Time to Exorcise the Cloning Demon

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The Preamble

The publication in *Cell*[1] on May 6, 2013, of the successful cloning of human embryonic stem cells has not only opened the way to new tissue-matched therapies but has also reawakened the debate on the ethics of human reproductive cloning, which may prove to be a safe enough byproduct of this technique. It has also re-awakened panic and hostility at the very mention of reproductive cloning.[2]

The "trick" of this latest piece of cloning was apparently partly achieved by the judicious use of caffeine! "By adding caffeine to cell cultures, their outputs were transformed. 'We were able to produce one embryonic stem cell line using just two human eggs, which would make this approach practical for widespread therapeutic use,' said Mitalipov."[3] As the London *Observer* newspaper commented at the time,

> the announcement was also greeted with horror. "Scientists have finally delivered the baby that would-be human cloners have been waiting for: a method for reliably creating cloned human embryos," said David King of Human Genetics Alert. "It is imperative we create an international ban on human cloning before any more research like this takes place. It is irresponsible in the extreme to have published this."
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> Several tabloid newspapers also carried banner headlines warning of the human cloning "danger." Such reactions have a familiar ring. When the cloning of Dolly the Sheep was revealed in 1997 there was an outpouring of hysteria about the prospect of multiple Saddam Husseins being created in laboratories.[4]

David King's typically inflammatory suggestion seems to imply that science that might save lives must be put on hold, despite the fact that what he fears might result, namely human reproductive cloning, is currently illegal in most countries, including the UK.

This article draws on my paper "Goodbye Dolly: The Ethics of Human Cloning" in the *Journal of Medical Ethics* 1997 Dec; 23(6):353–60; on John Harris, "Cloning and Human Dignity" in the *Cambridge Quarterly of Healthcare Ethics* 1998 Spring;7(2):163–8; and on my book, *On Cloning* (London: Routledge; 2004). I am grateful for helpful comments to participants in the Zagreb Applied Ethics Conference 2013, hosted by the Society for the Advancement of Philosophy and the Center for Croatian Studies, at the University of Zagreb, June 12–14, 2013, and to participants in "New Families and Genetic Identities" at the London School of Economics, June 20–21, 2013. I thank John Coggon for numerous kindnesses as well as for helpful comments. Finally I acknowledge support of the Wellcome Trust Strategic Programme: "The Human Body: Its Scope, Limits and Future."

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It is worth remembering in more detail the panic that greeted the birth of the redoubtable and much lamented "Dolly" on July 5, 1996.

The Reaction to the Birth of Dolly

When Dolly's birth was reported in *Nature* on February 27, 1997,[5] the reaction was hysterical. The then president of the United States, Bill Clinton, called immediately for an investigation into the ethics of such procedures[6] and announced a moratorium on public spending on human cloning. President Clinton said, "There is virtually unanimous consensus in the scientific and medical communities that attempting to use these cloning techniques to actually clone a human being is untested and unsafe and morally unacceptable."[7] In 2001, George W. Bush repeated this ritual genuflection in the direction of hostility to cloning. "I strongly oppose human cloning, as do most Americans. We recoil at the idea of growing human beings for spare parts, or creating life for our convenience."[8]

Members of the European Parliament demanded that each EU member "enact binding legislation prohibiting all research on human cloning and providing criminal sanctions for any breach."[9] The European Parliament rushed through a resolution on cloning, the preamble of which asserted:

> The cloning of human beings . . . cannot under any circumstances be justified or tolerated by any society, because it is a serious violation of fundamental human rights and is contrary to the principle of equality of human beings as it permits a eugenic and racist selection of the human race, it offends against human dignity and it requires experimentation on humans.[10]

The resolution went on to claim that "each individual has a right to his or her own genetic identity and that human cloning is, and must continue to be, prohibited."[11]

Soon after, the Council of Europe promulgated the Additional Protocol to the Convention for the Protection of Human Rights and Dignity of the Human Being with Regard to the Application of Biology and Medicine, on the Prohibition of Cloning Human Beings on December 1, 1998, in Paris. It states:

> Considering the purpose of the Convention on Human Rights and Biomedicine, in particular the principle mentioned in Article 1 aiming to protect the dignity and identity of all human beings . . . :
>
> **Article 1**
>
> 1. Any intervention seeking to create a human being genetically identical to another human being, whether living or dead, is prohibited.
> 2. For the purpose of this article, the term human being "genetically identical" to another human being means a human being sharing with another the same nuclear gene set.[12]

These proposals are almost entirely devoid of evidence or argument and rationale. There are vague references to "human rights" or "dignity" or the importance of

"genetic identity" with little or no attempt to explain what these principles are, or to indicate how they might apply to cloning.

The UNESCO International Bioethics Committee rushed out a resolution on the ethics of cloning. This demanded "the preservation of the human genome as common heritage of humanity."[13] A number of equally misguided governments, as already noted, had also rushed to legislation banning human reproductive cloning. The UK government, for example, outlawed human reproductive cloning in the hastily drafted Human Reproductive Cloning Act of 2001.

There were, it should be said, some more sober contemporary reactions to Dolly's birth, but they were drowned in the torrent.[14] My own interest in cloning predates the birth of Dolly by some years. I first wrote about the ethics of cloning some twelve years before the birth of Dolly[15] and again shortly after her birth.[16]

That the hostility to the prospect of human reproductive cloning was almost immediately turned into legislation in many countries is a testament to the capacity of government and legislative mechanisms to respond quickly and effectively in an emergency, something that is often thought impossible. It is also testament to the power of irrationality over evidence-based appraisal. That these ridiculous laws remain on the statute book also tells us something about how difficult it is to change bad laws. There are interesting public policy lessons of many kinds to be learned from this, but I shall not try to spell them out further here.

As Colin Blakemore recently noted a propos this reaction:

> At the time the chances of these horrors occurring—when scientists had not even created a single clone of a human cell—were remote. . . .
>
> Not that this worried the alarmists. The crucial point is that we should have spent the intervening time thinking about how we should react sensibly to the concept of a human clone when it does become possible. We have not done that and, although the science is still far off, it is getting closer. We need to ask, carefully and calmly: under what circumstances would we tolerate the creation of a human clone?[17]

Despite the long period of time that has elapsed since the birth of Dolly, interest in this careful and calm examination has declined dramatically. Indeed, the decline started about the time of the publication of my book on cloning in 2004. Perhaps people thought that my arguments had conclusively met this need? But such an inference would be as reckless as the reactions to Dolly just examined. Google trends have traced this decline, which has been summarized in two graphs accessible on the Internet.[18]

I agree with Blakemore that we need to think again about the ethics of cloning, but my second thoughts alarmingly mirror my first thoughts. In what follows I wish to examine some facts and arguments that might inform a balanced response to the prospect of human reproductive cloning.

The Amble and Some Arguments

The debate about the ethics and policy of human reproductive cloning is in essence a debate about the merits or otherwise of degrees of genetic relatedness between human beings and about the question of what it is to be or to remain human. It is

an irony seldom noted that humans tend to celebrate degrees of genetic relatedness in ascending order of closeness, with the notable exception of the big one!

Threats to Individuality

Some fear cloning because of alleged threats to individuality. The European Parliament's resolution on cloning claimed, as I have noted: "Each individual has a right to his or her own genetic identity and that human cloning is, and must continue to be, prohibited."[19] But there is no such thing as genetic identity or genetic individuality of persons. There is genetic identity and individuality of genomes, but that is something else.

Although, except in the case of clones and monozygotic siblings, there are small genetic variations between human individuals, "individuality" is not simply that which individuates numerically or spatiotemporally but that which differentiates historically, psychologically, and socially. It is a psychosocial concept; individuality is a property of persons, beings with personality traits, hopes, fears, expectations, and desires—features that make them more than living things with a genome, but persons with a distinct and distinctive personality. Individuality is what makes us identifiable as ourselves, that which would identify us to those who know us as persons.

Genetic Origins

Those who think genetic identity is a question of lineage, or origins, tend to link genetic identity with information about, or knowledge of, their progenitors. These people tend to talk of "a right to know one's genetic origins" and, for example, tend to deny any claims to anonymity by sperm donors or indeed by those who place their genetic children up for adoption. But a right to knowledge of this sort implies mandatory paternity testing.[20]

Nonpaternity refers to births in which the children of the family are not in fact genetically related to the person whom they believe to be their father and who usually believes he is their genetic father. Nonpaternity rates are quoted with wildly differing values (from less than 1 percent to more than 30 percent). A modest, and probably reliable, figure is 2 percent.[21] However, even at a modest rate of 2 percent, nonpaternity rates in the UK account for more than 12,785 births registered[22] annually to men who are not in fact the genetic father. Thus if there is such a thing as a need for children to know their genetic background and true identity, then on the grounds of numbers alone, we should start with "normal" families. This might imply an obligation for paternity testing in all families! The mischief and disruption this would cause is clearly incalculable. What price then a so-called need to know one's genetic origin! It is hard to believe there is any such thing, but if there is, it is doubtful that the arguments that might sustain it are such as to outweigh the rights of privacy of sperm donors, not to mention the rights to protection of the privacy of family life. Here of course the empirical evidence tells us nothing. It gives us numbers of sperm donors and estimated numbers of nongenetic fathers, but all the ethical work remains to be done! And that work should surely also make us skeptical about the wisdom of founding (or unfounding) families by revealing genetic origins as a matter of policy.

It also might imply cloning as the method of choice of reproduction, because the ability actually to meet the individual responsible for one's entire genome in person so that we can access this knowledge from the horse's mouth, would clearly be the most complete and foolproof way of acquiring knowledge of this sort.

It Is Only Cloning That Preserves the Human Genome (Every Other Reproductive Modality Varies It)

All forms of reproduction except cloning fail in fact to *reproduce*, they almost infinitely vary the genome via a random process, aptly called by some "genetic roulette."[23] This process is very dangerous, with an 80 percent failure rate and an 8 percent rate of serious genetic abnormality.

Sex preserves a varied genome, but often at high costs. This may not be universally desirable, and although universal cloning would be even more undesirable, cloning in moderation may have its merits.

We are not here to address the question, "What if everyone were to do that?" For as Yossarian said in *Catch 22*, "Then I'd certainly be a damned fool to feel any other way, wouldn't I?"[24] Indeed, it is always foolish to raise the specter of a slippery slope to universal application of any technology or activity: "You should not become lawyers because what if everyone were to do that?"

Cloning Is a Reproductive Modality with Which Humankind Has Always Been Very Familiar; God or Nature Is a Serial Cloner, at a Rate of 1 in Every 270 Births, 3 per 1,000

The existence and success of identical twins is a salutary reminder of our familiarity with clones and cloning, with its success as a reproductive technology, and with the chimerical nature of the fears provoked. Even identical triplets and quadruplets are not unknown.[25] Of course, they are problematic like all multiple births, difficult for the mother and fraught with dangers for the children, but not more so than multiple births that do not share a genome.

Moreover we know that IVF has increased the monozygotic twinning rate by a factor of three or more, and although there have been many moral qualms expressed about the ethics of assisted reproduction, I have not so far seen moral objections to assisted reproductive technology on the grounds that it has increased the rate of identical twins from around 1 in 250–70 births to 1 in 40–80 births.[26]

Since 1978 more than five million babies have been created through IVF worldwide.[27] This has, inevitably, increased significantly the number of "cloned" identical twins, and yet this fact has seldom if ever been cited as an argument against IVF. Indeed, as far as I am aware, no disquiet at all has been expressed about the increased probability of repeating examples of a particular human genome inherent in assisted reproductive technologies, although the increased danger of multiple pregnancies has received attention.

Cloning Treats People as a Means, Not as Ends in Themselves

A typical example, and one that attempts to provide some basis for objections to cloning based on human dignity, is Axel Kahn's invocation of this principle in his commentary on cloning in *Nature*. Kahn, a distinguished molecular biologist,

helped draft the French National Ethics Committee's report on cloning. In *Nature*, Kahn states:

> The creation of human clones solely for spare cell lines would, from a philosophical point of view, be in obvious contradiction to the principle expressed by Immanuel Kant: that of human dignity. This principle demands that an individual—and I would extend this to read human life—should never be thought of as a means, but always also as an end.[28]

I replied at the time to Kahn, also in *Nature*, noting that this Kantian principle, invoked without any qualification or gloss, is seldom helpful in medical or bioscience contexts.[29] As formulated by Kahn, for example, it would surely outlaw blood transfusions. The beneficiary of blood donation seldom thinks closely about the anonymous donor and uses the blood (and its donor) exclusively as a means to her own ends. The recipient of blood donations does not usually know of or even care about the identity of the blood donor. The donor figures in the life of the recipient of blood exclusively as a means. It may be true that, because the recipient of blood donation has no attitude at all to the blood donor, he or she may not be consciously treating him or her in any particular way. But surely it remains true that the recipient is using the donor instrumentally, consciously or not, just as I use the animals that I eat as means to my ends without thinking of them as individuals at all. Indeed that is precisely why it is instrumentalization. The blood in the bottle has, after all, less identity and is less connected with the individual from whom it emanated than the chicken "nuggets" on the supermarket shelf. An abortion performed exclusively to save the life of the mother would also, presumably, be outlawed by this principle.

On the Plus Side, Cloning Delivers a Tried and Tested Genome Rather than an Unpredictable and Often Disastrous One

As I argued in 2004:

> Cloning combines genetic predictability, with the advantages of a tried and tested genome, a genome we know that has stood the test of time and, in all probability, will do so again. This consequence of the refinement of cloning technology is one of the few that offers one of the real potential benefits of reproductive cloning, the opportunity to eliminate, or more realistically minimise, the chances of a range of errors or undesirable traits being produced by the essential random "gamble" of sexual reproduction.[30]

Safe cloning would avoid the dangers of sexual reproduction. And let's remind ourselves of just how dangerous this is.

Sexual Reproduction, on the Other Hand, Delivers an 80 Percent Failure Rate and a 6 Percent Abnormality Rate

Recent research has confirmed that the abnormality rate for births associated with sexual reproduction is almost certainly more than 6 percent: "Every year an

estimated 7.9 million children—6 percent of total births worldwide—are born with a serious birth defect of genetic or partially genetic origin."[31] It is doubtful that natural sexual reproduction, with its risk of sexually transmitted disease, its high abnormality rate in the resulting children, and its gross inefficiency in terms of the death and destruction of embryos, would ever have been approved by regulatory bodies if it had been invented as a reproductive technology rather than being simply found as part of our evolved biology.

Gaps in the Mind

In his essay "Gaps in the Mind,"[32] Richard Dawkins asks us to imagine a contemporary woman, holding her mother's hand on the coast of Africa. She holds her mother's hand, her mother holds *her* mother's, and so on. Each daughter is as much like her mother as daughters usually are. Each person takes up about one meter, a yard, of space as she holds hands back into the past. In just 300 miles (a small distance into Africa) the imaginary human chain reaches our common ape ancestor. We then need to imagine our ape ancestor holding by her other hand her other daughter and she hers and so on back to the coast. Again each daughter looks as much like her mother as mothers and daughters usually do. By the time the chain reaches back to the coast, two contemporary females are looking at each other each holding the hand of her mother, stretching in seamless connection back to a common ape ancestor. The two "women," shall we call them, looking into each other's eyes, are a modern human and a modern chimpanzee.

Dawkins's story reminds us of our ape ancestry and most importantly of the seamless transition between apes and humans. We need to bear in mind another lesson from evolution related to Dawkins's parable and outlined in his essay. The lesson is that it is an accident of evolution that the ape species with whom (which?) we humans might have been able, successfully, to breed have not survived. So although the chimpanzee who shares a common ancestor with humans probably cannot breed sexually with human beings (at least without technological assistance), there were certainly once nonhuman apes that, had they survived, could have been procreational partners for us, using "normal" sexual reproduction. To this extent our ability to define ourselves as a species distinct from the other great apes is—according to one of the most commonly used definitions of a species, namely, that its members are able to breed successfully with one another but not with other types of animals—an accident of history, not an immutable law.

Dawkins's dramatic image reminds us that preserving ourselves from radical genetic interventions is not always a good idea. It also reminds us that the preservation of the human genome as advocated by UNESCO, whatever that has to do with cloning, is not in fact an idea that recommends itself to reason.

Applications

Disease and Disability[33]

I have noted previously that human reproductive cloning may have a part to play in eliminating or palliating disease and disability, topics that are the subject of other articles in this special section. To that extent, cloning is not necessarily to be seen as a radical and unprecedented reproductive modality. Indeed, again as

noted previously, it is as old as reproduction itself. I cannot here respond to the interesting points made in the previous six papers, but I should make clear that I take it as axiomatic that disabilities are disabling and that illness involves being ill and not well. In both cases these things are to be avoided, for ourselves and others. Although it is of course true that the life of any particular person with disabilities might be better than that of many without those or indeed any comparable disabilities, those who take anything other than a harmed condition view of disability (the view I take) have a problem accounting for the wrong that might be done in deliberately injuring another person. Many accounts that depart from mine[34] would not be able to call, for example, deafening, blinding, cutting off an arm or a leg or the last joint of a little finger, or communicating the common cold "an injury" until the life of the person so affected could be assessed in its entirety by the person whose life it is. Those who do not see this as problematic clearly have a problem. Whether it is enough of a problem to call it a disability or a disease is of course another matter and one of a quite different nature.

Reproductive Beneficence

Cloning, although it repeats rather than varies the genome, may also prove an important enhancement technique, in that it can be used to optimize the genome of future children by giving them a tried and tested genetic constitution and by eliminating the risk of the usual genetic lottery of sexual reproduction.

Moreover, if and when particular genetic mutations give rise to beneficial traits hitherto unprecedented among humans, for example, resistance or immunity to certain diseases, not only might we have strong prudential and humanitarian reasons to use cloning as a reproductive modality of choice, but it might also in extreme cases become imperative to ensure the survival of our species: if, for example, we were to face a major life-threatening pandemic to which only particular genomes proved immune.

Those who accept that there are either strong moral reasons or indeed moral imperatives to create the best possible children will also have reasons to consider reproductive cloning among other available options. They will do so knowing that clones are likely to be no worse off than identical twins, and if the genome they inherit is otherwise advantageous, such children will, we may be sure, be as grateful to their parents as all good children should be, for the benefits that being given life bestows.[35]

Cloning will never be universal. We are talking, rather, about whether a universal ban on cloning is either rational or desirable. As I hope I have shown, cloning might have its uses, and even if these are modest, the prospect of human reproductive cloning is no more likely to frighten the horses than is sexual reproduction.

Notes

1. Tachibana M, Amato P, Sparman M, Gutierrez NM, Tippner-Hedges R, Ma H, et al. Human embryonic stem cells derived by somatic cell nuclear transfer. *Cell* 2013; available at http://dx.doi.org/10.1016/j.cell.2013.05.006 (last accessed 11 Oct 2013).
2. An *Observer* piece, by their science editor Robin McKie, also featured quotes from an interview with this author: McKie R. Human cloning developments raise hopes for new treatments. *Observer* 2013 May 18; available at http://www.guardian.co.uk/science/2013/may/18/human-cloning-heart-disease-genes (last accessed 11 Oct 2013).

3. See note 2, McKie 2013.
4. See note 2, McKie 2013.
5. Wilmut I, Schnieke AE, McWhir J, Kind AJ, Campbell KH. Viable offspring derived from fetal and adult mammalian cells. *Nature* 1997 Feb 27. Dolly the cloned sheep (5 July 1996–14 Feb 2003, R.I.P.).
6. See *Cloning Human Beings: Report and Recommendations of the National Bioethics Advisory Commission*. Rockville, MD; 1997 June.
7. From President Clinton's weekly radio broadcast, reported in *Bioworld Today* 1998 Jan 13;9(7); available at http://www.bioworld.com/content/calls-legislation-follow-cloning-announcement (last accessed 11 Oct 2013). Interestingly, the National Bioethics Advisory Commission (see note 6 above) stated that it was unethical *because* it was unsafe. Either Clinton misread his advisor's report or he decided to add "morally unacceptable" on top of the fact that it was untested and unsafe, rather than simply because it was untested and unsafe.
8. Bush GW. *Remarks by the President on Stem Cell Research.* Washington, DC: The White House; 2001 Aug 9; available at http://www.whitehouse.gov/news/releases/2001/08/20010809-2.html. (accessed 21 Aug 2001).
9. Ward M. Human Cloning: Washington: FDA claims oversight; Europe: Anti-cloning declarations get louder. *BioCentury–the Bernstein Report on Biobusiness*; 1998 Jan 19; available at http://www.biocentury.com/biotech-pharma-news/politics/1998-01-19/politics-and-policy-human-cloning-washington-fda-claims-oversight-europe-anti-cloning-declarations-get-louder-a8 (last accessed 11 Oct 2013).
10. The European Parliament. *Resolution on Cloning*. Motion dated 1997 Mar 11; passed 1997 Mar 13, at para. B.
11. See note 10, the European Parliament 1997, clause 1.
12. Council of Europe. *Additional Protocol to the Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine, on the Prohibition of Cloning Human Beings*. Paris, Article 1, 12.1.1998.
13. *The Universal Declaration on the Human Genome and Human Rights*. UNESCO; 1997 Dec 3 (pamphlet).
14. Harris J. Goodbye Dolly: The ethics of human cloning. *Journal of Medical Ethics* 1997 Dec;23(6): 353–60.
15. Harris J. *The Value of Life*. London, UK: Routledge and Kegan Paul; 1985, chap. 6 and 8.
16. See note 14, Harris 1997.
17. See note 2, McKie 2013.
18. Google Trends. *Google Trends*; n.d.; available at http://www.google.com/trends/ (retrieved 6 Apr 2013). https://support.google.com/trends/answer/92768?hl=en&ref_topic=13975. https://support.google.com/trends/answer/87282?hl=en. https://support.google.com/trends/answer/87284?hl=en&ref_topic=13975.
19. See note 10, the European Parliament 1997; Paragraph B. available at http://www1.umn.edu/humanrts/instree/cloning1.html (last accessed 11 Oct 2013).
20. Ravelingien A, Pennings G. The right to know your genetic parents: From open-identity gamete donation to routine paternity testing. *AJOB* 2013;13(5):33–41.
21. The most reliable published article on the subject is Macintyre S, Sooman A. Non-paternity and prenatal genetic screening. *The Lancet* 1991;338(8771):869–71, and ensuing correspondence.
22. This figure is worked out from the figure provided on National Statistics Online (http://www.statistics.gov.uk/cci/nugget.asp?id=369) that there were 639,721 live births registered in England and Wales in 2004.
23. http://www.google.co.uk/search?source=ig&rlz=1G1GGLQ_ENUK342&q=genetic+roulette&oq=genetic+roulette&gs_l=igoogle.3..0l10.71.7352.0.8189.15.9.0.6.6.0.261.1330.0j8j1.9.0...0.0...1ac.1.12.igoogle.AMGHxuPA7SA#rlz=1G1GGLQ_ENUK342&biw=1366&bih=632&sclient=psy-ab&q=sexual+reproduction+as+genetic+roulette&oq=sexual+reproduction+as+genetic+roulette&gs_l=serp.3...27233.39734.0.42094.29.27.2.0.0.5.536.4341.0j24j2j5-1.27.0....0...1c.1.22.psy-ab..24.5.429.BQyztlc9kBw&pbx=1&bav=on.2,or.r_qf.&bvm=bv.49784469%2Cd.bGE%2Cpv.xjs.s.en_US.MpiVkF51mpA.O&fp=a073705bef86f41b (accessed 27 July 2013).
24. Heller J. *Catch 22*. London, UK: Vintage; 1994 [1961], at 511.
25. See, e.g., Steinman G. Spontaneous monozygotic quadruplet pregnancy: An obstetric rarity. *Obstetrics & Gynecology* 1998:866.
26. In the literature I have so far found reference only to a rate of 1:80 births. See Sills ES, Moomjy M, Zaninovic M, Veeck LL, McGee M, Palermo GD, et al. Human zona pellucida micromanipulation and monozygotic twinning frequency after IVF. *Human Reproduction* 2000 Apr;15(4):890–5.

This still seems to be the case. See http://www.reproductivepartners.com/blog/429/does-ivf-increase-the-chance-of-identical-monozygotic-twins.html (last accessed 11 Oct 2013). See also Herranz G. The timing of monozygotic twinning: A criticism of the common model. *Zygote* 2013. doi:10.1017/S0967199413000257.

27. http://www.livescience.com/21355-5-million-babies-born-ivf-technologies.html (last accessed 11 Oct 2013).
28. Kahn A. Clone mammals . . . clone man. *Nature* 1997 Mar;386:119.
29. See Harris J. Is cloning an attack on human dignity. *Nature* 1997 June 19;387:754.
30. Harris, J. *On Cloning*. London: Routledge; 2004, at 29-30.
31. From *March of Dimes Global Report on Birth Defects*. White Plains, NY: The March of Dimes Birth Defects Foundation; 2006; available at http://www.marchofdimes.org (last accessed 11 Oct 2013). Additional hundreds of thousands more are born with serious birth defects of postconception origin, including maternal exposure to environmental agents (teratogens), such as alcohol, rubella, syphilis, and iodine deficiency, that can harm a developing fetus.
32. In Dawkins R. *The Devil's Chaplain*. London: Phoenix; 2004, at 23–31. I use the summary of Dawkins that appears in Harris J. *Enhancing Evolution.* Princeton, NJ, and Oxford: Princeton University Press; 2007. I apologize for my frequent recourse to this wonderful example.
33. Harris J. Is there a coherent social conception of disability? *Journal of Medical Ethics* 2000 Apr;26(2): 95–101.
34. For detail of my account, see Harris J. *Wonderwoman and Superman.* Oxford: Oxford University Press; 1992.
35. Burley J, Harris J. Human cloning and child welfare. *Journal of Medical Ethics* 1999 Apr;25(2): 108–14.