. Not to come down too heavily on all media, I must note that a few enlightened and well researched articles did appear in non-specialized publications (notably the *New York Times* and *Washington Post* among others), but, based on the reaction of the public, it would seem few people actually read them.

In a recent issue of the *Economist* (29 March 1997, pg. 21), the results of The Third International Maths and Sciences Studies (TIMSS) showed that US students barely pulled average marks when compared to the other forty nations in the study. In science, the US placed seventeenth, well behind the leaders of the pack -- Singapore, Czech Republic, and Japan. In mathematics they ranked even lower, placing twenty-eighth out of forty-one. Poor scores in math and science have long been a concern of educators in the US, and with good reason. The lack of a firm science background decreases the ability of the public to understand new technologies, and most especially biological technologies which have no familiar analog in the average household (like a cellular telephone or a home computer had when first introduced). This lack of scientific understanding leads directly to fear.

But even nations that ranked well in TIMSS have sought to place restrictions on cloning. England placed tenth in TIMSS for science, but experienced near hysteria at the news of the cloning in their own back yard<sup>4</sup>. The reaction of the British Government has been swift, as it immediately set about closing any potential loopholes in its current anti-cloning legislation. This suggests that the lack of science education is not the only factor contributing to public reaction. And in deed, I believe it is not.

The majority of Americans believe cloning to be morally wrong and to go against the law of God. As humans do not routinely clone, any artificial means to create a clone is viewed as unnatural and tampering with the "natural order." This "natural order" is a construct of the sociocultural myth of America, which is derived primarily out of the Judeo-Christian ideal. The biotechnical revolution, of which cloning is the most visible and easily grasped technique, attacks the very sociocultural foundation of the modern western world. It is primarily for this reason that the cloning of humans is considered by the majority of Americans and other westerners to be repulsive.

The cloning of humans raises difficult moral questions about God, life, and the uniqueness of humans over other animals. Considerable debate has focused on the perception that cloning allows man to play God. However, cloning is farther from playing God than nearly any other technique in the biotechnical arsenal. The ability to manipulate the genetic code<sup>5</sup>, and thus the most basic blueprint of an organism, allows biotechnologists to create new, cross-species organisms, something that almost never occurs in nature<sup>6</sup>. Cloning, however is simply an alternate mode of reproduction which occurs frequently in nature among a wide variety of plants and animals<sup>7</sup>. But most Americans do not view cloning in this manner.

Additionally, because there is no fusion of sperm and egg when creating a clone, there is no conception. Many Christian and pro-life groups involved in the abortion debate have defined conception as the start of human life<sup>8</sup>. Cloning obviously raises difficult questions about when life begins and what is man's place in the "natural order."

These philosophical questions (among others) will be harder to answer than the biological concerns related to the cloning of humans<sup>9</sup>, and it is these philosophical questions that have stopped human cloning research, and could potentially put a halt to all cloning research in the United States and other western countries. Unfortunately for most, I believe it is no longer a question of should we clone humans, but when will the first human be cloned. When this occurs, these difficult questions, temporarily shoved to simmer on the back

burner, will come to a boil, and I doubt the western world is ready to handle them.

In contrast, when I examined the reaction of the non-western world to the cloning news, I noticed something very different. According to futurist Jim Brock, who works frequently in the People's Republic of China and was in the country at the time the cloning news broke, the discussion of the cloning issue lacked the sensationalism seen in the western press. Fantastic accounts of resurrected Josef Stalins or mass roaming herds of multi-millionaires never the grace the pages of Asian periodicals<sup>10</sup>. Instead, rational discussion focused on the pro's and con's of cloning. China, for example, debated the potential benefits of human cloning as means to ease apprehension surrounding their one child per family legislation.

In Japan, a country that placed in the top three for sciences in the TIMSS study, the reaction to the cloning news was similar to that observed in China. A review of the English language daily the Japan Times produced a handful of primarily factual articles which never appeared on the front page, but were relegated to lesser importance inside. Though I was unable to accurately gauge public opinion, Rishid Hashmi of Nagasaki, in a 30 March 1997 letter to the editor of the Japan Times, berated the United States for its shortsighted overreaction to the cloning news, comparing President Clinton's moratorium on human cloning to that of the Pope's attempt to stamp out Galileo's astronomical work in the sixteenth century.

Though the lack of sensationalist press may be attributed in some part to the totalitarian regimes present in some Asian countries and to the death of Chinese leader Deng Xiaoping three days prior to the cloning news, the underlying sociocultural paradigm of the region certainly contributed to the distinctly subdued governmental and public reaction to the news.

Both China and Japan engaged in lengthy discussions prior to imposing any legal regulations on cloning. Japan has yet to enact any formal legislation or moratorium on cloning, as the government's Science and Technology Agency is still reviewing the scientific and ethical issues surrounding the new technology. A report is not expected from the Agency until later this summer. After nearly ten weeks of discussion, China decided in early May to ban human cloning research. The Chinese Academy of Sciences deemed the ban "absolutely necessary to maintain the ethical morality which holds together today's human society."

Unlike the sociocultural myth of the west, the ideals upon which the Asiatic sociocultural paradigm is built did not appear to be immediately threatened by the new cloning technology. An in depth study of the non-western response, beyond the scope of this paper and my ability, may produce interesting insights into some of the characteristics required for a new Biotechnical Myth<sup>11</sup> that would need to underlie the sociocultural paradigm of a biotechnical future. However, China's eventual ban on human cloning research illustrates that even the non-western sociocultural paradigm is not completely suitable for the Biotechnical Age, but it must contain critical components that may be deducible from further study. It is clear, however, that a biotechnical future is impossible under the sociocultural paradigm constructed from the Judeo-Christian ideal.

Appendix:

### The Science of Cloning

Several scientific misconceptions cloud the cloning debate. Though many seemingly valid concerns have been raised, our current level of biological knowledge shows that most are unwarranted. The ability to clone humans is currently a dangerous proposition, but the technological difficulties can and will be overcome. Therefore, the issue of cloning humans is not a scientific issue, but a social one, and should be addressed as such. Before this can be done, however, the scientific misconceptions about cloning need to be clarified. To that end, I have addressed five common scientific "concerns" below.

## \_1. "Cloning is unnatural."

Cloning occurs frequently in nature. In many cases, cloning occurs early in development when the young embryo is split and proceeds to develop into multiple individuals. The individuals are genetically identical. In animals where cloning is not the general method of reproduction, this type of cloning can occur naturally in frequencies. In humans, identical twins represent this type of cloning. Cloning of adult cells does occur in animals, but is considerably more rare. Sea Stars and corals clone themselves if they divide in half, producing two new, genetically identical individuals. Humans, are unable to do this.

Dr. Ian Wilmut and colleagues have found a different and much more powerful way to clone. Until Dr. Wilmut's breakthrough, human mediated cloning could only be accomplished with an undifferentiated cell (an embryo). Once a cell had differentiated for a specialized function (i.e. muscle cells, nerve cells, etc.), it proved impossible to get that differentiated cell to produce a whole new organism (i.e. muscle cells would only produce more muscle cells). In a differentiated cell, many of the genes are turned "off", allowing the differentiated cell to work efficiently at its specific task. Dr. Wilmut has discovered a way to turn all of the cell genes back on, and in essence turn a differentiated adult cell back into an undifferentiated cell (i.e. more "embryo" like).

## 2. "Cloning will reduce the genetic diversity of the human species."

Genetic diversity is a measure of all the genes possessed by a species. Genes dictate what traits an individual will possess, and in ideal situations, no single individual contains all of the genes of its species (exceptions can be found in some endangered species with very small populations). Genetic diversity is important to the continued survival of a species, especially in a changing environment, where traits important for future survival may be "stored" until needed. The higher the genetic diversity, the greater the number of potentially valuable traits a species possesses.

The likelihood of dangerously depleting the genetic diversity of the human species through cloning is small. Studies in genetics have shown that significant genetic diversity can be maintained in a population where only a very few individuals are sexually reproducing. Studies of small populations on islands support these findings -- species with low levels of genetic exchange (via sexual reproduction) with other populations of their species, retain a high level of genetic diversity and similarity with these other populations. Until the human desire to sexually reproduce is gone, cloning itself will not threaten the genetic diversity of human species.

## 3. "Cloning can only produce females and makes males obsolete."

Though Dr. Ian Wilmut and his colleagues cloned an adult ewe, there is no reason to believe that only females can be cloned. The technique used to create Dolly should not discriminate by sex, as theoretically any adult cell could have been used. Other cloning techniques can and do routinely produce males. For example, male identical twins do exist.

Cloning could potentially render males "obsolete" in a reproductive sense. However, males currently play a critical role in the recombination and maintenance of genetic diversity (via sexual reproduction). Males should not feel particularly threatened by the cloning news, as males, in many ways, are already reproductively obsolete and have not disappeared. The ratio of males to females does not have to be 1:1 (as seen in most human societies) and many scientists have argued that the ideal sex ratio should be skewed towards more females than males. In many species, a skewed sex ratio is simply not observed. Though several theoretical explanations have been proposed for the 1:1 sex ratio, the underlying truths are still not positively known.

## 4. "Cloning will allow abominations from our past to return."

Though it is theoretically possible to clone someone like Adolf Hitler (assuming you could find a complete set of his DNA), humans are as much a product of their environment as they are of their genetics. Though all traits have a genetic component (expressed as heritability), genes do not have absolute control over who we are. Interactions with our environment dictate what genes will be expressed in an individual. As an example, the interaction of a fair skinned individual with sunlight will activate the genes for melanin and cause the skin to darken. Simply put, genes control what we can be, while the environment around us makes us what we are.

The ability to clone long dead organisms does not currently exist. Dr. Ian Wilmut successfully cloned Dolly the sheep from the differentiated cell of an adult ewe. Without a cell and its complete DNA contents, the cloning technique developed by Dr. Wilmut will not work. This precludes the cloning of historical figures, fossil dinosaurs, and even someone who has been deceased for a relatively short time. It is possible to recover DNA from hair and bone samples, and the recovered DNA could potentially be used to clone the organism, but this technology still does not exist. DNA degrades over time, and this may make cloning long dead animals or people difficult if not impossible.

##### 5. "Cloning will solve human organ transplant shortages."

The currently level of cloning technology will not solve the organ shortage problem. Cloning, at its currently level of development, can only produce whole individuals. This has been called vertical cloning, where a differentiated cell is taken and a complete organism (with all its different cell types) is produced. This creates problem for organ harvesting as the resultant organism is a complete individual.

To solve the organ shortage, horizontal cloning techniques will need to be developed. In horizontal cloning, a cell type (i.e. heart cells) are cloned to produce only other heart cells and ultimately a complete heart. Difficulties with this type of cloning are numerous and non-trivial. Until artificial methods of sustaining individual organs are developed (and some methods are currently in the prototype stages of development), significant advances in horizontal cloning will not be possible. however, this does illustrate a viable, potential benefit from further human cloning research.

#### Endnotes

1. A clone is an organism that is genetically identical to its single "parent." An offspring from a sexual union receives genetic contributions from both parents.

2. The Human Fertilization and Embryology Act of 1990 prohibits the cloning of human embryos. British lawmakers are concerned that Dr. Ian Wilmut's technique, which uses adult cells and not embryos, is not covered by the act.

3. On 24 February 1997 President Clinton charged the National Bioethics Advisory Commission to prepare a report on the legal and ethical issues associated with cloning. The commission, a fifteen member group composed of theologians, scientists, and ethics experts was given 90 days to complete the task, a short time considering past commissions had taken as long as four years to produce recommendations.

4. In its 17 March 1997 report, the British Parliament's Science and Technology Committee recommended that the world adopt laws similar to Britain's Human Fertilization and Embryology Act to ban human cloning

and prevent unscrupulous scientists from dabbling in eugenics. The act does allow for non-human cloning research to continue. The Science and Technology Committee did recognize the scientific importance of the cloning breakthrough and the role of the media in the overreaction of many when Conservative committee chairman Giles Shaw said, "There was no doubt that the media furor, which provoked the suggestion that human cloning was around the corner or the master race was a week or two ahead, helped diminish [the importance of the cloning work of Dr. Ian Wilmut and colleagues]."

5. For thousands of years, humans have been manipulating the genetic composition of both plants and animals through selective breeding and other husbandry and agricultural techniques. The genetic make-up of humans has also been selectively manipulated through and various marriage and sexual customs and taboos. These practices are viewed as "natural" by most. Biotechnology is a more efficient and powerful tool for accomplishing similar ends.

6. Hybridization is the exception, as some closely related species may interbreed, producing offspring that are not distinctly like either species but somewhere in between (i.e. a mule). Evolutionary theory provides a good explanation for hybridization. Species that are not closely related do not interbreed.

7. Plants are the rampant cloners of the natural world, often reproducing by budding or fragmentation. Grafting and rooting plant cuttings are common ways for gardeners and horticulturist to propagate plants; these are also cloning techniques, as the resultant individuals have the exact same genetic make-up as the parent plant. In the animal kingdom, corals, sea stars, some insects and lizards clone themselves through a variety of mechanisms. One species of gecko in Hawaii reproduces almost exclusive through a cloning method called parthenogenesis. In some animal species, male individuals have never been observed. These species reproduce solely through cloning.

8. Conception also has been considered by the Roman Catholic Church to be the moment that humans receive their soul from God (ensoulment), setting them apart from other animals.

9. Biological concerns focus on the reliability and safety of the technique. Of nearly 300 embryos used by Scottish researchers, only one successfully produced a lamb. All of the others failed to develop or were naturally aborted at some stage of development, suggesting that something was "wrong" with the embryos. It has been noted that this success rate is comparable to early experimental work on in vitro fertilization techniques.

10. In a review of eight general English language periodicals from Asia (Asia Magazine, Asia Outlook , Asia Week, Beijing Review, China News Analysis, Far Eastern Review, India Today, and Japan Times), only a handful of articles on cloning were published from the last week of February 1997 through early June 1997. All but one article appeared in the Japan Times, and many of these were lifted directly from US sources like the Los Angeles Times. The lone non-Japan Times article appeared in the Beijing Review and was factual piece by a leading Chinese scientist explaining how cloning could not reproduce a personality, but only an exact genetic copy of an individual.

11. Three distinguishing characters of the Biotechnical Myth can be tentatively identified as: i) diversity and change are good and desirable, ii) it is not "evil" to modify the "classical" human, and iii) humans should have the individuals freedom to alter or not alter anything about themselves (i.e. the ultimate freedom of choice). These three characteristics may or may not be all inclusive and an examination and comparison with western and non-western sociocultural paradigms might prove insightful.

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