Chapter 9 GENETICS, REPRODUCTIVE TECHNOLOGY AND ETHICS

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9.1 INTRODUCTION - GENETICS, ETHICS AND THEOLOGY

The genetic revolution has important ethical and theological implications. This has been highlighted by a number of key developments in genetic knowledge and technology over the last 20-30 years.

These include ***firstly*** the introduction of genetic engineering by recombinant DNA technology in 1973. Initially this was followed by a voluntary moratorium for 2–3 years to enable some of the implications of this powerful technique to be explored.

Secondly the commencement of the ***Human Genome Project*** in 1990 with a planned completion date in 2005 (actually achieved in 2003). This program has created a number of ethical dilemmas — some relating to the use of this information for insurance and other similar purposes and some related to the use of the technology for gene therapy etc. and the possible danger for germ line changes.

A third development is the ***cloning, by adult nuclear transfer***, achieved for sheep in 1997. Dolly has become perhaps the most famous sheep in history. ***Human cloning*** from adult human cells is now technically feasible, particularly bearing in mind the enormous experience gained from in vitro fertilization technology over the last 20 years. At present however human cloning is under either voluntary or legal ban in western countries, but pressures for its use are mounting. There is also pressure from both religious and political sources to prevent its use. Bruce (Church of Scotland Ethics Committee) indicates it is a "clear violation of the uniqueness of human life", while Bill Clinton indicates that "those who wish to replicate themselves are trying to play God" Before considering the basic ethical approach to this area, it is necessary to consider the current scientific and technological background to the genetic revolution. To consider what is known and what is possible. The field is rapidly developing.

9.2 SOME INFORMATION FROM BIOLOGY

9.2.1 Reproductive physiology

Conception and implantation

Conception occurs from the biological standpoint with the fusion of the gametes or sex cells from the genetic parents. This results in the formation of a ***zygote*** from the combination of the nuclear material of the ovum and the sperm. Genetic fusion thus results in unique genetic material; i.e. a new ***biological*** individual results to give a one cell zygote. The zygote then progressively divides to become a multicelled organism—a blastocyst. One cell becomes 32, then 64 cells prior to implantation. These changes occur as the fertilized ovum makes its way through the Fallopian tubes to the uterus. Implantation in the wall of the uterus takes place at the blastocyst stage at 10–14 days from fusion. There is some confusion about the definition of "conception". Biologically this is understood to take place at fusion. However the term is often used clinically to represent the time of implantation at 10–14 days from initial fertilization.

Preimplantation embryo

Several characteristics of the preimplantation embryo are relevant to any consideration of its status as a "person". The preimplantation embryo is pluripotential—twinning is possible and occurs in a proportion of cases with the division of the original zygote into two to produce genetically identical or monozygotic twins. In addition particular cells from the zygote are not committed to develop into foetal cells at this stage. They may develop into either placental or embryonic cells. Moreover the removal of some of the blastocyst cells does not prevent full foetal development. A further consideration is that in abnormal circumstances a hydatidiform mole (a sort of cancer of the fertilized ovum) may develop. This abnormality contains genetically unique human genetic material,

but can hardly be considered on this criterion to be a "person". The preimplantation stage is also characterized by considerable wastage. Some 60–70% of fertilized ova fail to become implanted or to develop further and they are lost without any symptoms.

Embryonic growth and development

The term embryo is best reserved for the products of conception from implantation to the 8th week. There is both rapid growth and differentiation. The embryo attains a length of 2 cm, and a weight of 2 gm at 8 weeks. All main systems are developed and the external bodily form established by this time.

Foetal period—8th week to term

This period is considered to be the foetal period. There is rapid growth, but no major differentiation. Movements can be detected ultrasonically at 7–8 weeks, and clinically at 17–20 weeks. Viability is often the product of better neonatal technology. At present a premature foetus may survive from around 20 weeks or about 400 gm in weight.

Central nervous system

Neural tube development commences at three weeks with a definite polarisation of ends appearing. At this stage we can identify one end as the head. Cortical differentiation is, however, progressive from 7–8 weeks, with gradual development of cortical areas associated with consciousness etc., although the details of such development are still unclear.

9.2.2 Reproductive technology

Artificial conception—IVF

The first infant conceived by in vitro technology was born in 1979 in Cambridge (Edwards 1979). This is now a commonly used approach to infertility right around the world with Melbourne playing a very significant role. Human IVF makes possible the use of gametes from a variety of male and female sources and also of surrogacy. Its use of genetic material from other than couples in a stable relationship is however discouraged in many centres. In this case the biological and social parents are identical. The possibility of donated gametes and of donated wombs raises no technical problems, but certainly some ethical ones. In vitro fertilization also raises problems related to embryo wastage, since often large numbers are produced and not used. These may be stored for subsequent use or be candidates for embryo experimentation. Again the question is asked. Are embryos persons? This issue will be discussed below.

Pregnancy and prenatal diagnosis

Amniocentesis is a technique in which foetal cells are removed for genetic or other appropriate examination. It is an invasive technique, which has some risk. It cannot be performed until relatively late in pregnancy (18 weeks) so that the question of subsequent action is difficult. It may form the basis of a recommendation for an abortion under some circumstances where genetic abnormalities are detected. However such abortions are more hazardous. Chorionic Villi Sampling can obtain similar genetic information but can be done much earlier (12 weeks). It has become a fairly routine procedure in pre-natal care, but its role needs to be considered in relation to the potential use of the material. Genetic diagnosis of both genetic constitution, or abnormality, or, of course, of the sex of the foetus, is possible by present technology. However at present little can be done with this information apart from it forming a basis for abortion.

Abortion—surgical and chemical (RU486)

Most abortions occur spontaneously and represent normal attrition or the removal of genetically defective embryos. Most occur before implantation. Spontaneous abortion needs to be distinguished from induced abortion, in which active surgical or chemical intervention is involved. The surgical methods are now supplemented by the use of chemical agents such as RU486 which is a progesterone antagonist and prevents the continuation of implantation. The indications given for abortion may be medical—to protect the physical health of the mother. Abortion is however frequently performed for social reasons. With the advance of genetic technology and of the prenatal diagnosis of genetic abnormality, the latter is becoming an increasingly important indication. An extension of this indication is the use of prenatal diagnosis and abortion to tailor infant requirements to order. To select boys or girls or any other genetic feature for that matter. Thus we achieve the undesirable end of the commodification or the "production of children".

9.2.3 Genetic engineering, gene therapy

There have been a number of key developments in this area over the last half century.

Watson and Crick— 1953

The genetic code and its characteristics are considered briefly in Chapter 8. The role of DNA and the four bases, Adenine, Guanine, Cytosine and Thymine in forming a genetic code was not fully understood until 1966 even though Watson and Crick had determined the chemical structure of DNA in 1953. Adenine/Thymine and Cytosine/Guanine bonding ensures complementary pairing of the two strands of DNA. The three-base coding for individual amino acid addition in protein synthesis provides the basis for the chemical nature of genes as the carrier of genetic characteristics.

Nobel Laureates 1963–1973

The period between 1963 and 1973 was particularly productive in elucidating the mechanisms of DNA and RNA function. Transfer RNA provides a means whereby the nuclear message is transmitted to the cytoplasm of the cell. The genetic characteristics carried in the nucleus DNA are thus translated into somatic cell activities. The mechanism for gene synthesis has also been elucidated.

Recombinant DNA molecular biology—1973

In 1973, as indicated above, techniques were developed for synthesizing and cloning DNA. This raised tremendous possibilities not only for general biological applications but also for human applications. Human proteins such as insulin or human growth hormone could be synthesized by non human means. There was also however the possibility of human gene therapy <has something dropped out of this sentence?>somatic and germ cell.

Human Genome Program—A biological "moon shot"—1990-2005

This program is the biggest biological program ever attempted. Three billion dollars based at NIH is committed to determining the total human genetic constitution. It has been compared to a "biological moon shot". It will be possible to identify all the genes that make up the human genome and the aberrant genes that replace these in genetic abnormalities. There are 23 pairs of chromosomes, 1.5 million "potential" genes, but only 20,000–30,000 actual genes. These will be sequenced and localized and their function determined. The program raises many ethical questions.

Human gene therapy

Somatic 1990

The synthesis by cloning techniques of human genes which can be used to replace deficient genetic functions in individuals so affected is now feasible. Adenosine Deaminase deficiency has been treated by such somatic gene therapy. It involves the introduction of modified white blood cells and retroviruses into the bone marrow of patients with defective genes. In this way the defective enzyme is produced.

Germ cell

This procedure is currently forbidden because of the potential dangers involved with changing the genetic constitution of the individual. This is an irreversible process involving as it does the substitution of synthetic genes for natural genes in the germ cells which of course then replicate in subsequent generations.

Cloning adult nuclear material—Dolly

As indicated above the technology for human cloning is now available and conjures up all sorts of pictures of rows of little Hitlers etc. being produced in laboratories. It certainly has its ethical counterparts that warn about proceeding without due caution, but we need to be guided by proper ethical principles not by emotion.

Stem cell cloning

Similar procedures may be used to prepare cloned embryos, which can be used to produce stem cells—so called therapeutic cloning. These can then be used as a source of transplant material.

The wealth of human and animal techniques available make genetic engineering a powerful tool in the manipulation of biological nature. It also forces us to consider the nature of being human and the implications of humanity for any biological manipulation.

9.3 SOME ETHICAL NORMS

9.3.1 General approach to ethics

Problem of rules/principles

Ethics and morality need to be distinguished. Morality is essentially a set of rules, whereas ethics provides a framework for making moral decisions. It is thinking about moral behaviour—moral philosophy. In many areas and in particular in the emerging bioethics scene there are no set nor clear-cut rules. We need to define the principles that should determine our actions. These may often conflict with each other. It is not appropriate for this to be an emotive response, but rather one that is based on rational considerations.

Basis for behaviour

Classically the basis for behaviour may be defined by two types of criteria:

Principles—deontological ethics

Such principles may be derived from natural law, or from biblical/theological principles or by society norms. However we are reminded that we live in a pluralist society.

Consequences—teleological ethics

This is ultilitarianism, the criterion being the production of the best result for all (see Singer, Wells). There are limitations to both systems, but a critique is beyond the present scope.

Morality and legality need to be distinguished.

Moral issues are concerned with what is "right". Legal issues are concerned with the protection of society or its weaker members. For example, embryo rights may have both moral and legal aspects.

We operate in a fallen world—outside Eden.

Therefore we are frequently faced with the issues of the lesser of two evils, of reconciling conflicting principles. Thus it is possible to conceive of a situation where the "moral course" may involve actions that are "sinful" taken in isolation.

Pluralism, Christian morality

Again "what is acceptable" may not be "what is good". The ethical view is not necessarily the accepted practice. It is important however to respect autonomy of decision, e.g. regarding abortion, homosexuality.

9.3.2 Ethical principles in the biotechnology debate

There are three basic areas for consideration in the bioethics debate.

Technology Dominion Stewardship

Medical treatment, including genetic manipulation, is part of the Genesis 1 stewardship mandate. We are not playing God, but exercising the mandate given to humanity by God. The question remains however, how far can we go? Our stewardship is exercised in an atmosphere of responsibility to God and his creation. It is subject to limits. Questions of cost arise and of relative cost, where (ethical) choices must be made. A single IVF treatment may be costly. Compare this to a third world immunization program! Care must also be exercised in the invasion of the technocratic approach into a relational field such as procreation. There are no trite answers to these sorts of issues, but they must be considered in supporting any responsible action.

Biblical understanding of family, marriage

Genesis 2 sets forth as a basic creation ordinance the institution of marriage and of procreation as being conducted within a monogamous, exclusive, heterosexual and mutually supportive relationship. Procreation is not just a biological function associated with genetic sex, but with the development of children in a family relationship. Sexuality is thus not just biological, but involves mutual support—community.

Nature of humanity—human worth

Humanity is created in the "image of God". Therefore human dignity does not depend on any intrinsic value, but is determined by the possibility of relationship to God. It is not determined by the value of an individual to society for example. Human life is subject to the sovereignty of God and is not to be taken lightly either in self murder or murder.

Exodus 20, "Thou shalt not kill", is not just a negative proscription, but involves the positive, preservation of life in all circumstances. However it will be noted that Exodus 20 is qualified. It is a general principle, but there are exceptions in the Hebraic law. The emphasis is on the preservation of life: both positive—"do not kill", and negative—to promote a climate to support life. Therefore it is concerned also with the protection of infants from environmental assaults in pregnancy, with famine in Ethiopia, with the prevention of road accidents and with the provision of

cheaper HIV AIDS therapy to pregnant third world victims etc., because human life is valuable to God.

9.3.3 Questions

- What about the foetus?
- What about the embryo?
- Are embryos persons? Do they have equal value?

Abortion, IVF, embryo experimentation, stem cell cloning issues are determined by these questions.

9.4 THE EMBRYO—IS IT A PERSON?

Several possibilities present themselves. Firstly let us consider the proposition that the embryo is a person. Can this position be sustained as some maintain and if so what are the consequences?

9.4.1 The embryo is a person.

The first argument is based on biology. The embryo is a unique genetic individual.

Biological basis—genetic uniqueness.

It cannot be denied that at conception we have the beginning of a new, unique individual. It is a strong argument for the value of embryo "personhood". There is a continuum from this point, both as a member of the species and as a "human person".

However, we must ask whether humanness is comprised of "genetic uniqueness".

Being human is not just biological or genetic. This position asserts that humanity is fully described by their genes. This is a reductionist view and is discussed in relationship to the nature of humanity in Chapter 8. We must reject that proposal. In any case ***Genetic uniqueness may not determine humanness.*** As indicated above "hydatidiform mole" chimera are abnormal, but have unique human genetic material. They do not develop into a person nor would any consider they have any claim to personhood. Again as indicated above the early embryo is pluripotential. Twinning, therefore will produce two or more individual persons, but with identical genes. The genetic material is thus not unique, but is held in common with the identical twin. The early embryo develops partly into placental and partly into foetal tissue. Thus any part has the potential for either. Embryo wastage is extensive. We do not claim that the destiny of wasted embryos is the same as for persons. An embryo therefore needs ***nurture, environment, social surroundings to become a person, not just genetic identity.***

Moral or social basis—O'Donovan

O'Donovan considers that the status of the embryo is not defined by the biological alone, but defined by our personal engagement, commitment as a society. We have a stance of moral commitment: the embryo is to be treated as a person. Care and attention are associated with the response to the embryo.

Thus all embryos are to be treated as persons, although they are not actual persons; i.e. they are considered in relationship with society (and with God).

Philosophical basis - Iglesias

Emphasizes that there must be a distinction between the potential to ***become*** a person, and the potential ***of*** a person. That is, ontologically the embryo is a

person and becomes what it is. "What makes us persons is the kind of beings we are" not the manifestations or attributes which may come later.

To consider the embryo is a person has certain implications.

Implications

The embryo would have full human rights, and be treated as of equal value to an adult.

This consideration is relevant to abortion—no distinction can be made between mother and foetus. It is relevant to the disposal of surplus embryos, and of experimentation in IVF and in stem cell cloning.

What are these human rights re experimentation? They are defined by the l964 World Med. Assoc. guidelines and the 1975 Declaration of Helsinki. There are three aspects emphasized.

- The importance of the research must be proportionate to the risk.
- Consideration of the individual must prevail over the interests of science or society; i.e. life and health of the patient/subject is paramount.
- Informed consent is required, and, if not possible, a procedure is only considered if no harm is done to the patient/subject and the procedure is for therapeutic purposes.

Cf. embryo research—death of the embryo i.e. issues of damage/consent.

These considerations do not hold if the embryo is not a person.

Does one therefore equate all embryos as persons?

This leads us to the second possibility.

9.4.2 The embryo becomes a person at some definitive point.

But when? There is a biological continuum, so no clear cut biological point can be attested. There are, however, a number of points that have been suggested. They include:

- Implantation: 10–14 days
- Neural development
- Early late, 3 weeks after birth or post birth.
- Quickening
- Ultrasonic 7 weeks, clinical 17–20 weeks
- Viability
- 20 weeks, but reducing
- Birth—continuing care is necessary
- After birth, cf. Singer
- Foetus is thus of no value
- Prochoice prevails therefore with abortion

McKay position

Attempts to cope with the wastage issue

Therefore we have M and X embryos, those that survive and those that are wasted.

Bases personhood on cortical neural development

That is, a decisive moment of maturation of the CNS before which the "I" does not exist—there is nobody there—not a cognitive, relational agent. This proposes development of personhood at some point.

M embryos can look back to the hand of God in their development.

X never reach development, therefore have no history.

There is no basis in Scripture or science to consider every embryo is a person with a moral claim on us.

Implications of a step wise personhood

The pre-person embryo must be considered as a non person, with no rights. Therefore it has no more value than a piece of "tissue", such as a removed appendix. It has the potential to become a person but is *not* a *person*. Therefore it can not be treated as a person.

9.4.3 Embryo is a potential person—relative value

See G Jones (l987) p. 152:

> *"A human foetus is a potential person in contradistinction to an actual person (a normal adult human) or a being with a capacity for personhood (a temporarily unconscious person) or a possible person (a human sperm or ovum) or a future person (a person in a future generation)."*

Thus it has value at all stages, but the value of the embryo is less than that of the six months foetus. For example, the potential person will become a person with suitable nurture and therefore deserves to be treated with respect. In this view a high premium is set on embryonic life at all stages but the value is less for an embryo than a foetus etc. Protection is never absolute.

9.5 SOME SPECIFIC ISSUES

Finally let us consider some particular issues in this area.

9.5.1 Pre implantation screening

Cystic Fibrosis, Tay Sachs and Huntingdon's Chorea are all serious genetic abnormalities that can be detected by pre natal genetic screening. Should we destroy affected embryos? Is the embryo a person?

9.5.2 In Vitro Fertilization

Are we playing God? The issues become more complex ethically as we move from the simple situation of ova and sperm coming from the social parents to the issue of donation of either ova or sperm or both. In this case the genetic and social parents are not the same. A further move is to the usage of a donated uterus (Surrogacy). With the production of excess fertilized embryos the thorny issue of embryo experimentation also arises.

The following issues also raise significant questions:

- Genetic screening and abortion
- Gene therapy—somatic, germ line
- Cloning—reproductive and therapeutic references

REFERENCES

Cameron, N, Ed., 1987, *Embryos and ethics: The Warnock report in debate*, Rutherford House, Edinburgh.

Cole Turner, R, Ed., 1997, *Human cloning—religious responses*, Westminster Press. Louisville.

Collins, F, 2006, *The language of God: A scientist presents evidence for belief*, Free Press, NY.

Fisher, A, 1987, *IVF, The critical issues,* Collins Dove, Melbourne.

Jones, G, 1987, *Manufacturing humans*, IVP, Leicester.

Jones, G, 2007, *Bioethics: When the challenges of life become too difficult,* ATF Press, Adelaide. 2007

Nelson, JR, 1994, *On the new frontiers of genetics and religion*, Eerdmans, Grand Rapids.

Peters, T, 1996, *For the love of children*, Westminster Press, Louisville.

Peters, T, 1997, *Playing God?*, Routledge, NY.

Peters, T, Ed., 1998, *Genetics: Genes, religion and society*, Pilgrim.