Is 'cloning' mad, bad and dangerous?

The tenth anniversary of the birth of Dolly the sheep coincided with the reverberation of the South Korean cloning scandal, which exemplified how career pressures and imprecise experimental reproducibility combine to render the biomedical sciences susceptible to misconduct (Goodstein, 2002). However, the exposure of Woo Suk Hwang also demonstrated an important strength of science: its self-correcting nature, which ensures that falsehoods—like incorrect theories—are identified and rejected. But while occasional revelations of deviant practice keep the scientific community on its toes and help to maintain quality standards, they also provide opportunities for media sensationalism, with negative effects on the public's perception of science.

How can we allay the public's increased wariness of nuclear transfer between human cells? One way might be to take more care with our terminology, particularly the word 'cloning'. As a moniker for genetic copying—borrowed from the capacity of plants for vegetative reproduction—cloning has become synonymous with nuclear transfer, a technology that was developed over 50 years ago in frogs and since progressed in mammalian species (Di Berardino *et al*, 2003). But language is in a continual state of flux; its unchecked misapplication can lead to altered meaning, compromising the public's understanding of science. Public awareness relies on prior-held ideologies and schemata; only minimal amounts of new information are assimilated to inform or reinforce a viewpoint (Nisbet, 2005). This 'principle of least effort' explains why cloning is used as an approximation of nuclear transfer processes, because it conforms to a worldview informed by science fiction and the Promethean myth (Maio, 2006). Distinguishing between reproductive and therapeutic cloning is thus futile because the public's default perception is almost always 'reproductive'. We therefore need to explain principles such as nuclear

transfer more carefully, for the benefit of both science and society.

Nevertheless, the negative connotations of the word 'cloning' will take time to overcome. Meanwhile, as we continue to ruminate over the extent of moral respect accorded to the pre-implantation embryo—and waste valuable time on scientific chicanery such as 'altered nuclear transfer' (Check, 2005)—we overlook the fact that this technology obviates many of the ethical arguments. Nuclear transfer is not a sexual process and does not create commodified cloned embryos. It produces a reconstructed cell, cultured as a quasi- or pseudo-embryo, with the aim of deriving immune-compatible embryonic stem cells for biomedical research. Instead of convoluted arguments on the origin of human life, personhood and ensoulment—issues on which we will never attain universal agreement—we should focus on reaching a consensus.

The fact is that we cannot permit the application of nuclear transfer for human reproduction because we cannot circumvent the requirement for trial and error. So, could it be that we are making the wrong ethical case against human 'reproductive cloning'? The recent TGN1412 debacle in the UK served as a horrific reminder of the limitations of animal tests that precede pre-clinical safety trials for new drugs: despite passing animal safety tests, this therapeutic antibody caused life-threatening side effects in six human volunteers. However, even successful clinical trials do not guarantee safety: in the UK, adverse reactions to prescribed medicines result in 250,000 hospital admissions per year (Hitchen, 2006). Analogously, no matter how efficacious nuclear transfer might become in reproducing other mammals, we cannot guarantee a risk-free process in humans, until a sufficient number of resulting individuals—'clones', if you like—have lived demonstrably healthy lives.

Although that argument may be scientifically contentious, it is inescapable that any clinical trial requires free and informed consent by volunteer participants. However, in this scenario, the subjects do not exist to give such consent beforehand, and would be unlikely to withdraw it subsequently.

Nobody asks to be born, but we usually opt for health and longevity thereafter. To pre-designate future human persons as involuntary test subjects of an unproven technology would be a totalitarian act, and is the real ethical reason why human reproductive cloning should remain prohibited, and not vacuous arguments that are offensive to identical twins.

Over a decade after Dolly's birth, it is remarkable that nuclear transfer technology still invokes such agitation. Whether or not it leads to new therapies, it will nevertheless facilitate improved understanding of early human development and disease, and, through individual-specific drug testing, might prevent future calamities similar to the TGN1412 trial. Although Hwang and his colleagues were not attempting to reproductively clone humans, the media portrayal of their fraud obscures more relevant arguments against such an idea, such as the risk to the life-long welfare of non-consenting individuals. But, in continuing to designate nuclear transfer technology under 'cloning', scientists share culpability for the ensuing public scepticism. Human embryonic research should be dissociated from this culturally embedded misnomer in both peer-reviewed and popular scientific literature.

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