

Stem Cell Research and Same Sex Reproduction

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Abstract. Recent advances in stem cell research suggest that in the future it may be possible to create eggs and sperm from human stem cells through a process that we term *in vitro* gametogenesis (IVG). IVG would allow treatment of some currently untreatable forms of infertility. It may also allow same-sex couples to have genetically-related children. For example, cells taken from one man could potentially be used to create an egg, which could then be fertilized using naturally produced sperm from another man to create a genetically-related child with half of its DNA from each of the men. In this chapter we consider whether this technology could justifiably be denied to same-sex couples if it were made available as a fertility treatment to different-sex couples. We argue that it could not.

Consider the following hypothetical case:

(Jack & Jill) Jack and Jill present to a fertility specialist. The couple would like to have a genetically-related child but without assistance they are unable to do so. Jack produces an abundance of healthy sperm. However, Jill is completely unable to produce eggs or bear children as she has no ovaries or uterus – they were removed as part of a cancer treatment. Fortunately, a new technology is available that can overcome the problem. The technology will allow the creation of eggs from Jill's somatic (body) cells through a process known as *in vitro* gametogenesis (IVG). Genetic material from one of Jill's somatic cells will be transferred into an enucleated oocyte (an egg that has had its nucleus removed) via somatic cell nuclear transfer, creating an embryo which is a clone of Jill. Once the embryo has reached the blastocyst stage or beyond, stem cells will be harvested and induced to mature into eggs. These will then be fertilized with Jack's sperm before being implanted into the uterus of a surrogate, who will gestate the pregnancy.

The treatment described in this case is not yet feasible, but it may become so. Major advances towards IVG have been made in the mouse. Both sperm-like [1-4] and egg-like [4-6] cells have been derived from mouse embryonic stem cells *in vitro*. One laboratory also reported the production of live offspring following fertilization of natural mouse eggs with sperm-like cells derived from embryonic stem cells.[3] The technique was highly inefficient with 210 oocytes used and 65 embryos implanted in order to create the 12 live animals that were born.[3] In addition, only 7 of the mice had genetic material from both parents and all died prematurely. However, the creation of live offspring following *in vitro* gametogenesis was a significant preliminary step. Subsequent work has

demonstrated that functional sperm can be produced, partially *in vitro*, from mouse epiblast cells.[7] The epiblast cells are pluripotent stem cells harvested from the embryo at a slightly later stage (post-implantation) than traditional embryonic stem cells.[8] These cells were induced to form primordial germ cells (gamete precursors) *in vitro* before being transplanted into mouse testes to produce sperm, which were capable of fertilizing eggs to produce healthy and fertile offspring.[7] This is the first proof of principle for partially *in vitro* gametogenesis in mice.

Progress in humans has been slower, but researchers have been able to derive cells expressing markers specific to mature germ cells from human embryonic stem cells.[9,10] Testing the reproductive functionality of these cells is challenging due to ethical constraints placed on human research. However, further scientific advances combined with changes in regulation may enable the creation of functional gametes and embryos capable of normal development. The fertility treatment described in *Jack & Jill* may eventually become feasible.

Suppose it were already feasible. Should Jack and Jill be permitted to take advantage of the treatment? Some might be reluctant to permit the treatment on the grounds that it requires the harvesting of eggs from a third party (although the same technology could also enable the creation of a plentiful supply of eggs[11]). Others might object to the creation and destruction of a human embryo.[12] However, now suppose that these issues can be avoided; a somatic cell taken from Jill can instead be converted directly into a stem cell which can then be used to derive eggs. That is, one of Jill's own somatic cells, for example, a skin cell, could be used to produce a healthy supply of her own eggs. Though this possibility is even more speculative, it is not entirely fantastic. It has been shown that somatic (body) cells can be induced to become immature cells with the characteristics of stem cells, termed induced pluripotent stem (iPS) cells.[13-19]

Given this amendment, we suspect that many would judge that Jack and Jill should be permitted to utilise IVG to produce a genetic child, at least provided that the treatment is reasonably safe, that Jack and Jill are prepared to pay its full cost, and that there are appropriate safeguards in place to prevent the exploitation of surrogates. It's true, of course, that Jack and Jill could instead adopt a child, or create a child with the help of sperm and egg donors and a surrogate. But couples often have a preference for genetically-related children, and this preference is widely accepted as legitimate; many societies have been willing to make assisted reproduction technologies such as *in vitro* fertilisation and intra-cytoplasmic sperm injection available to couples who wish to have genetically-related children. In some cases, these technologies have even been publicly funded.

But now consider the following case:

(*Hamish & Harry*) Hamish and Harry present to a fertility specialist. The gay couple would like to have a child genetically related to them but without assistance they are unable to do so. Hamish is able to produce an abundance of normal sperm, however Harry is completely unable to produce eggs or bear children as, being male, he has no ovaries or uterus. Fortunately, a new technology is available that can overcome the problem. The technology, IVG, will allow the creation of eggs from Harry's somatic cells. The procedure will then be similar to that described in *Jack & Jill*.

As in *Jack & Jill*, the treatment described in *Hamish & Harry* may become technically possible. Recent research suggests that it may become possible to take somatic cells from a man, generate stem cells via either somatic cell nuclear transfer or iPS cell technology, and then generate eggs from those stem cells.[5,6] These eggs could then be fertilised with another man's sperm before being implanted in the uterus of a surrogate. Some experts doubt whether this will become feasible in humans.[20] Moreover, at this point it seems that it will prove extremely difficult to create sperm from female cells due to the absence of the Y chromosome which holds a gene responsible for initiating sperm development. Nevertheless, it would be bold to rule out the possibility that same-sex reproduction may become feasible through further developments in stem cell research.

Suppose that IVG were already feasible, and safe, in same-sex couples. Should Hamish and Harry be permitted to take advantage of IVG? If Jack and Jill should be permitted to use the technology, then it is difficult to see how it could justifiably be denied to Hamish and Harry. After all, the situation of the two couples is very similar.

The intuitive case for making IVG available to Hamish and Harry can be strengthened by considering another case:

(Roberta & Rex) Bob wants to have a sex change. He does so and becomes Roberta, who is legally recognized as a woman. Roberta (formerly Bob) then meets Rex and they begin a relationship. After a few years, Roberta and Rex decide that they want to have a baby, but since Roberta has no ovaries, they cannot conceive. Fortunately, it is now possible to create eggs using Roberta's somatic cells via IVG.

So long as we allow sex change operations, there is at least a case for accepting the use of IVG by someone like Roberta: IVG could be regarded as merely providing Roberta with a *more effective* sex change. Not only does Roberta now have the physique of a woman, but she can also reproduce as a woman. Moreover, if we grant that IVG should be made available to Roberta, it seems doubtful that it could justifiably be denied to a same-sex couple. How could we deny the use of IVG to a man wishing to reproduce with his male partner as a man (Harry), while granting access to a biological man who wishes to reproduce as a woman (Roberta)? Surely it is an unreasonable imposition to expect the gay man to undergo a sex change operation in order to be able to reproduce with his partner.

Nevertheless, we suspect that many people would be reluctant to make IVG available to Hamish and Harry. In the United Kingdom, a group of MPs have already argued (unsuccessfully to date) for an existing prohibition on IVG as a fertility treatment to be lifted.[21,22] However, they accepted that the technology should be banned for same-sex couples, largely because they recognised that the prospect of same-sex reproduction was unlikely to be politically palatable.[23,24] Clearly, widespread resistance to same-sex reproduction is expected.

In this chapter we consider whether the opportunity to have genetic children via IVG could justifiably be denied to same-sex couples while being provided to different sex couples. We consider four arguments a difference in access. These hold respectively that:

1. Same-sex couples have chosen to be infertile, infertile different-sex couples have not.

2. For different-sex couples, the inability to have genetically-related children is a deviation from normal functioning, for same-sex couples, it is not.
3. It is contrary to nature to create a child descended from same-sex parents.
4. Children descended from same-sex couples would typically have lower wellbeing than other children (including those created via IVG from different-sex parents).

We will argue that none of these arguments is persuasive. Throughout, we will assume that IVG for same-sex couples ('same-sex IVG') would be similar to IVG for different-sex couples ('different-sex IVG') with regard to safety, the need for surrogacy and the need to create cloned embryos. We will also assume that the widespread availability of existing varieties of assisted reproduction, such as gamete donation, surrogacy and *in vitro* fertilisation, to different-sex couples is justified. We will *not* assume that the availability of these techniques to same-sex couples is justified, though we believe that it is; presumably many who would object to same-sex IVG would object to *all* assisted reproduction for same-sex couples, though they might object much more strongly to same-sex IVG, since it alone would allow same-sex couples to have *genetically-related* children.

I. CHOICE

Hamish and Harry can be regarded as suffering from the same condition – infertility – as Jack and Jill. But it might be argued that there is an important difference between the two cases: Hamish and Harry's infertility was chosen in a sense that Jack and Jill's was not. More generally, it could be argued that same-sex couples have chosen to be in a relationship which invariably involves an inability to have children whereas infertile different sex couples typically have not. This difference might then be used to defend denying IVG to same sex couples while making it available to different sex couples. Perhaps it could be said that same-sex couples have, by choosing to be infertile, waived any claim they might otherwise have had to IVG. A person who chose to form a sexual relationship with a non-human animal would not have a claim to fertility treatments allowing reproduction with the animal. Likewise, it could be argued, a person who chooses to be with a member of the same sex in one's own species has no claim to fertility treatments.

Importantly, this argument does not rely on the controversial claim that people can choose their sexual orientation. Rather, it relies on the weaker claim that, regardless of their sexual orientation, people can choose whether to form same-sex or different-sex relationships. However, even if we grant this claim, the argument faces a serious difficulty. Though homosexual people sometimes do have the choice to form relationships with people of the opposite sex (and thus, perhaps, form a fertile couple), making this choice would have significant personal costs. It would require overriding one's sexual inclinations. It is likely also to require forming a relationship with someone whom one does not love. It may require dishonesty about one's own sexual orientation and motivations. It is doubtful whether we should require individuals to make such costly choices in order to have genetically-related children with their partners.

Consider the following case:

(Lyle & Leila) Lyle and Leila, present to a fertility specialist. The heterosexual couple would like to have a genetically-related child but without assistance they are unable to do so. Lyle has a low sperm count, while Leila produces very few eggs. Either would be able to have a child naturally with another partner of normal fertility. But as a couple, their chances of conceiving

naturally are negligible. Moreover, both were aware of these facts before they formed a couple. Fortunately, there is a technology – intracytoplasmic sperm injection (ICSI) – that may enable them to conceive.

Like Hamish and Harry, Lyle and Leila knew before forming a relationship that they could reproduce naturally if they chose different partners. Moreover, the psychological costs for them of choosing different partners would probably have been lower than for Hamish and Harry, since at least they would not have had to over-ride their sexual orientation. Nevertheless, few would object to the provision of ICSI in this case on the grounds that Lyle and Leila could have had children naturally if they had chosen different partners. The presence of this option seems to provide no or insufficient reason for refusing access to assisted reproduction. It is therefore difficult to see how it could provide a sufficient ground for refusal of IVG in the case of a same sex couple.

Moreover, there is no necessary, conceptual connection between same sex relationships and infertility. It just happens to be a feature of our biology that same sex humans do not reproduce. But if IVG were developed, this would no longer be so. To choose to be in a relationship with a member of the same sex of the same species would not then be to choose to be infertile. Thus, the very development of same-sex IVG would undermine one premise of the present argument for denying it to same-sex couples.

II. TREATMENT VERSUS ENHANCEMENT

A second argument for prohibiting same-sex IVG holds that, whereas for same-sex couples infertility is normal, for different-sex couples it is not. Thus, while different-sex IVG could be regarded as a treatment – an intervention intended to restore normal functioning – same-sex IVG must instead be viewed as an enhancement – an intervention which aims to augment functioning to a supranormal level.

This difference could be important. Some regard the distinction between treatment and enhancement as morally significant, holding that engaging in enhancement is typically morally problematic, perhaps even morally wrong, whereas undergoing treatment is not.[25,26] If IVG for same-sex couples counts as an enhancement, then perhaps there would be good grounds for prohibiting it, even while permitting IVG treatments for different sex couples.

There is, however, scope to question the classification of same-sex IVG as an enhancement. Though infertility might be the norm for same-sex couples, it is not obvious that this is the relevant standard of normalcy. Perhaps we should instead focus on what is normal for ‘romantic couples – sexes not specified’. If we consider romantic couples as a single group, disregarding whether they are same-sex or different-sex couples, then it seems clear that fertility is the norm. And if this is the relevant standard for normalcy, we could regard the infertility endured by same-sex couples as a deviation from what is normal in precisely the same way that the infertility endured by, say, ‘incompatible’ couples like Lyle and Leila is a deviation from the norm. On this interpretation, same-sex IVG could qualify as a treatment.

There is also scope to question whether reproductive assistance for infertile different-sex couples always qualifies as a treatment rather than enhancement. Some would hold that treatments must be responses to diseases, disorders or disabilities. It is not clear that infertility need be due to any of those things, especially in cases where it is caused by

incompatibility between partners rather than absolute infertility in one member of the pair. It may be, then, that both same-sex and different-sex IVG would, in some circumstances, be enhancements.

In any case, pinning an argument for prohibiting same-sex reproduction on the treatment-enhancement distinction seems a risky strategy to take, since the moral significance of the treatment-enhancement distinction is hotly disputed. Two of the authors have argued against its significance elsewhere.[27,28] Moreover, even those who regard it as significant and believe that enhancements should generally be prohibited are typically still willing to entertain that there might be good reasons to make exceptions to this blanket prohibition, for example, where there are good reasons to provide a particular enhancement. We believe that there are good reasons to make same-sex IVG available even if it is an enhancement. Doing so would allow many same-sex couples to achieve a highly valued outcome (having genetically-related children) and would not directly harm others (a point to which we will return below).

III. UNNATURALNESS

New assisted reproduction technologies, and other biomedical technologies that extend the boundaries of orthodox medicine, are often alleged to be contrary to nature and therefore ethically problematic. No doubt some would object to same-sex IVG on similar grounds.

In order to assess the suggestion that same-sex IVG would be unnatural, we should distinguish between some different senses of ‘unnaturalness’. David Hume helpfully distinguished between three different concepts of nature; one which may be opposed to “miracles”, one to “the rare and unusual”, and one to “artifice”.[29, pp. 473-475] This taxonomy suggests a similar approach to the concept of unnaturalness. We might equate unnaturalness with miraculousness, with rarity or unusualness, or with artificiality.

Clearly, producing children via same-sex IVG need not be literally miraculous. However, it might well qualify as unnatural on each of the other senses. At least at first, same-sex IVG would certainly be unusual. It would also be artificial. To say that something is artificial is roughly to say that it involves human intervention, or perhaps certain types of complex or sophisticated human intervention (such as the use of *technology*). IVG is, arguably, a paradigmatic example of an artificial process.

Few would argue that same-sex IVG ought to be prohibited merely because it is unusual. But some might object to its artificiality, perhaps even holding that it should be prohibited on this basis. This suggestion seems to have some implausible implications, however. Almost all medical therapies are artificial. Similarly, the works of art and the buildings we live in are plausibly artificial. But treating disease, making art and constructing buildings can be good. Moreover, for many of us, their artificiality doesn’t seem to detract at all from their goodness; it is not as though medical treatment is objectionable insofar as it’s artificial, but good insofar as it cures disease.

Perhaps it could be argued that, though artificiality and unusualness are not *generally* problematic, they *are* problematic within the specific realm of human reproduction. Leon Kass argues that “... the severing of procreation from sex, love and intimacy is inherently dehumanizing, no matter how good the product”,[30] while Margaret Sommerville holds that “the most fundamental human right of all is the right to be born

from natural human origins that have not been tampered with by anyone else”. [31, p. 198] These claims could be interpreted as assertions of the view that artificiality has no place *in human reproduction*.

However, even this view has some implausible implications. Artificial ‘tampering’ with reproduction is now commonplace in developed nations, from the use of amniocentesis to detect abnormalities in the foetus, to the use of life saving medical experience and equipment to assist with the delivery of premature babies, to the use of surrogacy, *in vitro* fertilization and artificial insemination by infertile couples. *In vitro* fertilisation was itself described as “against nature” at an early conference on its development in 1972. [32] Even the use of contraception to control fertility must be classified as artificial tampering with natural human reproduction. If Kass and Sommerville are right and artificial interference in human reproduction is objectionable, then it seems that we must regard all of these practices as objectionable. But this is counter-intuitive (and is also inconsistent with our assumption that it is permissible to provide existing assisted reproduction services to different-sex couples). Even within the limited sphere of reproduction, it seems doubtful whether artificial interference is inherently objectionable.

To avoid this problem, a critic of same-sex IVG could appeal to a further concept of unnaturalness according to which to be unnatural is just to be contrary to some *natural moral law* – that is, roughly, a set of moral norms that is not man-made but is inherent in or derived from nature. On such a concept of unnaturalness, there is no question whether something unnatural is objectionable or wrong; being wrong is part of what it is to be unnatural. However, claiming that the creation of same-sex parented children is unnatural in this sense provides no argument or reason for thinking that it is wrong. It is simply a way of asserting that it is wrong. A further argument for why the putative natural moral law prohibits same-sex IVG would need to be provided.

One possible argument is suggested by the literature on sexual ethics and same-sex marriage, where a natural moral law has also been widely invoked. Drawing on Aristotelian and Thomist traditions, some natural law theorists opposed to homosexual acts and same sex marriage have sought to ground their arguments on the idea that reproduction is a basic human good, and, crucially, that (different-sex) marriages are a uniquely suitable setting within which to realise this good.¹ They have then argued that engaging in homosexual acts and recognising same-sex unions are objectionable because they tacitly deny the unique suitability of different-sex marriage for reproduction. [33-35] One can imagine an analogous argument being offered against the provision of same-sex IVG, which might also be thought to tacitly deny the privileged status of different-sex marriage as a setting for reproduction.

We are not in a position to fully develop and critique this possible line of argument here. Instead, we will simply outline three major challenges that it would face.

First, the claim that different-sex marriages are a uniquely suitable setting for reproduction is a controversial philosophical or theological claim. Accepting such claims as a basis for regulation would be inconsistent with liberalism, which requires neutrality between controversial and competing accounts of the human good.

¹ Often left implicit is the further premise that assisted reproduction is not also a basic human good.

Second, at least in some liberal democracies, accepting the claim that different-sex marriages are a uniquely suitable setting for reproduction would be in tension with actual policy in other, related areas. Many states have, for example, sought to lower the legal hurdles faced by homosexuals seeking to form families despite influential religious views which regard homosexuality as contrary to a natural moral law. Particularly relevant in the present context is that many jurisdictions have sought to enable same-sex couples to form families. For example, in the state of Victoria, the *Charter of Human Rights and Responsibilities Act 2006* and subsequent legislation recognises same-sex parented families and attempts have been made to improve the access of same-sex couples to biomedical interventions that enable them to found families. The *Assisted Reproductive Technologies Act 2008* ensures that single women and same-sex couples have the same access to assisted reproduction as different-sex couples. In the Second Reading Speech the Attorney-General stated that “persons seeking to undergo ART must not be discriminated against on the basis of [their] sexual orientation, marital status, race or religion”.^[36] The Act also introduces a presumption that if a woman in a lesbian relationship undergoes a procedure as a result of which she becomes pregnant, she is presumed to be the mother and her female partner is presumed to be a legal parent of the child provided she was the woman’s partner at the time she became pregnant and consented to the procedure.^[37] It would be difficult to reconcile these reforms with a prohibition on same-sex IVG based on the idea that different-sex marriage is a uniquely suitable setting for reproduction.

Third, the possibility of IVG might in fact undermine the central premise in the natural law argument sketched above: the claim that different-sex marriage is a uniquely suitable context for reproduction. This premise has typically been grounded on the idea that, unlike same-sex unions, different-sex marriages are procreative in kind; they are unions of the sort that are capable of and “oriented to” realizing one of the distinctive goods of marriage, namely, the creation and rearing of children.^[35, pp. 427, 432] In response to the possibility of same-sex couples creating children with the assistance of gamete donors, natural law theorists have fine-tuned this claim so that to be procreative in kind, a union must be capable of and oriented to creating children who “each can only have two parents and who are fittingly the primary responsibility (and object of devotion) of *those two parents*”.^[33, p. 131 (Finnis’ italics)] But if IVG were possible, same-sex couples could also be procreative in kind, even on this strict criterion; same-sex unions could produce children with only two parents who would then be raised by those same two parents. Natural law theorists opposed to endorsing same-sex unions would thus be deprived of their central basis for distinguishing between different-sex and same-sex unions. In response to this problem, opponents of homosexuality and same-sex marriage could seek to further fine-tune their account of what counts as a union that is of the procreative kind. They might hold that a couple must be capable of reproducing without technological help, or capable of reproducing through typical forms of sexual intercourse.^[35, p. 430] However this will look suspiciously like an *ad hoc* amendment to the argument.

IV. THE WELLBEING OF THE CHILD

A more promising argument for denying IVG to same-sex, but not different-sex, couples would appeal to the welfare of the resulting child. Considerations of wellbeing are, after all, well accepted as grounds for legal restrictions both in liberal theory and in actual liberal societies. *Child* wellbeing is arguably an especially important consideration in setting public policy since children are vulnerable members of society, dependant on others for their welfare and wellbeing and without a voice in public debate. If it could be

shown that children conceived via same-sex IVG are likely to have substantially lower wellbeing, on average, than other children – including children conceived through IVG from *different*-sex parents – then perhaps there would be grounds for selectively prohibiting the use of IVG by same-sex couples.

Note that prohibition of same-sex IVG could not be grounded on the claim that children born through this method would be *harmed*. Even if children conceived through same-sex IVG were significantly worse off than other children, they would not be harmed by their parents' decision to reproduce. After all, if the parents had not reproduced, those children would not have existed at all. Perhaps if the child's life was so horrible as to be not worth living then we could say that the child had been harmed by being brought into existence.[38] But no-one is suggesting that the lives of children born to same-sex genetic parents would be so bad. It seems clear that they would be better off existing with same-sex genetic parents than not existing at all. So a prohibition on same-sex reproduction could not be justified on the basis that it is necessary to prevent harm to the future child.

Perhaps, however, concerns about the wellbeing of the resulting child could justify restrictions on access to IVG even though that child would not be harmed by the use of IVG. For example, perhaps having a child likely to have reduced wellbeing could be regarded as an impersonal harm – a harm 'from the point of view of the universe' – and could be regulated on this basis. But why should we expect children with same-sex genetic parents to have reduced wellbeing? And could a reduction in wellbeing really justify a prohibition on same-sex IVG?

Parenting Skills

One answer to the first question might be that same-sex couples would typically provide less effective parenting than different-sex couples. It might be argued that couples of different sexes typically have complementary parenting skills that same-sex couples lack. However, if this is true, then we would expect existing children raised by same-sex couples to be worse off, on average, than those raised by different sex couples. There is little evidence that this is the case. Empirical research has demonstrated that children raised by same-sex social parents fare no worse than other children on a range of standard criteria measuring relationships and development.[39,40, pp. 6, 32] Studies conducted in a range of countries indicate that what is important is the quality of family relationships, the quality of the parenting, the level of support within the family and the family's access to resources, not the structure of the family. A recent review of studies from 1978 to 2000 concluded that they "did not reveal evidence that children of lesbian mothers differed from other children on emotional adjustment, sexual preference, stigmatization, gender role behaviour, behavioural adjustment, gender identity or cognitive functioning" and further that the studies were remarkably consistent in these findings.[41]

Discrimination & Disapproval

There are some more convincing reasons to suppose that children conceived through same-sex IVG might have lower wellbeing, on average, than other children (including children produced through IVG from different-sex parents). These children are, for example, likely to be victims of discrimination and social disapproval. Studies have shown that children raised by same-sex couples suffered bullying and discrimination because of the sexuality of their parents. In one study, half the children surveyed had

experienced homophobia by the age of 10.[40, p. 33] As the abovementioned studies suggest, this does not appear to have a significant impact on their overall wellbeing. However, children *genetically descended from* same-sex parents might be even more likely to suffer from discrimination and negative attitudes because of the ‘all male’ or ‘all female’ origins of their DNA. Additionally, it might be suggested that, to the extent that homosexuality is, or is taken to be, partially genetic in basis, children born of homosexual parents might be viewed as more disposed to homosexuality themselves. This could make them even more likely targets for discrimination or negative attitudes.

Having same-sex genetic parents may restrict one’s wellbeing by making one a victim of discrimination or negative social attitudes. However it is difficult to see how this could justify prohibiting IVG for same-sex couples. The likelihood that a couple’s child will be subjected to discrimination or negative attitudes is not normally regarded as providing good reasons to prevent reproduction. In some societies, children of Black or mixed-race couples are subjected to discrimination, but we would not contemplate restricting their freedom to reproduce or access to assisted reproduction because of this. Not only would doing so significantly disadvantage already victimised groups, it would also be seen as implicitly condoning or encouraging the objectionable social attitudes in question.[42]

Disturbing Knowledge

Children conceived via same-sex IVG might also be disturbed by the mere knowledge of the circumstances of their conception.

One possibility is that the children would be disturbed by the technological nature of the IVG process. However, this seems unlikely to be a significant effect. Children conceived via IVF might also be disturbed by the technological means of *their* conception, yet there is no evidence of any difference in cognitive or emotional development between IVF children and children conceived naturally.[43] In any case, if children conceived through IVG from same-sex parents would be disturbed by the technological nature of the IVG process, surely children conceived through IVG from *different-sex* parents would be similarly disturbed, so it’s not clear how this concern could justify different access to IVG for same-sex and different-sex couples.

Another possibility is that the children of same-sex genetic parents would be disturbed by knowledge of their genetic origins, that is, by the knowledge that their DNA comes from two persons of the same sex. It seems somewhat doubtful whether such knowledge would have a significant effect on wellbeing. Knowledge about one’s origins is surely a minor determinant of wellbeing compared with other factors like health status, economic wellbeing, and the quality of one’s relationships. While it was disturbing to Victorians to discover that they were descended from a common ape ancestor, most enlightened people today have got over this. And it would be presumably more disturbing to discover that one was descended from an ape than from two male human beings.

But let us grant that knowledge of their (currently) unusual genetic origins would nevertheless significantly restrict the wellbeing of the children conceived through same-sex IVG. We should also grant that the wellbeing of children conceived through *different-sex* IVG would not be restricted in the same way; their genetic origins would be similar to those of children conceived naturally. (Although if IVG involved the creation of cloned embryos, the genetic material would be passed down in a less direct way.[12])

Nevertheless, we question whether same-sex IVG should be prohibited merely because the resulting child might be disturbed by his or her genetic origins. Children descended from notorious criminals or tyrants might well be disturbed by their origins, but few would seek to prevent descendants of men like Pol Pot, Josef Mengele or Edi Amin from having children, for example, by restricting their access to assisted reproduction. Indeed, liberal societies have been willing to allow couples to reproduce (and access assisted reproduction) even when there are much more serious risk factors for reduced child wellbeing, for example, where the prospective parents are very poor, terminally ill, in a dysfunctional relationship, or carriers of a genetic disease. In most if not all of these cases we would regard the possible impediment to child wellbeing as insufficient to justify constraints on access to assisted reproduction. If this is right, then it would clearly be unjustified to restrict access to same-sex IVG on the basis of a much milder impediment to child wellbeing – the concern that children would be disturbed by their unusual genetic origins. If there is any ‘harm to the universe’ involved in having children who might be disturbed in this way, it simply is not serious enough to justify withholding assisted reproduction.

V. CONCLUSIONS

Advances in stem cell research may make it possible for same sex couples to conceive genetic children via *in vitro* gametogenesis (IVG). IVG could also be used as a fertility treatment for some different-sex couples who are unable to reproduce naturally or using existing assisted reproduction technologies.

We have examined four arguments for prohibiting same-sex IVG while allowing different-sex IVG.

The first argument attempted to justify different treatment for same-sex and infertile different-sex couples on the grounds the former have chosen to be infertile whereas the latter have not. It failed for two reasons. First, we can imagine different sex couples (like Lyle and Leila) for whom infertility is also a choice, and to whom we would not deny assisted reproduction. And second, were same-sex IVG technically feasible, choosing to be in a same-sex couple would *not* be choosing to be infertile.

The second argument appealed to the treatment-enhancement distinction to justify distinguishing between same-sex and different-sex IVG. It claimed that different-sex IVG qualifies as a treatment whereas same-sex IVG would be an enhancement. We challenged this argument both by questioning the classification of different-sex and same-sex IVG as, respectively, treatment and enhancement, and by doubting the moral significance of the treatment-enhancement distinction. We also noted that there are good reasons to make IVG available to same-sex couples even if we grant both that it would qualify as an enhancement and that enhancements are generally morally problematic.

The third argument held that we should prohibit same-sex IVG because it is unnatural to create children with same-sex genetic parents. A problem was to identify a concept of unnaturalness according to which this is both true and morally important. Creating such children would certainly be unnatural in the senses of being unusual and artificial, but neither unusualness nor artificiality is morally significant. Alternatively, it could be argued that same-sex IVG is unnatural (and thereby also immoral) in the sense of being contrary to a natural moral law. Perhaps this argument could be grounded on the claim that different-sex marriages are a uniquely suitable setting for reproduction. However,

grounding a prohibition on such a controversial claim would be inconsistent both with liberalism, and with reforms which many actual liberal democracies have enacted. Moreover, this claim would be undermined by the possibility of IVG, which would call into question the thought that only different-sex unions are procreative in kind.

Finally, the fourth argument appealed to the claim that children conceived through same-sex IVG could be expected to have reduced wellbeing compared to children conceived through different-sex IVG, perhaps because they would be victims of discrimination or disapproval or would be disturbed by the knowledge of their genetic origins. However, even if this is true, it would not justify a prohibition on same-sex IVG. Prohibiting same-sex IVG on the grounds that the resulting children will be the victims of negative social attitudes could be viewed as implicitly supporting those attitudes and is inconsistent with providing assisted reproduction to members of victimised racial minorities. Prohibiting same-sex IVG on the grounds that the resulting children will be disturbed by their genetic origins is inconsistent with providing assisted reproduction in a wide range of circumstances where the resulting children are at elevated risk of reduced wellbeing on certain dimension(s), for example, where the parents are in a non-ideal relationships.

We have been unable to identify any persuasive argument for distinguishing between same-sex and different-sex couples in regulating access to IVG. Unless such an argument can be provided, consistency requires that IVG should be made available both to different-sex and same-sex couples, or to neither. Granting same-sex and different-sex couples different liberties in respect of the use of this technology would be discrimination in the most fully pejorative sense of that term.

REFERENCES

1. Geijsen N, Horoschak M, Kim K, et al. Derivation of embryonic germ cells and male gametes from embryonic stem cells. *Nature* 2004;427(6970):148-154.
2. Toyooka Y, Tsunekawa N, Akasu R, et al. Embryonic stem cells can form germ cells in vitro. *Proceedings of the National Academy of Sciences* 2003;100(20):11457-11462.
3. Nayernia K, Nolte J, Michelmann HW, et al. In Vitro-Differentiated Embryonic Stem Cells Give Rise to Male Gametes that Can Generate Offspring Mice. *Developmental Cell* 2006;11(1):125-132.
4. Kerkis AA, Fonseca SASAS, Serafim RCRC, et al. In vitro differentiation of male mouse embryonic stem cells into both presumptive sperm cells and oocytes. *Cloning and stem cells* 2007;9(4):535-48.
5. Hubner K, Fuhrmann G, Christenson LK, et al. Derivation of Oocytes from Mouse Embryonic Stem Cells. *Science* 2003;300(5623):1251-1256.
6. Lacham-Kaplan O, Chy H, Trounson A. Testicular Cell Conditioned Medium Supports Differentiation of Embryonic Stem Cells into Ovarian Structures Containing Oocytes. *Stem Cells* 2006;24(2):266-273.
7. Ohinata Y, Ohta H, Shigeta M, et al. A signaling principle for the specification of the germ cell lineage in mice. *Cell* 2009;137(3):571-584
8. Tesar PJ, Chenoweth JG, Brook FA, et al. New cell lines from mouse epiblast share defining features with human embryonic stem cells. *Nature* 2007;448(7150):196-199
9. Chen HF, Kuo HC, Chien CL, et al. Derivation, characterization and differentiation of human embryonic stem cells: comparing serum-containing versus serum-free media and evidence of germ cell differentiation. *Hum. Reprod.* 2007;22(2):567-577.

10. Clark AT, Bodnar MS, Fox M, et al. Spontaneous differentiation of germ cells from human embryonic stem cells in vitro. *Hum. Mol. Genet.* 2004;13(7):727-739.
11. Testa G, Harris J. Ethics and Synthetic Gametes. *Bioethics* 2005;19(2):146-166.
12. Mertes H, Pennings G. Ethical aspects of the use of stem cell derived gametes for reproduction. *Health Care Analysis* forthcoming.
13. Takahashi K, Yamanaka S. Induction of Pluripotent Stem Cells from Mouse Embryonic and Adult Fibroblast Cultures by Defined Factors. *Cell* 2006;126(4):663-676.
14. Nakagawa M, Koyanagi M, Tanabe K, et al. Generation of induced pluripotent stem cells without Myc from mouse and human fibroblasts. *Nat Biotech* 2008;26(1):101-106.
15. Takahashi K, Tanabe K, Ohnuki M, et al. Induction of Pluripotent Stem Cells from Adult Human Fibroblasts by Defined Factors. *Cell* 2007;131(5):861-872.
16. Park I, Zhao R, West Jea. Reprogramming of human somatic cells to pluripotency with defined factors. *Nature* 2008;451(7175):141-146.
17. Drusenheimer N, Wulf G, Nolte J, et al. Putative human male germ cells from bone marrow stem cells. *Society Of Reproduction & Fertility Supplement* 2007;63:69-76.
18. Dyce PW, Wen L, Li J. In vitro germline potential of stem cells derived from fetal porcine skin. *Nat Cell Biol* 2006;8(4):384-390.
19. Yu J, Vodyanik MA, Smuga-Otto K, et al. Induced pluripotent stem cell lines derived from human somatic cells. *Science* 2007;318(5858):1917-1920.
20. The Hinxton Group. Consensus statement: Science, ethics and policy challenges of pluripotent stem cell-derived gametes. 2008 11 April 2008. Available at <http://www.hinxtongroup.org/>.
21. Roberts M. UK MPs reconsider artificial gamete ban. *BioNews* 2008 18 March 2008. Available at http://www.bionews.org.uk/page_13333.asp. Accessed 25 June 2010.
22. Alghrani A. The Human Fertilisation and Embryology Act 2008: a missed opportunity? *Journal of Medical Ethics* 2009;35(12):718-719.
23. New Scientist. Getting ready for same-sex reproduction. *New Scientist* 2008 2 February 2008. Available at <http://www.newscientist.com/article/mg19726413.000-editorial-getting-ready-for-samesex-reproduction.html>. Accessed 25 June 2010.
24. Aldhous P. Are male eggs and female sperm on the horizon? *New Scientist* 2008. Available at <http://www.newscientist.com/article/mg19726414.000-are-male-eggs-and-female-sperm-on-the-horizon.html>. Accessed 25 June 2010.
25. Fukuyama F. *Our Posthuman Future: Consequences of the Biotechnology Revolution*. New York: Profile Books, 2002.
26. Sandel M. *The Case Against Perfection: Ethics in the Age of Genetic Engineering*. Cambridge, MA: Harvard University Press, 2007.
27. Douglas T. Moral enhancement. *Journal of Applied Philosophy* 2008;25(3):228-245.
28. Savulescu J. Genetic interventions and the ethics of enhancement of human beings. In: Steinbock B, editor. *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press, 2006:516-535.
29. Hume D. *A Treatise of Human Nature*. Second ed. Oxford: Clarendon Press, 1978.
30. Kass L. The Wisdom of Repugnance. *The New Republic* 1997;216(22).
31. Sommerville M. Children's human rights and unlinking child-parent biological bonds with adoption, same-sex marriage and new reproductive technologies. *Journal of Family Studies* 2007;13(2):179-???
32. Jonsen A. *The Birth of Bioethics*. New York: Oxford University Press, 1998.

33. Finnis J. The good of marriage and the morality of sexual relations: Some philosophical and historical observations. *American Journal of Jurisprudence* 1997;42:97-134.
34. Grisez G. *The Way of the Lord Jesus, Vol. 2: Living a Christian Life*. Quincy, IL: Franciscan Press, 1993.
35. Lee P. Marriage, procreation, and same-sex unions. *The Monist* 2008;91(3-4):422-438.
36. Victoria, Parliamentary Debates, Assembly, 10 September 2008, 3442 (Robert Hulls, Attorney General)
37. s13 Assisted Reproductive Technologies Act 2008 (Victoria).
38. Robertson J. *Children of Choice*. Princeton, NJ: Princeton University Press, 1994.
39. Millbank J. *Meet the Parents: A Review on the Research of Lesbian and Gay Families* 2002.
40. Victorian Law Reform Commission. Assisted Reproductive Technology & Adoption: Final Report 2007.
41. Anderssen N, Amlie C, Ytterøy EA. Outcomes for children with lesbian or gay parents. A review of studies from 1978 to 2000. *Scandinavian Journal of Psychology* 2002;43(4):335-351.
42. Little M. Cosmetic surgery, suspect norms, and the ethics of complicity. In: Parens E, editor. *Enhancing Human Traits: Ethical and Social Implications*. Washington, DC: Georgetown University Press, 1998.
43. van Balen F. Development of IVF Children. *Developmental Review* 1998;18(1):30-46.