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## HUMAN REPRODUCTIVE AND GENETIC TECHNOLOGY

### **Prior reading recommended**

Weinberg, Robert A. "The dark side of the genome". In Teich, Albert H. *Technology and the Future*, 7th edition, 1997.

Frohock, Fred M. "Special Care: Medical Decisions at the Beginning of Life." in Teich, Albert H. *Technology and the Future*, 7th edition, 1997.

Two popular works which are readily available may also be found useful:

Suzuki, David T. & Knudtson, Peter (1990). *Genethics: the ethics of engineering life*.

Don Mills ON: Stoddart. [QH 442 S89 1990]

Rifkin, Jeremy (1983). *Algeny: a new word - a new world*. Penguin.

The March 1996 issue of *Policy Options* contains very important articles from the Canadian viewpoint.

### **Scope**

The field of human reproductive and genetic technology has been selected for study because it brings important moral issues into focus which are currently being debated in the Standing Committee on Health of the Parliament of Canada<sup>1</sup> and in the United Nations (International Convention on the Human Genome).<sup>2</sup> 'Moral' here includes 'economic' because many of the issues concern the allocation of resources under conditions of scarcity, which happens to be one of the classical definitions of economics.

The technological scope of HRT includes:

- contraceptive technology
- the "New Reproductive Technologies" (NRT).
- foetal diagnosis and therapy
- the use of electively aborted foetal tissue for transplantation (FTT)<sup>3</sup>

This excludes other aspects of human gene technology, some with an important moral dimension e.g. post-natal gene somatic therapy<sup>4</sup>, the use of DNA for the identification of individuals, and the Human Genome Project. Genetic screening is the subject of a film and associated commentary elsewhere in this book.

Before entering into the technical discussion, I want to introduce the idea of motivational context.

### **Motivations of the principal actors**

It is important to recognize that the motivation behind any of these techniques can vary greatly from case to case. There are **individual** motives involved in family planning or sex selection and in the use of the NRT to address infertility problems or to achieve a desired type of offspring. The motives may be **medical**: for example to correct a physical defect in the foetus by micro-surgery; to correct a chemical malfunction of the foetus with drugs; to de-select embryos or foetuses bearing harmful genes. Note that personal problems are commonly medicalized (see later section on this topic) in order to avoid certain social stresses. The motives may be **social (collective interests)** as in the practice of eugenics or in genetic screening for diseases

which entail large public expenditures. Finally, the motives may be purely **commercial** as the new technologies open up opportunities for profit in drug companies, in sex selection and fertility clinics..

These contexts should be born in mind as the technological aspects of Human Reproduction are addressed.

### **Contraceptive technologies**

Contraception offers an excellent example of social controls over technology.<sup>5</sup> Threat of lawsuits, inadequate government financing and pressure from social and religious groups have forced all but one major US pharmaceutical company out of the field of contraceptive research according to a report by a Committee of the US. National Research Council. No developments have taken place since the pill and the IUD in the 1960s. Up to 3 million accidental pregnancies occur yearly in the USA as a result of contraceptive failures. Half the 1.5 million/a abortions result from them. Surgical sterilization is often the result. In Europe there is a much wider range of contraceptive technology available including subcutaneous implants, new oral and injectable contraceptives and a variety of sterilization devices and IUDs. Then there is the Post-coital Menses inducer RU486 which is the object of particularly vigorous campaigns from various moral camps. I have discussed this elsewhere: there is also a WEB page provided by the Polytechnic University of East Anglia devoted to the issue<sup>6</sup>.

One of the strange aspects of contraception research is the low priority that has been given to male contraception<sup>7</sup>. This may have something to do with a perceived threat to masculinity.

### **The New Reproductive Technologies**

The New Reproductive Technologies represent an extension into the sphere of reproduction of the intensive division of labour characteristic of the Industrial Revolution and of out-sourcing that is characteristic of the Post-Industrial model. The following activities, previously carried out by a team of two, are now outsourced and performed by numerous actors, including specialized technicians:

- Production of eggs and sperm
- Fertilization
- Gestation
- Social parenting

The new technologies include the following:

#### **Artificial Insemination**

Artificial insemination either AIH or AID (husband or donor). This is really a very old technique having been performed in the UK as early as 1799.

#### **Egg donation**

The counterpart to AI is egg donation. The procedure is then rather more complicated.

1. Match contracting mother and egg donor for physical type
2. AID with contracting husbands sperm
3. Lavage (no surgery or anaesthetic) to remove fertilized egg from contractor
4. Egg implantation in contracting mother (office procedure)

## 5. Natural birth

A moral problem has arisen with the growing practice of obtaining oocytes (eggs) from women desiring In Vitro Fertilization but unable to pay for the procedure. In a standard IVF cycle all the woman's eggs are fertilized with her partner's sperm and the resulting embryos not immediately implanted are cryopreserved. If the number of available eggs is reduced, her chances of successful pregnancy though repeated cycles are less<sup>8</sup>.

### **In vitro fertilization**

The next stage in complication involves "in vitro" fertilization. "in vitro" is the Latin for "in glass" and refers to the laboratory glassware in which the fertilization takes place outside the body. Within the body the process is known as "in vivo" or "in utero".

For the "in vitro" procedure super-ovulation is usually induced with drugs (menotropins). As a result there are usually several fertilized eggs in the dish. The problem then is what may be done with them. What is their moral and legal status?

Researchers are keen to carry out experiments on the numerous surplus embryos produced by the in vitro technique. This includes freezing spare embryos in liquid nitrogen for later use<sup>9</sup>. This results in further oocyte retrieval being unnecessary, "thus avoiding the rare but real risks of hematoma, infection, and bowel perforation."<sup>10</sup> Rothschild (1984) feels that there is a real danger of women losing control of what is in fact part of them to a generally male-dominated medical research institution. The Toronto General Hospital has decided to put a two-year limit on embryo storage after which unused ones will be destroyed or used for research. Toronto General East has different rules.

Who owns the embryo if the couple divorce or die? In a well publicized Australian case, *Ross v Ross*, the parents left an estate worth 1 M\$ after being killed in a plane crash. They made no mention of the embryos in their will. The court decided that the embryos could be implanted into volunteer Surrogate Mothers but that they would be considered the legal children of the Surrogate Mothers and could not inherit.

In *Davis vs. Davis* there were seven embryos. The parents divorced. Both sued for custody, he to destroy them, she to implant them. The court gave them to her on the grounds that human life begins at conception.

### **Surrogate contracts**

A social and legal complication may be introduced at this stage if a surrogate mother is contracted to perform the gestation. This would be forbidden under the new legislation.

"It is both legally and morally questionable as to whether individuals can make contracts dealing with parental rights to an unborn child where these rights are relinquished or created in exchange for money"

In some SM contracts, the SM agrees to have an abortion if tests reveal that the foetus is genetically or congenitally abnormal. This would not be enforceable as it constitutes intrusion into the woman's body against her will.

The commissioning husband might refuse to accept the child. The Stiver v. Malahof suit about this was tried on the Phil Donahue Show!

It is suggested that SM arrangements should be made between all four parents, that they should be non-enforceable and subject to family law rather than law of contract'

At the present time the medical profession controls the whole process. They judge whether the partners are stable. They screen the donors (but tend to reproduce themselves by selecting medical students). There are no standards.

Why should financial status count when it does not for children produced in the old way? Why should the existence of husband be relevant when it is not in ordinary births? These are some of the questions that have been raised. Under the proposed legislation, matters would be taken out of the hands of doctors and administered by a federally appointed board.

The system is characterized by poor record keeping both of children and donors. But a child might want to avoid marrying its half-sibling. A medical student donated 50 batches of sperm. Later in life he realized that some of his children might be marrying their half-brother or sister.

When all this is done a child may have five parents. One egg-donor; one sperm donor; one surrogate mother and two social parents.

Although it seems to me that the NRT enterprise is largely technology-driven (to which we must add the large profits to be made from the services) - ostensibly it is in response to a the problem of infertility to which I shall now turn. At the same time it opens up opportunities for genetic selection either for sex choice or for eugenic purposes which will be discussed later.

### **Infertility**

There are many causes of infertility, most of them social rather than genetic or developmental. Yet both the Warnock Commission in the United Kingdom and the Royal Commission on the New Reproductive Technologies in Canada treated the problem as exclusively a medical one.

Age is one of the primary determinants of infertility and the economic pressure for a dual income and a meaningful career moves women out of the optimum period of fertility.

Other factors are alcohol, tobacco, dieting -- the ideal female image vs. the rubesque. There are occupational exposures to toxic compounds. In some cases there has been a tubal ligation or vasectomy later regretted. Female infertility in the age range from 20 to 30 in Canada has tripled due to the epidemic of sexually transmitted disease which accounts for 15 to 30% of total infertility. We have little knowledge or statistics about male infertility and there has been a tendency to assume that the female partner in a barren marriage is "to blame".

Is the pressure on couples to have children biological or is it a social response to the stigma of selfishness or ill-health attached to childless couples? In any case, the services we choose in order to meet our desires determine what the problem is called. Once we choose to go to a doctor the problem is called infertility. We might have gone to a psychological counsellor or a lawyer rather than a doctor. In which case it

might have been called stress or incompatibility! As Maureen McTeer has pointed out, the British medical establishment moved into the vacuum caused by lack of government regulation in the United Kingdom to establish a voluntary regulatory body, but the result was "to cement in the minds of the public and politicians alike that reproductive technologies were therapeutic, beneficial and effective medical tools for the 'cure' of infertility."<sup>11</sup>

### **Alternative social responses**

Many possible social responses are open to childless couples as alternatives to the technical fix. They might adopt, look after foster children, change partners or simply accept the childless state.

Society, unfortunately, treats problems classed as medical very much more generously than other types of problem. There is less stigma. Time off work is allowed with pay and there may be insurance benefits. All these are social promoters of technicization which tend to overwhelm the many negative features of the NRT which include:

- risk of multiple pregnancies
- need for "selective reduction" of foetuses
- low chance of success
- need to ingest superovulatory drugs with unknown side effects
- strain on hospital neo-natal facilities.

### **Sex Selection**

The ability to choose a child's sex is really an unintended consequence of diagnostic techniques. Sex can be determined early in foetal development (in utero) from the chromosomes and a little later with ultrasound. Sexual selection is then achieved by aborting foetuses of the undesired sex.

In the case of IVF it is possible to do in vitro diagnosis and selection.

Some private clinics claim to be able to separate male from female sperm and to use the selected sperm for AIH.

The social problem of sex selection is that it almost invariably favours boys over girls and is characteristic of specific ethnic minorities. In a study of 8000 abortions carried out in a hospital in Bombay it was reported that all except three were to prevent the birth of female babies<sup>12</sup>. The practice of sex selection is spreading to Canada, though not necessarily by selective abortion.

### **Research**

The rapid development of new technologies calls for a steady supply of research material. British law has created "an entirely new stage of human development: all human embryonic life created in vitro is up until 14 days referred to as a pre-embryo and can be used for research purposes."<sup>13</sup>

### **Eugenics**

Eugenics is the science of improving the physical and mental qualities of human beings either through controlled selection of parents or through control of the factors influencing heredity.

Positive eugenics is concerned with selecting culturally favoured characteristics such as height and blue eyes in northern Europe and intelligence elsewhere (a sperm bank of Nobel prize-winners was established in California).

Negative eugenics is concerned with the elimination of undesirable traits from the population such as those causing hereditary disease or, more controversially, those thought to cause deviant behaviour.

Dysgenics is the increase in undesirable genes as a result of other human activities. If, for example, there were a hereditary component to intelligence, and if intelligence and socio-economic status were positively correlated, and if family size were negatively correlated with socio-economic status, then this set of conditions would have a dysgenic effect. Darwin, in *The Descent of Man*, pointed to the dysgenic effects flowing from the social and medical programs of his day.<sup>14</sup>

#### **Positive selection of parental phenotype**

The controlled selection of parents for positive eugenics is a political rather than a technological issue. "Controlled" selection implies the presence of a controller - the state, the party or the slave owner. And of course it implies that the controllers have some way of knowing what "improvement" means in this context. These matters are well beyond the scope of the course but one should not forget the strong hold these ideas had upon not only the Nazis but on English, American, and Canadian, opinion a hundred years ago. Positive eugenics is currently a taboo topic. But negative eugenics through the elimination of harmful genes is a topic of lively debate.

#### **Negative selection of parental genotype**

It is not inconceivable that, as a result of genetic screening, moral or even legislative pressure could be brought to bear on parents carrying defective genes to prevent conception. This matter is discussed elsewhere.

#### **Pre-implantation de-selection of embryos**

It is now possible, when using the NRT, to do a genetic diagnosis on an embryo at the 8-cell stage before implantation. "Such embryos can be biopsied (one or two cells removed without apparent detriment to the further development) and a variety of genetic tests performed by means of highly sensitive rapid DNA amplification technology<sup>15</sup>. If genes causing hereditary disease are present, the embryo can be de selected i.e. join the surplus embryos destined for research or destruction. The threat foreseen by some ethicists is that genetic manipulation might be attempted at this stage by the addition or deletion of specific gene sequences revealed by the Human Genome Project.<sup>16</sup>

#### **Foetal de-selection**

Foetal diagnostics through amniocentesis and other more recent techniques permit fetuses bearing genes for well-known diseases to be aborted if the mother chooses.

#### **Positive selection through germ-line therapy**

Germline therapy would involve changing the genetic constitution of the reproductive cells and thus passing the change on to future generations. This procedure has been judged too risky in most countries and is and will be forbidden in Canada if Bill C-47 becomes law.

The technical means are, however, now in place for parents to choose the type of offspring they will have; in other words, for positive eugenics.

## **The gene cafeteria**

The problem is that it is not very clear what ideal is to be aimed at. With cows we want more milk. But do we want more aggressive men and self-assertive women who will fight to the top of the corporate ladder. Or do we want a son like Jesus when we might get Jimmie Baker? Commercial interests may in fact hesitate before promoting any technique that enhanced the distribution of the cardinal virtues. As someone<sup>17</sup> has pointed out: Without greed, what would become of Wall Street; without lust what would happen to network TV; and without pride who could make a fortune in real estate? Nobel laureate N.Tinbergen said about all this<sup>18</sup> "I find it morally reprehensible and presumptuous for anybody to put himself forward as a judge of the qualities for which we should breed". Jonathan Glover<sup>19</sup> suggests that the best way to handle it would be the cafeteria approach: That is, each couple could decide what genes they desired to have. There should be a power of veto vested in some body appointed by society because strange requests are made. For example, since the identification of the gene for achondroplasia, the most common form of dwarfism, was announced, some sufferers from this abnormality have expressed a preference for a dwarf child<sup>20</sup>. Some congenitally deaf parents have likewise expressed a desire for a deaf child. There is a movement to justify the selection of genotypes with the euphemism "quality of the parenting experience" and "reproductive meaning"<sup>21</sup>. The child then becomes a means to parental satisfaction, not an end in herself or himself.

## **Moral Issues**

Certain deep moral issues underlie the particular ethical problems associated with technologically assisted reproduction and cognate matters. Most people adopt one of three metaphysical viewpoints: the fundamentalist view of life as sacred and apart from any scientific theory; the pure science view of life as ultimately reducible to chemical reactions; and the "science-spirit" view argued by scholars such as Margaret Somerville<sup>22</sup>. Without invoking the supernatural or adopting a religious stance she still considers humans to be sacred in some special sense. She contrasts her view with that of the Deep Ecologists who regard all life as equally sacred and claim that to favour humans is a form of "speciesism". The fundamentalist view is not amenable to reasoned discussion but one's position between science and science-spirit will probably determine whether one adopts a deontic ethic (based on "eternal" values) or a consequential ethic (in which values are determined by the expected outcome of the act).

"Like all knowledge, genetic knowledge is a social product, motivated by certain interests and delivered into a social environment where its arrival will have consequences."<sup>23</sup> The old question of whose interests are being served has to be asked. "Whose values are driving the growth and application of genetic knowledge and what alternatives are precluded by its dominance?". There is the fascination of the human gnome project, there are the pecuniary interests of fertility clinics and the special interest groups associated with certain diseases. Are resources being diverted from, from example, preventive medicine, where the money could do more good.

From the viewpoint of deontic ethics it would be wrong to spend money trying to keep genetically diseased Canadian children alive when an equal sum could save

thousands more healthy children in other countries who cannot afford vaccines or clean water.

It has been argued that laws must protect the individual's right of disclosure of genetic information and must limit the claims of employers and insurance companies<sup>24</sup> to information about late-onset conditions or susceptibility.<sup>25</sup> This obviously runs counter to "efficient market theory" which forms the basis of our capitalist system and requires perfect information in order to function.

The Royal Commission on the New Reproductive Technologies recommended legislation to prohibit, with criminal sanctions:

- using embryos in research related to cloning
- animal/human hybrids
- use of eggs from female fetuses
- sale of eggs, sperm, zygotes, or foetal tissue
- commercial surrogacy arrangements

In July 1995 the Canadian Health Minister called for a voluntary moratorium on the following procedures which were formally prohibited in Bill C-47 introduced into the Parliament of Canada on 23 October 1996:

- sex selection for non-medical purposes
- commercial surrogacy arrangement
- sale of eggs, sperm, zygotes, or foetal tissue
- ovum donation as part payment for IVF procedures
- germ-line alteration
- artificial wombs (ectogenesis)
- animal/human hybrids
- cloning of human embryos
- retrieval of ova from dead and fetal bodies for donation or research.

Note that retrieval of sperm from dead bodies is not disallowed, neither is sperm screening to select for sex.<sup>26</sup>

Michelle Mullen<sup>27</sup> has called for a reconceptualization of the whole debate in terms of the status of women rather than the status of the foetus where is now seems to be focused (which, I believe, may reflect a patriarchal bias). We are dealing here with allocation of power.

The commercialization of the procedures is a central issue. Sex and reproduction have been commercialized since historical records exist. Prostitution is claimed to be the price paid for monogamy. The moral argument against the commercialization of the NRTs is that it "makes objects of human beings, treating them as means to other ends, rather than serving each person as an end in himself or herself." In the selection of ideal types, "it is far too easy for the child to be viewed, not as a person, but as a desirable good."<sup>28</sup> Bernard Dickens, on the other hand, feels that poor women are penalized if they cannot trade spare eggs for IVF services<sup>29</sup>.

## **Questions**

1. Professor Nisker asks "Canadians do not consider reduction in positive therapeutic outcome because of financial misfortune morally acceptable in the treatment of cancer

or heart disease; why is a reduction in positive outcome to fund therapy permissible in IVF?"

Nisker is referring to oocyte donation to rich couples by financially disadvantaged mothers who cannot afford the IVF treatment. In giving up some eggs the poor mothers reduce their chances of success. This procedure would be forbidden in Bill C-47. Do you think this will penalize poor women?

2. On 1 June 1995, a law came into effect in China<sup>30</sup> forbidding couples diagnosed as having genetic diseases from marrying unless they agree to be sterilized or to take "long term contraceptive measures". The French company Genset has negotiated an exclusive contract with the Chinese Academy of Medical Sciences to screen China's population for genetic diseases. Many Western geneticists have said that the information could be used in the marriage law and that this would bring genetic research into disrepute. Do you agree?

3. What is the moral argument against the commercialization of the NRT?

4. In what procedures of the NRT is superovulation induced by menotropins and what moral and technical problems result from it?

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<sup>1</sup>Bill C-47 of the 35th Parliament.

<sup>2</sup>*New Scientist*, 2 Nov. 1996, p.3,8.

<sup>3</sup>Mullen, Michelle A. "The policy perils of New Reproductive Technologies". *Policy Options* (March 1996), p.15-17.

<sup>4</sup>Frohock, Fred M. "Special Care: Medical Decisions at the Beginning of Life." in Teich, Albert H. 6th edition, 1993.

<sup>5</sup>Gooderham, 1990.

<sup>6</sup>Maintained by Sharon Tabberer.

<sup>7</sup>"Male contraceptive found effective" *Globe and Mail*, 2 April 1996.

<sup>8</sup>Nisker, Jeffrey A. "The use of IVF patients as oocyte 'donors'." *Policy Options* March 1996, p.25-29

<sup>9</sup>Surtees, 1988.

<sup>10</sup>Nisker, Jeffrey A. "The use of IVF patients as oocyte 'donors'." *Policy Options* March 1996, p.25-29.

<sup>11</sup>McTeer, Maureen A. "A regime to regulate reproductive technologies." *Policy Options* (March 1996), 29-33.

<sup>12</sup>This report should be treated with caution. It has some of the characteristics of an urban myth.

<sup>13</sup>McTeer, op. cit. p.32.

<sup>14</sup>Iain Cameron and David Edge, 1979 Ch.2

<sup>15</sup>Mullen, Michelle A. "The policy perils of new reproductive technologies". *Policy Options* (March 1996), 15-17.

<sup>16</sup>Mullen, op. cit.

<sup>17</sup>Lapham, 1987

<sup>18</sup>In Glover, J. (1984). *What sort of people should there be?* Penguin Books.

<sup>19</sup>Glover, J. (1984). *What sort of people should there be?* Penguin Books.

<sup>20</sup>Westley, Arlene. "The myth of designer babies."

<sup>21</sup>Robertson, John A. *Children of Choice*. (reported by Wesley, op.cit.).

<sup>22</sup>"Are we just 'gene machines' or also 'secular-sacred'?" From *New Science* to a new societal paradigm. *Policy Options* (March 1996), 3-6.

<sup>23</sup>Elizabeth Boetzkes "Genetic knowledge and reproductive practices". *Policy Options* (March, 1996), p.7-10

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<sup>24</sup>Wilkie, Tom (1996) Why genes attract unhealthy interest. *Manchester Guardian Weekly*, 13 Oct. 1996.

<sup>25</sup>Boetzkes p.10

<sup>26</sup>Bernard Dickens "Do not criminalize New Reproductive Technologies" *Policy Options* (March 1996) p.11-14.

<sup>27</sup>Mullen, op. cit.

<sup>28</sup>Scorsone, Suzanne Rozell. "Prohibit commerce in human reproduction." *Policy Options* (March 1996), 18-21.

<sup>29</sup>Dickens, Bernard (1996). "Do not criminalize New Reproductive Technologies." *Policy Options* (March 1996) p.11-14.

<sup>30</sup>*New Scientist* 16 Nov. 1996, p.3-4.