

LIVE AND LET LIVE

A Christian Perspective on Biotechnology

ALEX TANG

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2006

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This book is dedicated to my wife, Agnes,
and my two lovely daughters, Christina and Alexis.

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PREFACE

The only constant in the world we are living in is change. And change is happening at an accelerating rate. Alvin Toffler, author of *Future Shock* and *The Third Wave* observed that human society developed in waves.

The first wave was the agricultural age in which we gained mastery of the soil, the seeds and the seasons. Human society reorganised itself accordingly. Farming communities were formed and new technologies of the horse-drawn plough, fertilisers and selective breeding of animal stocks were developed.

The next wave of development was the industrial age. Human society again changed accordingly. The centre of growth shifted to the cities as technologies were developed to make steel and textiles, and to build railway and factories.

Toffler called the third wave, the information age, the age in which we live. In the last few years, we have seen tremendous changes to our way of life, from desktops to mobile cellphones, from postal mail to email, and from empirical medical care to evidence-based medicine. We have moved from hardware to software to wetware. From computer chips which are silicon-based, technology is moving to the reprogramming of human cells, which are carbon-based. In this century, we shall see advances in biotechnology which we cannot imagine. Who would have thought that the chip in our portable notebook

would have more computing power than all the mainframe computers used to send Apollo 13 into space and back. And this change has occurred only in a period of about 20 years.

With the completion of the mapping of the human genome in the year 2000, we are at the threshold of changing the very nature of the human body. New discoveries in molecular genetics and nuclear transfer technology have enabled scientists to clone animals and establish stem cell lines that have potential for great medical benefits. There are now newer and safer ways to prevent pregnancy or enable an infertile couple to have children. Medical advances have not only prolonged life but also delivered painless death.

All these changes have implications for us as Christians. Biotechnology like all technology is neutral morally. It is our use of them that we have to be aware of. We have the responsibility to ensure that God's moral laws are not abused in the development and use of biotechnology. In this book, we shall examine the issues of abortion, reproductive technologies, cloning, stem cell research and eugenics. We shall also examine the question of when human life begins and when it ends.

The Bible does not have specific pronouncements about biotechnology nor did the apostle Paul teach about cloning and stem cell research. However this does not mean that the Bible does not address these issues. A careful study of the Scriptures would reveal general principles which can be applied specifically to these issues.

Firstly, the principle of the sovereignty of God. God created

men and women in his own image (Genesis 1:27). He chose to give children to married couples as gifts (Psalm 127:3-5, 128:3-4) and opened the womb of infertile women (Genesis 30:22, 1 Samuel 1:19-20). God is in ultimate control over all things. It is he who decides when one is born and when one dies. Life and death is the prerogative of the Creator and not the created. We are living in his created universe by his permission. He gave us freedom to do as we like but ultimately it is his creation. As we begin to understand how wonderfully our universe is made, the correct response is adoration and worship. We should approach his creation with humility. However, it is observed that as scientists and researchers discover more and more of his handiwork, they become proud rather than more modest. The secularist's approach to creation is one of arrogance. Ian Wilmut, recounting his achievement with the cloning of Dolly, calls his book and his work, *The Second Creation*. Pompousness over technological advances in the past decades has led to widespread exploitation of natural resources and destruction of the environment. Ultimately, such arrogance will lead to more human misery.

Secondly, the principle of the sanctity of human life. All human life bears God's image (Genesis 9:6,7) and should be treated with respect. The weak, the sick, the helpless, the genetically deformed have equal rights and dignity with the rest of 'normal' human beings. We are born different but that does not give one group the right to exploit another group. Apart from exceptional circumstances, e.g. protection of the innocent or a just war, God does not give us permission to kill other human beings. The sanctity of life extends to the unborn child as well as to the old and sick. The foetus is the most defenceless being on earth, totally dependent on the

mother. Sanctity of life means that we must take all measures possible to ensure that the unborn foetus and the old and sick are adequately cared for and protected. Human life is to be treasured, not squandered.

Thirdly, the principle of stewardship. When God created humans, he also gave them responsibility. He put them to work in the Garden of Eden (Genesis 2:15), to care for the other creatures. Adam was asked to name the animals thus exercising authority over them (Genesis 2:19,20). After the Fall, redemption applies not only to humans but also creation (Genesis 1:26-28, Romans 8:19-22). So we are to be 'co-creators' with God to redeem the present creation. Hence we have a responsibility for the present environment, society and our physical bodies. As 'co-creators', it is our responsibility to use the environment to fulfil our other mandate, given by the Lord Jesus, to help our neighbours. That is why Christians are often the first to start hospitals, care for the sick and the disadvantaged. The principle of stewardship compels us to help others, using the discoveries of medical sciences. The role of science is to discover the natural laws that God has incorporated into the building of his universe. The fact that we can manipulate these laws indicates that God allows us to use them. He also gave us the intellect to decide how they are to be handled and where the boundaries are. Following the age-old doctors' maxim "first do no harm, then do some good," we should be conscious not only of what we can do but also make sure that what we can do will not harm others. This is important in the area of biotechnology.

With gene therapy, we are now able to introduce changes to the genetic code of certain human beings. The intention is

good, mainly to correct certain genetic defects. In one form of therapy called the germ gene therapy, the modified gene can be transmitted to subsequent generations. But what if something went wrong and a defective gene was created in the process? The technology to affect the genetic code of subsequent generations of human beings places an awesome responsibility on us. As stewards of God's creation, we must bear this responsibility with great wisdom and discernment.

Fourthly, the principle of sexuality, marriage and family. God created man and woman in his own image (Genesis 1:27). He created them to be different: physically, sexually, emotionally and mentally. But the Bible insists that both are created in the image of God and bear his likeness. Hence man and woman are equal in God's eyes. Only their roles are different. God also created marriage as a life-long, community-based, heterosexual monogamous relationship (Genesis 2:24, Matthew 19:4-6, Ephesians 5:31-33). A family is a marriage with children. God instituted the family as a nurturing incubator where children grow up and learn to love God and be good stewards of their talents and environments. Thus it falls on the married couple to decide about family planning to limit fertility or to seek treatment for infertility and other problems.

We are living in interesting times. Change is constant while knowledge is accumulating at an ever increasing rate. One standing joke among doctors is that by the time they graduate, everything they have studied as medical students will be out of date. We human beings have been given stewardship of this created order. Our past record has not been too impressive. Our role as Christians in the care of the environment has not been too impressive either. Now

we may have another chance. As we move into the era of biotechnology with the potential to reprogramme the genetic code and cells, will we do a better job in giving our input and directing the developments with our Christian point of view? Christians need to understand these 'interesting' times they are in and appreciate the challenges abortion, reproductive technologies, cloning, stem cell research and eugenics will pose in their lives. We need to arrive at a Christian consensus. Comments and opinions on this subject have been heard from the academicians and theologians. It is the conviction of the author that it is time that Christian professionals involved in these areas should add their voice to the debate. It is with this in mind that this volume is submitted.

Soli Deo Gloria

Alex Tang, MD

June 2006

1 WHEN DOES HUMAN LIFE BEGIN? A Very Good Question

In Genesis, the first book of the Christian Bible, it is recorded that God created humans out of the dust of the earth. He made the first man named Adam, and breathed life into him (Genesis 2:7). This implied a process. First, God formed Adam out of the dust of the ground. He became a living being only after God breathed the breath of life into him. Then God created woman, Eve, out of a rib from Adam, the first recorded case of plastic and reconstructive surgery (Genesis 2: 22). In the case of Adam and Eve, we know when life began and when they became human beings and persons. But the Bible does not give further information on when the rest of humankind become human beings and persons. The Bible records that Adam had sexual intercourse with Eve and Eve became pregnant. After a term of pregnancy, Cain was born. Nowhere in the Bible is it stated when human life begins.

This fact is important when we discuss bioethical issues of

abortion, reproductive technologies, cloning and stem cell research. Central to many of the arguments and disagreements concerning these issues is the question, "When does human life begin?" The debate has divided Christians from the various traditions (Roman Catholic, Orthodox and Protestant) because the Bible is silent on this matter. It also makes it difficult to dialogue with people from other traditions and beliefs. It is especially relevant as science and technology intrude into our sexual reproductive processes.

The Biology of Sex

During a woman's reproductive period from puberty (menarche) to menopause, she produces a few hundred thousands eggs or ovum which are released from her ovaries into her fallopian tubes during the fertile phase of her monthly menstrual cycle. During sexual intercourse, a male ejaculates millions of spermatozoa into a woman's vagina. These race upwards into the fallopian tubes. There, these millions of spermatozoa meet a single egg. Fertilisation is said to have taken place when a single spermatozoa penetrates the egg or ovum. Once a spermatozoon has penetrated an ovum, a barrier is immediately built up to prevent other spermatozoa from entering. In the egg, there is fusing of the DNA genetic materials resulting in the forming of an embryo or fertilised ovum or blastomere. This begins to divide by a process of mitosis where it begins to split down the middle and two identical cells are formed. This process is replicated continuously. In the meantime, the embryo moves down the fallopian tubes into the uterus. It takes about four to seven days before it reaches the uterus. By then, it will be

composed of about 100 cells and is known as a blastocyte or 'pre-implantation embryo'. The blastocyte has to implant itself in the uterine wall and produce a secretion, human chorionic gonadotrophin (hCG) which makes the uterine wall favourable to further growth and prevent menstruation. Failure to implant in the uterine wall will result in the blastocyte being washed out of the uterus and die. It is estimated that 40 to 70 percent of all 'pre-implantation embryos' are discarded without the woman being aware of it.

When Does Human Life Begin?

Conception

The Roman Catholic Church, the Orthodox Church and some of the Protestant denominations regard conception as the point when the spermatozoa penetrates the ovum and fertilises it. To them, conception is when human life begins. Conception is when the soul enters the cell or ensoulment has occurred.

The philosopher Aristotle believed that at conception the future child is endowed with a principle of only vegetative life. This is exchanged after a few days for an animal soul. The animal soul is succeeded by a rational soul much later. His followers taught that a male child receives his rational soul on the fortieth day. The female child receives her rational soul on the eightieth day. This belief was widely accepted by the ancient world for many centuries. In the fourth century, Gregory of Nyssa, who was well educated in Greek teaching, advocated the view that at the time of conception, the embryo is given a life principle (soul) and begins to live a distinct individual life.

However, Thomas Aquinas, the great Dominican theologian, reverted to Aristotle's teaching that a male was given a soul after 40 days and the female after 80 days. This was accepted by the church and later became widely accepted as a church tradition until 1875. In 1875, the German embryologist, Oskar Hertwig, discovered the fusion of the spermatozoa and the ovum (egg) in fertilisation. That year, the Sacred Congregation for the Doctrine of Faith in Rome declared that a human being exists and becomes 'ensouled' the moment the spermatozoa enters the ovum. In 1987, it modified this view by declaring that human life begins not at the moment when the spermatozoa penetrates the ovum but at the moment of fusion between the male and female genetic materials (nuclei). Modern science has discovered that there is a time lapse of 22 hours between the moment the spermatozoa penetrates the ovum wall and the fusion of the genetic materials.

The late Pope John Paul II reaffirmed the Roman Catholic tradition that life begins at conception when he wrote: "When a unique set of human genetic instruction is present, a person is present." In his attempt to modernise church tradition, the late pope implied that the presence of a complete set of human DNA makes a cell a human person. To modern scientists, this may not make sense. They may retort that all our skin cells have complete sets of human DNA and we lose millions of skin cells every day! Is each cell then a person? Having a complete set of human DNA does not make a person as in the case of a teratoma. A teratoma is a fertilised ovum mutated into a tumour. There are differentiations of tissues in a teratoma though in a chaotic manner. When we cut open a teratoma, we may find hair, mixed with tooth and other organs but a human being is not formed. All the

genetic information may be present but the development has gone haywire. Another point to be considered is that 40 to 70 percent of fertilised eggs die when they fail to implant in the womb. If the presence of a complete set of DNA defines a human person, then one would have to say that the majority of human beings were never born or lived no longer than a week.

Professor John Guillebaud from the University of College, London, has suggested that conception is a process. He believes that conception has two components: fertilisation and implantation. Fertilisation without implantation has zero survival rate. With fertilisation and implantation, the foetus has about 80 percent chance of making it to term. Hence Professor Guillebaud considers conception to have taken place only when a fertilised ovum implants in a uterine wall. Conception, according to him, would not have taken place if a spermatozoa penetrated the ovum and fertilised it but was not implanted, as in spontaneous abortions or fertilisation in a test tube.

On the other hand, Professor Ramsey, a noted Protestant ethicist, believes that a zygote is a human being i.e. human life begins at conception. Professor Ramsey did not go into the technical details.

Fourteen Days

Many in the scientific community believe that human life begins 14 days after conception. Implantation begins at day five and completes by day nine. By day 14, the cells of the embryo begins to specialise so that the embryo has a top, bottom, front and back. A primitive streak is formed

which will develop into the spinal cord and nervous system. Other cells begin to separate into foetus, placenta and other supportive tissues.

At 14 days, the possibility of twinning recedes. Twins are formed when the embryo splits into two, each with equal and identical genetic materials. They are identical twins because they are from one embryo. They share one placenta. Non-identical twins happen when two ova are fertilised and the two embryos are implanted at almost the same time. They develop independently of each other. Triplets, quadruplets and so forth are similarly formed.

Some would regard this as an important fact. If one were thinking in terms of souls, then would an embryo that is destined to split and become twins be given two souls at conception? Could two souls coexist in one embryo? If at conception, one soul were given, what would happen when the embryo splits into two when twinning occurs? Another observation is that prior to 14 days, two embryos can fuse and subsequently develop normally but with four sets of genetic information.

In the United Kingdom, an ethics committee led by Dame Mary Warnock, a philosopher, came to the conclusion that it is not unethical to create and experiment on embryos as long as it does not occur fourteen days after fertilisation. The Warnock Committee's recommendation served as the basis of The Human Fertilisation and Embryology Authority Act passed in the United Kingdom in 1990. This Act governs IVF (in-vitro fertilisation) and the treatment of embryos. Experimentation of embryos was allowed under the Act up to fourteen days

after fertilisation.

The 14-day mark is the choice of the Embryo Research Panel of the National Institute of Health (1994) in the USA and of the Donaldson Report in the UK. Many other research institutes also follow similar definitions that human life begins at 14 days with the formation of the primitive streak and considering that the possibility of twinning recedes beyond that point.

Twenty Eight Days

The formation of all body systems and organs is complete after 28 days. The embryo is about two millimetres long. During subsequent growth, these organs will increase in size and functions. The embryo can now be considered 'formed'. A human body or *basar* may be said to be present. In the early and medieval church, the consensus among theologians was that God would give a soul at the point when the body is fully 'formed' in the womb. This is known as soul creationism. Another school of thought called traducianism taught that a soul is inherited from one's parents and will be fully formed when there is a formed body. One can only be a human being if one has a body and a soul. This is obviously different from the beliefs of the Early Church Fathers that a life principle (soul) is given at conception. Both soul creationism and traducianism reason that one needs to have a body to have a soul. The distinction is between 'formed' and 'unformed'. Those who taught this include Lactantius, Jerome, Augustine, Cyril of Alexandria and Thomas Aquinas.

Forty Days

Aristotle wrote that the male embryo develops a human soul about 40 days after conception, whereas a female embryo

acquires its soul 80 days after conception. One author has suggested that the early church was influenced by this 'delayed ensoulment' principle and allowed abortion up to 90 days.

At 40 days, primitive undeveloped brain waves can be detected. High resolution ultrasound done on the foetus at this stage shows incredible details—the foetus begins to look like a baby. In the Jewish rabbinic understanding of the Talmud and subsequent teachings, a developing foetus before 40 days is 'like water'. It is only worthy of consideration after 40 days.

Twenty Four Weeks

About 24 weeks, the foetus becomes viable. This means that if it was delivered prematurely, it can survive with the help of modern medical care. The World Health Organisation (WHO) defines abortion as any product of conception delivered before 28 weeks. However, nowadays, it is routine to be able to save babies born prematurely at 24 weeks. Some medical ethicists use viability as a measure of being human.

Twenty Six Weeks and Later

At 26 weeks, the foetus has greater viability and is more developed. Brain wave patterns show waking and sleeping stages. To some people, this self-awareness is what makes a human being. Self-awareness is an important criterion of personhood. Carl Sagam believed that the ability to think is what makes us human.

First Breath at Birth

The Jewish rabbinic commentary regards the foetus to be part of the mother's body and it is only at the moment when the

breast or the greater part of the breech is delivered that the foetus becomes an individual. But it continues to be regarded as a non-souled entity until after 30 days. Jewish children are not named or admitted to the community until after the eighth day and for those who die in the perinatal period (30 days), the rituals of death are not necessary.

Human Life and the Bible

The Bible does not give an answer to the question, "When does human life begin?" Attempts have been made by various scholars to cite evidence that God considers the foetus to be fully human by referring to Psalm 139, Job 3:11, Jeremiah 1:5 and Luke 1:39-44.

John Stott made an ingenious argument by using Psalm 139. Firstly, using verse 14, "for you created my inmost being; you knit me together in my mother's womb," he concluded that the psalmist is already aware at his conception i.e. creation. Secondly, he noted that there is continuity between the verses: verse 1 "you have searched me" (the past), verses 2-3, "you know when I sit and when I rise" (the present) and verse 10, "your hand will guide me, your right hand will hold me fast" (the future). Thirdly, the whole Psalm 139 speaks of communion between God and the psalmist. John Stott concluded that these three words (creation, continuity, communion) give us the perspective that the foetus is already a human life, though not yet mature, has the potential of growing into the fullness of humanity. The point he made was that the beginning of human life is found in the pre-natal period and there is continuity from life before and life after birth.

"Why did I not perish at birth, and die as I came from the womb?" Job 3:11 (NIV). This verse sheds no light whatsoever on the status of the fetus Job. It provides a retro perspective view as it is the adult Job contemplating his circumstances.

"Before I formed you in the womb I knew you, before you were born I set you apart; I appointed you as a prophet to the nations" Jeremiah 1:5 (NIV). The focus of this verse is more on Jeremiah's calling to be a prophet than it is a statement about when he became a human being.

Luke 1:39-44 relates the meeting between Mary and Elizabeth, both of whom were pregnant. Elizabeth's baby (John the Baptist) "leaped in her womb" in response to Mary's greeting. The case is made here that Luke uses the same word *brephos* for an unborn child (1:41,44) as a newborn baby (2:12,16) and little children brought to Jesus to be blessed by him (18:15). It is difficult to derive an ethical principle on the basis of one Greek word. Nevertheless, Luke who was often careful with his words classifies all of them as children. Being a medical doctor, he must have been aware of 'quickening' or when the unborn child makes his or her first movement in the womb. The emphasis in this passage is on the reaction of the unborn John the Baptist to the unborn Jesus.

These often quoted passages do not address the question, "When does human life begin?" With proper exegesis, one can only conclude that the emphasis is on the sovereignty of God and his interactions with human beings.

Human Life and Personhood

In recent years, the discussion on "when does human life begin?" has changed to "when does a person become a person?" There are a few ethicists who think that having the human genetic code and looking like a human being does not guarantee that the entity is human. Being human also involves personhood. Mary Anne Warren's criteria for a person are 'consciousness, reasoning, self-motivated activity, capacity to communicate and self-awareness. A newborn baby does not seem to exhibit all of these characteristics. Peter Singer, Ira W. DeCamp Professor of Bioethics, University Center for Human Values, Princeton University, believes that personhood occurs weeks after birth. A fertilised ovum or a developing embryo in the uterus is not a person until it becomes self-aware. According to Peter Singer, self-awareness is an important criterion for personhood and this comes long after birth. More about personhood when we discuss abortion in the next chapter.

Conclusion

It is obvious there is no general consensus about when human life begins among the Christian community. There is also no consensus about when personhood begins or even whether personhood is a prerequisite of being human, or when the soul enters an embryo (ensoulment). Firstly, it must be noted that the various options discussed above are based on learned speculation. Speculations which were widely accepted became church tradition. It must also be noted that while these church teachings draw on the teachings of the

Bible, the Bible itself does not specify exactly when human life begins except for Adam and Eve.

Here we must be clear as to what is theology and what is church tradition. We also need to differentiate these from absolute truth. Theology is the study and knowledge of God's revelation of himself in the Bible and in his creation. We are finite in our understanding and are limited by culture, time and language. Hence our theology is an approximation but never the absolute truth. Only God has absolute truth. But as we develop new scholarship tools, we grow in our understanding. That is why theology is constantly developing as we understand more and more of absolute truth. Some revelations of God are certain and unchangeable. One example is the Trinity: three persons yet one. No amount of development of theology can add another person to the Trinity. Another example is the fact that Jesus Christ is fully God yet also fully human. Other areas of theology are formed and informed by our times and culture. As we have already noted, church theologians such as Augustine are neo-platonic in their approach while Thomas Aquinas leans towards Aristotle's teachings. Church traditions are often human formulations made to meet the needs of the times and politics. But usually once implemented, it becomes inflexible and believers are required to follow unquestioningly. Tradition may or may not be based on absolute truth.

Secondly, there must be room for differences of opinions since the Bible does not specify when human life begins. As our knowledge of human embryology improves, we learn more of the formation of the wonderful human body. We must realise that earlier church speculations were based on

the knowledge of human embryology at the time. One cannot help but wonder what the Early Church Fathers would have done if they knew that the human foetus develops gills, tail and other characteristics similar to other animals before developing into a form that we are used to.

A Christian Medical Fellowship survey published in 1996 showed that of the 2,580 Christians doctors who responded, only 36 percent believed that human life had 'full value' at the time of fertilisation. However for the 8-week old foetus, the figure had risen to 85 percent. This survey clearly showed that practitioners, people who are engaged in marketplace ministries, often have different perceptions of the issues involved compared with those from theological institutions. It must be noted that the survey was about abortion and how Christian doctors perceive the issues involved.

We must have the humility to acknowledge that there are limits to human knowing. In this case, we just do not know when human life begins. Theologians may argue from scripture but they must acknowledge that the few passages we have alluded to do not actually tell us when human life begins. Empirical scientific data or philosophy with a working knowledge of embryology may arrive at a 14 days guideline. Judaism has another timeframe. The simple truth is that we just do not know. When a human life begins remains and will always be one of the mysteries of God.

Thirdly, in areas where the Bible is non-specific, the church has always gravitated to a principle of least harm done. This is a notable principle and I think the most relevant for our argument. If we really do not know, then we should gravitate

towards a stand that will cause the least harm. I am sure most people will agree with this. The fundamental rule of medicine is "first do no harm." The stand that does the least harm considers human life as beginning at conception.

Finally, our decision on when human life begins has a decisive effect on how we deal with the issues of abortion, use of reproductive technologies, cloning and stem cell research. While the Bible is silent on when human life begins, it has given us a clear mandate to love our neighbours and help the weak and the sick. Maybe that is precisely why the Bible is silent on when human life begins. God may want us to use our judgment on how we can love our neighbours and help the weak and the sick. He knows that as scientific data increases, we need to evaluate our works of charity instead of being fixed by a mould. The prophet Micah wrote, "He has showed you, O man, what is good. And what does the Lord require of you? To act justly and to love mercy and to walk humbly with your God" (Micah 6:8). Our perspective on when human life begins must consider available facts, whether it's helpful to our neighbours and the weak, and if it causes least harm. Most important of all, we must be humble. All our bioethical decisions must be made in humility before our Creator God who has given us the power to be 'co-creator' with him. We recognise God as the Creator who created *ex-nihilo*. But we are also called to be 'co-creator' with him as we 'create' new things from materials in his creation.

2 ABORTION

Please Let Me Live

The debate on abortion has been waged since the early church. It is still on-going since it is a complex issue. John Stott wrote in *New Issues Facing Christians Today* that abortion has medical, legal, theological, ethical, social and personal aspects. It often involves painful personal dilemmas. It is one of the difficult questions we Christians have to face if we are to be the 'salt and light' of the world.

A medical dictionary defines abortion "as the premature expulsion from the uterus of the products of conception—of the embryo or of a non-viable foetus." "Embryo" refers to the first eight weeks of gestation after fertilisation of the ovum by the sperm. "Foetus" refers to the embryo after eight weeks until birth. Abortion can be a naturally occurring process. It is estimated that 50 to 60 percent of all conceptions end in abortion because for some reason the embryo was non-viable. This is known as 'spontaneous abortion'. In this chapter, we

shall limit our discussion to abortion involving a normal viable embryo or foetus, which if left to the natural process would be delivered as a full-term baby. In other words, we are referring to cases where the mother intentionally seeks help to remove a growing embryo or foetus in her womb.

Abortion on demand is not available in Malaysia. Abortion can only be performed for medical reasons as provided in Section 312 of the Penal Code and its has to be certified by at least two doctors. In Singapore, abortion is available on demand. It even allows teenage girls to procure abortion without their parents' knowledge. In Britain, abortion was illegal until the Infant Life (preservation) Act of 1929 which provided that abortion was admissible if it is to save the life of the mother. This was further liberalised in the 1967 Abortion Act. By 1983, over two million legal abortions had been performed since the 1967 Act was passed and by 1995, over 4.5 million. In January 1973, the United States Supreme Court declared seven votes to two in the *Roe v. Wade* case that it is constitutional for a woman to choose to have an abortion done on her during the first three months (first trimester) of her pregnancy and during the second and third trimester if the pregnancy affects her physical or mental health. This ruling opened a floodgate for abortions to be performed in the USA. The premise behind the ruling is that a woman has the right to decide what is to be done to her body and that includes an 'unwanted' foetus. This is usually described as 'pro-choice'. 'Pro-choice' means a woman has total right to choose what is done to her body.

Techniques of Abortion

Most abortions are done during the first three months of

pregnancy. There are a number of ways a foetus can be aborted. I have not included herbal or other manipulations done by traditional healers and back-street abortionists.

Vacuum Aspiration

This is used for pregnancies up to 12 to 14 weeks. In this technique, the cervix is dilated and a tube connected to a suction apparatus is inserted. The foetus is sucked out into a jar. The foetal body parts are examined to ensure total removal. Foetal parts or remnants of the placenta, if not totally removed from the womb, will cause bleeding and infection. Infection of the womb can be life threatening.

'D & C' - Dilatation and Curettage

This is the most common technique. The cervix is dilated and a 'curette' inserted. The walls of the womb are scraped until the foetus is cut into pieces and removed. This is the technique of choice for abortion in pregnancies less than 12 weeks.

Toxic Solution

In this technique, a hyperosmolar solution, usually saline is introduced into the womb by means of a needle. The saline kills the foetus which will be expelled naturally through the vagina. This is usually used in pregnancies of 12 to 16 weeks.

Hysterectomy

This is similar to Caesarean section whereby the foetus is removed through an incision in the womb. Unlike Caesarean section, however, the foetus is left to die. Usually, this is performed when the foetus is in the second trimester which is about three to six months.

'D and X' - Dilation and Extraction

This is done in late stage pregnancies when the foetus is fully formed and is too strong for dismemberment by the above mentioned techniques. Here the foetus is manipulated into a breech position and labour induced by a drug, prostaglandin. The baby is partially delivered feet first until the head remains in the womb. Then the doctor creates an incision at the base of the skull and a suction catheter inserted. The brain is then sucked out through the catheter, causing the skull to collapse. The now dead baby is then removed from the womb by pulling on the feet.

RU486 with Prostaglandin

In 1991, RU486 was licensed for use in the United Kingdom. It is not available in Malaysia. RU486 can be used during all three trimesters. It produces an abortion by destroying the lining of the womb. It is often used with prostaglandin, a drug that facilitates labour and the evacuation of the abortus from the womb.

'Morning after' Pill

This pill contains a high dose of oestrogen, which makes the lining of the womb unsuitable for implantation of the fertilised ovum. It is effective if taken within 72 hours of sexual intercourse.

There are many techniques to abort an embryo or a foetus. Some techniques are relatively safe while others have certain dangers. What is important to note is that these techniques are readily available and can be done by any competent doctor. The easy availability and safety of the procedures have given rise to demands for abortion from pregnant women

for whatever reasons. A pregnant woman can check into a hospital or clinic in the morning, have an abortion done and be home in the afternoon in time for tea.

Basic Positional Response to Abortion

There are many confused responses to abortion. Many people look to their spiritual leaders for guidance but unfortunately, they do not have the answers. Meanwhile, the theologians may have a different stand from that of doctors who profess the evangelical faith. An academician may respond differently from a pastor offering grassroots care to a pregnant teenager. A rape victim may think differently from a busy female executive.

The various responses to the emotive issue of abortion can be categorised into four basic views:

1. Abortion is never justified

There are people who believe that abortion is never justified whatever the circumstances. Proponents of this stand believe that the foetus is a human being and there is no justification whatsoever to allow for the killing of a human being. The Roman Catholic Church is strongly against abortion even if to save the mother's life. Some conservative Christians also hold this view. Life is sacred and cannot be destroyed for any reason. The consideration here is the sanctity of human life.

2. Therapeutic abortion

Another group of people believe that abortion is permissible only in one special circumstance: to save the mother's life.

This group also hold the view that the foetus is a potential human being. When weighed against the life of the mother, who is a realised human being, the foetus can be sacrificed. Many conservative Christians hold this view. Since Vatican II, the Roman Catholic Church has made some allowance if one has to choose between the life of a mother and her unborn child. The abortion done here is called therapeutic abortion because it is used to save lives. The consideration here is the value of an individual.

3. Justifiable or 'hard cases' abortion

A third group also hold the view of the second group concerning the relative value of the foetus and the mother. However they extend the justification to include victims of rape, incest or congenital abnormalities in the foetus. They consider these circumstances as 'hard cases' because they believe in the sanctity of human life. But in a fallen world, bad things do happen to people. Taking into account the trauma of sexual abuse and the tragedy of an abnormal baby, the 'hard case' view makes a choice on the basis of the lesser of two evils to end the pain by killing the foetus. The consideration here is compassion.

4. Pro-choice view of abortion

Some people feel that the mother has the right to choose and that society, government and religious authorities have no right to interfere. The foetus is considered part of a woman's body and she has the right to decide what is to be done to her body. While others recognise the foetus as a potential human being, this group regards it as a lump of cells equivalent to a tumour. The act of performing an abortion is likened to the removal of tumours. Secular society prizes individualism

and individual rights. These people believe they have total autonomy over their own bodies. Hence they resent society placing a limit on their freedom. "My body is my own and I can do anything with it" becomes "My baby is my own and only I can decide what is to be done to it." The consideration here is the right of an individual to choose.

The first three groups are often called 'pro-life'. Most evangelical Christians and Catholics would be included in this group. The last group is called 'pro-choice'. Unfortunately, dialogue and attempts to understand each other's views have not been successful. The polarisation of views has led to protests by both pro-life and pro-choice groups that sometimes end in violence. There have been instances of fire bombing of abortion clinics and even murder of a doctor who performs abortion.

The Church's Response to Abortion

The Church has always been pro-life, working from the principles of sanctity of human life, value of an individual and compassion. But there are different views about abortion, different reasons for rejecting abortion and different degrees of tolerance to those who seek abortion. Before we look at these views, let us look at history to see how the early church dealt with this issue.

Abortion and the Early Church

The early church existed in the intellectual climate of the Greeks. During this period, it was generally agreed that physicians, some of whom were followers of Pythagoras,

were against non-therapeutic abortion. The Hippocratic Oath specifically forbade the giving of pessary to cause abortion. However, social and philosophical ethics (especially those of Plato and Aristotle) endorsed abortion which was widely practised. Meanwhile, the Alexandrian Jewish position, which was influential in the Jewish world at that time, viewed abortion as immoral and punishable in direct contrast with the Greek and Roman situation where abortion was permissible.

The earliest written references to abortion are those in the *Didache* and the *Epistle of Barnabas*. The *Didache* declared, "Thou shalt not murder a child by abortion/destruction." Similarly in the *Epistle of Barnabas* under the section "Thou shalt love thy neighbour more than thy own life," the foetus is seen, not as part of the mother but as a neighbour. Clement of Alexandria (ca 150-ca 215) in his *Prophetic Eclogues* argued that the foetus has a soul and is a living person. Tertullian (ca 160-ca 240), one of the most eloquent apologists in the West, considered the foetus a human being though still dependent on the mother. After the 'Christianisation' of the Roman Empire under Constantine, the practice of abortion increased in the church. According to Epiphanius of Cyprus (ca 315-ca 403), pagan influence in the church was the cause of the increase.

In AD 305, the Council of Elvira became the first Christian body to enact punishment for abortion and five major Church Fathers—Basil, Jerome, Ambrose, Augustine and Chrysostom—commented on the practice. Early Christian ethics seem consistent against abortion.

Abortion and the Catholic Church

The Roman Catholic Church has consistently been against

abortion. It held that at the moment of conception when the sperm fertilises the ovum a human being is born. This is the official position of the Roman Catholic Church today. Since abortion is the destruction of the product of conception, it is no different from the destruction of an adult. Both are considered murder.

The destruction of the foetus is allowed only if it is the result of a foreseen but unintended consequence of another procedure, for example, removal of the uterus with a foetus inside. This is the doctrine of double effect. If an action produces both good and bad results, but the good is better than the bad, then the act is permissible. In other words, it may be allowable to do wrong if some good may come out of it.

Abortion in Evangelical Churches

Though strongly pro-life, evangelical churches today are polarised over their views on abortion. These views range from absolute prohibition of all abortions, even in situations where it may save the mother's life, to allowing abortion for 'hard cases' which include rape victims, victims of incest and abnormal babies. 'Hard cases' are open to abuse as the criteria tend to be elastic. Add to this theological porpoise militant 'pro-lifers' who, in some cases, have resorted to violence to impose their views on 'pro-choicers'. Due to the lack of consensus among the evangelical churches, they have not been too effective in influencing society on abortion. In Singapore, the church is growing rapidly; however, there is hardly any dissent over the government's policy to make abortion available on demand. Francis Schaeffer and Everett Koop rightly observed that Christians have lost the opportunity to make any impact on society because of their

Lack of consensus on major issues.

Abortion and the Bible

The Bible surprisingly makes no reference to abortion. It does not give an answer to the most crucial question on the abortion issue: when is the foetus considered a human being? Attempts have been made to cite evidence that God considers the foetus to be fully human by referring to Psalm 139, Job 3:11, Jeremiah 1:5 and Luke 1:39-44 as we have noted in chapter one.

The Scriptural passage, to which both proponents and opponents appeal to in the current debate, is Exodus 21:22-25.

If men who are fighting hit a pregnant woman and she gives birth prematurely but there is no serious injury, the offender must be fined whatever the woman's husband demands and the court allows. But if there is serious injury, you are to take life for life, eye for eye, tooth for tooth, hand for hand, foot for foot, burn for burn, wound for wound, bruise for bruise. (NIV)

This passage can be understood in different ways. Firstly, it seems to imply that there is a distinction between a fully formed human life (the mother) and the life of a foetus. One can go further to say a foetus is not considered a fully human person and therefore has less inherent value than an already-born person. Thus the death of a foetus merits only a fine while death or injury to the mother calls for the application of

lex talionis (life for life, eye for eye, etc.). However, it should be noted that the foetus does have value, though less than that of the mother.

Secondly, the passage may be interpreted according to Jack Cottrell who argues that verse 22 does not refer to a miscarriage but to premature birth. Thus an act that causes premature birth merits a fine but death or injury to the premature baby or the mother is punishable by *lex talionis*. Thus Cottrell concludes: "...the life of the foetus is valued just as highly as the mother, and the *lex talionis* principle applied to both." R.C. Sproul came to the same conclusion following John Frame:

Dr. Frame also examines the verb *yatzta*, found in Exodus 21:22. The term means 'go out' or 'depart'. *Yatzta* is normally used to describe ordinary births (Genesis 25:26, 38:28-30; Job 10:18; Jeremiah 1:5, 20:18). The only possible exception is the use of *yatzta* in Numbers 12:12. Again, the Hebrew has a more accurate term for miscarriage and spontaneous abortion: *shukol* (Genesis 31:38, Exodus 23:26, Job 2:10, Hosea 9:14, Malachi 3:11). The proper interpretation, then of the phrase *weyatzze'u yelalbeyla* in Exodus 21:22 would not be an induced miscarriage nor the death of an unborn child but an induced premature birth of a living child.

Finally, Dr. Frame examines the term *ason* (injury) in verses 22 and 23. Had the writer intended to refer only to the woman, *lah* meaning 'to her' would have been added. The harm then refers to the woman, to her prematurely born child, or to both.

Regarding the various interpretations of the passage, Gareth Jones writes,

I regard this as slender basis on which to build a whole theology of the foetus. The biblical writer was dealing with the regulations within a covenant community, and his primary concern at this junction was with the nature of the punishment to be inflicted for injury following accidents or fighting. He was not dealing with the status of the foetus as such, or with its importance relative to that of an adult human life. This passage deals with unintentional abortion brought about by personal conflict.

There are even greater difficulties in applying this passage to the status of the embryo and early foetus. The miscarriage at the heart of Exodus 21:22-25 must have been of a relatively well-developed foetus, perhaps six months or older. Had the miscarriage been that of an embryo of just a few days' or a few weeks' gestation, the woman would probably not have been aware of her pregnancy, let alone of her miscarriage. To extrapolate from the miscarriage of an older foetus to the status of an embryo a few days old involves a major leap, which has to be justified on grounds of legitimate biblical interpretation. I do not consider that such justification exists.

The Bible, though silent on abortion, teaches that men and women are created in the image of God (Genesis 1:26-27). Humankind bears the image of God (*imago dei*) because God blew his breath or *nephesh* into them. This implies that a

foetus also bears the image of God. Donald Lake wrote,

While I maintain that the image of God is present in the foetus (as is *nephesh*), it is not something static. Rather, it is dynamic. It develops through one's life. The image of God refers to the total human being; shape and form as well as his role in creation. Consequently, the image of God is something that a human being grows into rather than simply is.

What is implied is that the foetus bears the image of God (*imago dei*) and yet it is in the process of becoming. A New Testament analogy is that we are to 'conform' into the image of Christ (Romans 8:29-30). Renewal is present at spiritual birth yet it also takes a lifetime of growing into completion. Donald Lake concluded, "Consequently, abortion is wrong not just because the killing of the foetus is destroying the image of God, but rather because abortion prevents the image of God from being fully manifested!" This is similar to the argument about personhood.

Current Discussion on Abortion: Personhood and the Right to Live

The nature and premise of the discussion on abortion has changed over the years. The Judeo-Christian foundations of the debate have now changed to a pragmatic materialistic postmodern footing. Where once the discussion was based on the value of an individual (personhood), it is now centred on the rights of an individual. The challenge to Christians is that they must participate in this discussion or be marginalized. In

this postmodern world, the voice of Christians must be heard or it will be silenced.

What then is a person? Robert Joyce says: "...a person is essentially a being that is naturally gifted (not self gifted) with capabilities or potentialities to know, love, desire, and to relate to self and others in a self-reflective way. The person is—not by self but by nature—*able* to be aware of who he or she is and *able* to direct his or her own self *in accord* with this nature" (italics author's). Joyce went on to emphasise that the stress is on the person being "a natural being and not simply a functional being." The implication is that a developing foetus is a natural being but not a functional being. This distinction is important when we discuss personhood. A human embryo has the inherent potential for personhood if it is allowed to develop, with the necessary nourishment and stimulation. In time, it will develop into a human being. Thus an unfertilised egg or spermatozoa, or a liver cell do not have the inherent potential for personhood. A fertilised ovum, on the other hand, under the right conditions will, in time, develop into a human being.

Discussions on abortion have moved into the area of personhood and the right to life. Instead of asking, "When does human life begin?" the question now being asked is, "When does a person begin?" This discussion has serious implications for the moral permissibility of abortion and infanticide. A person would have an inherent right to life and society has an obligation to protect this person. On the other hand, a non-person would not have an inherent right to life and society does not have any obligation towards it. Most discussions about personhood and the right to life can be summarised as follows:

- Only beings with a developed capacity for conscious self-reflective intelligence have a right to life.
- Beings with either a developed capacity or a 'natural potential' for conscious self-reflective intelligence have a right to life.
- All members of the human species have a right to life, whether or not there is a potential for conscious self-reflective intelligence.

These categories can be labelled as the actuality principle, the potentiality principle and the species principle respectively.

a. The Actuality Principle

This principle is the most radical and is hotly debated at the present time. It holds that an individual possesses the right to life only when the individual possesses self-awareness and self-reflective intelligence. This view is notorious because it means that foetuses, infants and the irreversibly comatose have no right to life. The implication of this principle can be summarised as follows:

| <i>Possessors of right to life</i> | <i>Non-possessors of right to life</i> |
|------------------------------------|--|
| Children | Foetuses |
| Adults | Infants |
| The reversibly comatose | The irreversibly comatose |
| The less severely retarded | The severely retarded |

According to this principle, no one is 'harmful' in an abortion because the foetus is not a person and thus has no right to life. No one has the right to come into existence; they only have the right to remain in existence.

b. The Potentiality Principle

The potentiality principle holds that it is wrong to kill what will naturally and in due course develop into a person. The potential is taken into consideration. The implication of the principle is as follows:

Possessors of right to life

Foetuses
 Infants
 Children
 Adults
 The reversibly comatose
 The less severely retarded

Non-possessors of right to life

The irreversibly comatose
 The severely retarded

c. The Species Principle

The species principle declares that human life is rendered inviolable by virtue of membership in the species *homo sapiens*. Thus those who have the genetic code of *homo sapiens* will automatically have the right to life. A fertilised ovum would be included in this category. The implication of this principle is as follows:

Possessors of right to life

Foetuses
 Infants
 Children
 Adults
 The reversibly comatose
 The irreversibly comatose
 The severely retarded
 The less severely retarded

Non-possessors of right to life

This theory is attractive because the Bible states that humans are unique, not because of their self-awareness or other special abilities but because they bear the image of God (*imago dei*). Thus membership in the human race confers a right to life.

Of the three theories, most Christians would have problems with the actuality theory, some with the potentiality theory but all should have no problem with the species theory.

The potentiality theory may be reasonable in assigning a hierarchy of personhood but is flawed in that it does not assign personhood to the severely retarded or those in the state of irreversible coma or a persistent vegetative state.

Two main groups of people are affected. The first group consists mainly of children. When a baby is born without a brain, it suffers from a condition called anencephaly (literally 'no brain'). Such a baby can breathe but will not be able to drink or suck. In such children, the primitive brain stem which controls breathing and heartbeat remains intact. Obviously, without a brain, these children will have no potential to develop self-awareness. According to the potentiality theory, such babies are 'non-persons' and hence have no right to live or come under society's protection. Another group of babies who do not qualify for personhood are those who suffer from severe brain asphyxia (lack of oxygen) at birth or some brain infection that results in a severely damaged brain. Since brain cells do not regenerate, a severely damaged brain cannot recover. Suffering from severe cerebral palsy, such children would be totally dependent on nursing care. They are spastic, unable to eat or respond, and will never be normal again. In some ways, they are like anencephalic babies except they

were born normal but suffered brain damage subsequently. Under the potentiality theory, such people were persons at birth but became 'non-persons' when their brains were damaged. In The Netherlands where euthanasia is legalised, there have been reports of severely brain-damaged children put to death by means of euthanasia.

The second group comprises brain-damaged children and adults. A person in the state of irreversible coma has very minimal brain function and is unlikely to recover and become self-aware. Those in a persistent vegetative state do not have any brain function at all even though their brain stems are intact. In that sense, they are like those who suffer from anencephaly. According to the potentiality theory, such people ceased to be persons when they entered into their present state. Hence society has a right to withdraw protection from them.

While the potentiality theory accords personhood to the foetus, it does not protect the two vulnerable groups mentioned above from having their lives taken from them.

With the species theory, all members of homo sapiens have equal value. The unborn foetus has equal value with the mother. According to this theory, there is no room to choose in a medical crisis; one cannot be sacrificed for the other.

Christian Alternative to Abortion

If the Church makes a stand against abortion, it must be ready to help those to whom abortion seems to be the only solution

to their problem. The biblical mandate to help our neighbours and protect the weak and the defenceless is most prominent in the abortion issue. In this case, our neighbours are frightened pregnant mothers seeking a way out of their quandary. The weak and the defenceless are the foetuses. No other group of individuals are as weak and defenceless as the foetuses.

Education

The Church must be at the forefront of sex education. There must be on-going teaching on abstinence, i.e. avoiding pre-marital sexual relationships especially amongst teenagers because of strong peer pressure. Young people must also be taught pregnancy prevention and the different contraceptive methods.

Adoption

For unwanted babies resulting from pre-marital sex, rape, incest or other reasons, adoption is an option for carrying the baby to term. There are many couples who are unable to have children and the Church has a role to help them.

Love and Compassion

Counselling, love and compassion should be given to those who are seeking abortion or have had an abortion. There are many frightened pregnant women seeking help. Many Christians who have undergone abortions have suffered spiritual wounds which need healing.

The issue of abortion offers good opportunity for the Church to be engaged with the State and society.

Conclusion

Abortion is a complex issue. The Bible does not give us specific instructions about abortion. However, from the principle of the *imago dei*, we conclude that the foetus has value because it is made in the image of God and has potential for personhood. As Christians, we are unable to accept the actuality and potentiality principles but we can accept the species principle for inherent personhood and the right to life. Thus we have a platform to engage non-Christians in further dialogue. Concerning the destruction of human life, if one is to take 14 days as the point in which human life begins, then abortion should not be allowed beyond that point. Usually at 14 days, most, if not all, mothers are not aware that they are pregnant. It is about this time that some of them may become conscious that their menses is late. Hence this is a moot point because most people will only consider abortion if they have missed a period and this usually happens only after 14 days.

The Church, which is the community of Christians, has an important role to play in this complex issue. It must reach out in compassion and love while offering education, support and adoption possibilities. It must engage the State once again to defend the weak and defenceless. The weak and defenceless focuses need advocates who will stand up for their rights as human persons and their right to life.

3 REPRODUCTIVE TECHNOLOGIES

Babies, Anyone?

Adam called his wife Eve because she was the mother of all humankind. Following God's mandate to be 'fruitful and multiply', there are six billion human beings on earth today with more being born everyday. While some couples are very fertile and want or need to limit the size of their families, there are other couples who want to have children but are unable to. Research in human reproduction has developed many methods to limit or improve fertility. These methods are known as reproductive technologies.

Contraceptive Technology

There are many ways to prevent pregnancy. Some Christians have problem with the idea of contraception because of God's command to be fruitful and populate the earth (Genesis 2). The Roman Catholic Church stand is based on the idea that

marriage is for procreation and childrearing. Hence any control of fertility is wrong and unnatural. Roman Catholics are forbidden to use any form of contraception. This thinking is derived largely from Augustine (*Marriage and Concubiscence*) who considered anything that distracted Christians from the spiritual realm and moral behaviour as wrong.

The best way to prevent pregnancy is abstinence. However, this should not be practised in a marriage because sexual intimacy is a very important part of marriage. Sexual intimacy has physical, emotional and spiritual dimensions that bond the husband and wife together. Paul taught that a husband and wife should not avoid sexual intercourse except for special reasons like prayer and fasting for a fixed period of time. Sexual intercourse produces babies. And there are many reasons why a couple may not want a baby at certain phases of their married life. So over the years, many methods of contraception to prevent pregnancies were developed. Basically, contraception can be divided into the following categories: methods that prevent conception and methods that prevent implantation.

Methods That Prevent Conception

Methods that prevent conception include 'coitus interruptus', rhythm method, barrier method, the pill, Norplant and sterilisation.

'Coitus interruptus' and the rhythm method may raise some concerns as they interfere with the natural course of sexual intercourse. 'Coitus interruptus' is the withdrawal of the penis during sexual intercourse so that ejaculation occurs outside the female. In this way, no spermatozoa is deposited in the

vagina and sucked up the fallopian tubes where fertilisation usually takes place. The Bible mentions 'coitus interruptus' in connection with Onan in Genesis 38:9. One of the customs of the Patriarch period was that when a husband died, his brother was required to have sexual intercourse with the widow so that she could bear children. Onan disobeyed by practising 'coitus interruptus'. The Bible mentioned that Onan was regarded as wicked, not because of 'coitus interruptus', but because he disobeyed God.

In the rhythm method, couples abstain from sexual intercourse during the period when the woman is ovulating. This is the simplest method of contraception and is widely used. Most people have no ethical problem with this method except when one considers the biblical mandate to 'go forth and multiply', it could be regarded as disobedience.

The barrier method is a means to prevent the spermatozoa from getting into the uterus and fallopian tubes. It can either be a condom used by the male or a cervical barrier inserted into the vagina by the female. In both cases, conception is avoided because there is a barrier between the spermatozoa and the ovum.

In the use of contraceptive pills, a combination of estrogen and progesterone is ingested. Different types of pills contain estrogen and progesterone in different ratios. These regulate a woman's menstrual cycle and prevent the release of the ovum. Without the ovum, fertilisation and conception cannot take place.

Methods That Prevent Implantation

Some types of contraceptive pills cause the uterine wall to be hostile to implantation of fertilised ovum or stimulate menstruation thus washing out any product of conception.

Methods that prevent implantation are intra-uterine devices (IUD), progesterone only contraceptive pill, morning-after pill and RU486. Intra-uterine devices are usually small plastic coils that are inserted into a woman's uterus. While in the uterus, it irritates the uterine wall and makes it hostile to implantation of any fertilised ovum. An intra-uterine device may be left in a woman for many years. The progesterone only pill, morning-after pill and RU486 also act on the uterine wall, making it a hostile environment for implantation. All these methods entail abortion as they prevent the embryo from implanting in the lining of the uterus. Their acceptability to Christians depends on our understanding of when human life begins. If a 'pre-implantation embryo' which is made up of less than 100 cells is not considered a human being, then there should not be any issue using these methods. As pointed out earlier, if conception is a process consisting of fertilisation and implantation, then conception has not taken place if implantation has not occurred. But if human life is considered to begin at fertilisation, then these methods will not be acceptable because by making the uterine walls hostile to the implantation of the fertilised ovum, one is intending to kill these fertilised ova. However, if one is to hold to the belief that human life begins at 14 days after conception, these methods will then be acceptable.

Infertility Technology

Infertility occurs in about one in eight couples in the USA. A couple may begin to seek advice about infertility if the wife has failed to become pregnant after one to two years of unprotected sexual intercourse. Even under the best of circumstances, there is only a 15 to 20 percent chance of pregnancy among 'normal' couples having sexual intercourse regularly. In young women having unprotected intercourse, the rate of pregnancy is about 20 percent; while for women over 40 years of age, it is 5 percent. Some Christians regard infertility as a medical problem and are comfortable with seeking medical help. Others regard it as a curse as there are many cultural stigmata attached to infertility. There are many biblical examples where infertility or being barren is regarded as a curse while God rewards those who are faithful to him by 'opening their wombs'.

For many Christian couples, being infertile is a traumatic experience especially in the Asian context of extended families where it is 'expected' that a marriage will produce children. There have been cases where church members and leaders are not too supportive and even forbid these couples from seeking medical help.

The Bible and Infertility

Children are a gift from God. The psalmist says, "Behold, children are a heritage from the Lord. The fruit of the womb is his reward. Like arrows in the hand of the warrior, so are the children of one's youth. Happy is a man who has his quiver

full of them" (Psalm 127:3-5a). Children are gifts, not a right. If God should decide to give children to a Christian couple, they should celebrate this fact and embrace the responsibility of nurturing these little gifts. It is not a right.

Secondly, God is sovereign in a marriage. It is he who opens and closes wombs. The biblical examples of Sarah, Hannah and Rachel are illustrations of his sovereignty and the mystery of providence. According to doctors working with infertile couples, in one third of cases, the problem lies with the woman, in another one third of cases, the problem lies with the man, and in the remaining one third of cases, the problem cannot be identified. In some cases, it may not be God's will for a couple to have children. God may have other better purposes for them. Christian couples should never think that infertility is God's judgment on them. It is estimated that 10 to 20 percent of couples are unable to conceive after one year of attempting to become pregnant. This is termed primary infertility.

Thirdly, infertility, like all other trials, may be a call to pray. I Samuel 1 is a powerful example of that call. Hannah was an infertile woman who was mocked. In her desperation, she called out to the Lord. Once she was so absorbed in her prayers that people thought she was drunk (1 Samuel 1:11-15). In time, God answered her prayers and she conceived a son named Samuel ('heard of God' in Hebrew). Infertility may be a call for the couple to seek the Lord in prayer to fulfil his loving purposes in their lives.

God often accomplishes his purposes by using human instruments, in this case doctors and nurses dealing with

infertility. Within the Christian community, there should be no objection to couples seeking medical help to treat infertility. It is, however, important that the couples seeking help understand the reproductive technologies and the ethical and moral consequences they may pose.

Reproductive Technologies

For a couple to have a baby, the husband must be able to produce an adequate amount of healthy spermatozoa and the wife have patent fallopian tubes, a normal uterus and healthy ovaries to produce enough normal ova (egg). If any one of these factors is missing, the couple will not be able to produce children. However, barrenness need not be accepted as a curse. These days, there are technologies to help such couples produce children.

Artificial Insemination

Artificial insemination by the husband (AIH) is used when the husband's sperm count is low. It involves concentrating several semen samples and introducing these into the cervix or neck of the womb when the wife ovulates. Though this procedure has been in use for more than 50 years, unfortunately, the success rate is low. The only possible objection to this is that sexual intercourse did not take place. It might even be considered an 'unnatural' means of conceiving.

Sperm Donation

If the husband cannot produce adequate amounts of sperm or have abnormal sperm, sperm donation may be considered. A sperm donated by another person other than the husband

may be used to fertilise the wife's ovum by direct insemination (AID). Fertilisation may also take place in a 'test tube' and the egg transferred into the wife's womb. Would a woman who receives another man's sperm in her body be considered to have committed an act of adultery? Clearly, this will be carrying the biblical and social definition of adultery too far. Adultery is considered to have taken place when a man or woman has sexual intercourse with another who is not their spouse. In sperm donation, no sexual intercourse has taken place. However, the child produced will have some of the genetic material of the donor father.

Egg Donation

If the wife is infertile, a donor's ovum can be fertilised by the husband's sperm in a 'test tube' and then transferred to the wife's womb. Again this may be considered an 'unnatural' conception as the conception takes place in a test tube and not in a woman's body. However, the fertilised ovum is 'normal' in the sense that there is no genetic damage and when implanted into the womb will produce a normal baby. To date, there are thousands of normal, healthy children produced as a result of conception taking place in test tubes.

Embryo Donation

If both husband and wife are infertile, it is possible to get the ovum and sperm from donors, fertilise the ovum in a 'test tube' and then transfer it into the wife's womb. The child born will have neither of the parents' genetic inheritance. This can be considered a form of 'test tube baby' adoption.

Womb Donation – 'Surrogate Motherhood'

If both the husband and wife are fertile but the wife's womb

is unable to bear children, it is possible to fertilise the wife's ovum with the husband's sperm, and transfer the embryo into another woman's womb. The woman provides a 'surrogate womb'. This has become common practice in some countries. Occasionally, one hears of surrogate mothers so attached to the children they carried to term that they refuse to be parted from them.

In-vitro Fertilisation (IVF)

In-vitro, in Latin means 'in glass'. The technique of in-vitro fertilisation (IVF) followed by embryo transfer was first developed by Dr. Robert Edwards, a Cambridge University physiologist and Dr. Patrick Steptoe, a gynaecologist, in the United Kingdom. Their first 'test-tube baby' was Louise Brown who was born in 1978. Since then, thousands of babies have been conceived by IVF.

In in-vitro fertilisation, eggs and sperm are collected and brought together in a petri dish. The fertilised egg or zygote is incubated for a few days until it is a blastocyte of eight or more cells. The woman is often given fertility drugs so that she can ovulate many eggs at one time. Sometimes as many as 24 eggs are extracted from the ovaries at one time. Hence many blastocytes or embryos are produced each time. These are examined and healthy blastocytes are inserted into the mother's womb. The more blastocytes inserted, the better the chances of success. Current international regulation does not permit more than three blastocytes to be inserted at any one time.

IVF technology has been helpful to many infertile couples. What is of concern to many Christians is what to do with the

spare embryos. For those who hold to the idea that human life starts at fertilisation or conception, they are left with the question of what to do with the extra little persons. It would not be an issue if they believed that these embryos are not human beings but masses of cells.

In a survey of some IVF laboratories in the USA, the fate of these embryos differs. Some of them are frozen. It is estimated that there are 100,000 to 180,000 frozen embryos in storage in the USA. Many experts believe this to be a very low estimate. There is really no hope for these frozen embryos. A very small number may be 'adopted' by other couples and a few may be used again for the next cycle by the mother. But most embryologists prefer to make a new fresh batch. One of the reasons why these embryos are frozen in storage is that nobody knows what to do with them and for religious reasons, people are afraid to get rid of them. As time passes, their own parents may not want them. There is a suggestion which is gaining popular support that these stored unwanted embryos be used for stem cell research in the USA.

For Christians, another concern with IVF is 'embryo reduction'. Each cycle of IVF is very expensive so the doctors are under pressure to produce a viable pregnancy. The more blastocytes or embryos implanted, the better the chances of success. Although most regulations recommend no more than three embryos be implanted, there have been cases where up to six embryos have been implanted at one time. Some of the implanted embryos will die. The problem arises when a few of them survive. The doctors will then suggest that they be allowed to remove the extra embryos. Doctors allow four weeks for the implanted embryos to survive and grow into

foetuses. So they are actually asking for permission to abort some of the foetuses. Christian couples must be aware of this possible scenario if they go for IVF. They must discuss with their doctors and insist that no more than three embryos be implanted. Then the most they will get are triplets.

GIFT

In Gamete Intra-Fallopian Transfer (GIFT), the egg and sperm are collected and placed in a fine tube separated by an air bubble. The tube is inserted into the woman's fallopian tube and the contents released, allowing the egg to be fertilised naturally. Many consider GIFT to be preferable to IVF. Technically, it is simpler and cheaper. Ethically, it precludes the production of 'spare' embryos.

ZIFT

Here the egg and sperm are brought together before being inserted into the fallopian tube. This means that fertilisation takes place outside the body. The newly fertilised egg is immediately inserted into the fallopian tube, hence the name—Zygote Intra-Fallopian Transfer (ZIFT).

Sex Selection and Genetic Screening

With the recent advances in genetics, it is possible to remove the embryos, check the sex of the embryo as well as other hereditary diseases and then re-implant the embryo into the mother's womb. This technology is called pre-implantation genetic diagnosis (PGD). Sex selection has always been an art rather than science. With the preference for male children especially in the Asian context, many people are happy for

the opportunity to choose the gender of their babies before they are born. Unwanted gender embryos are not implanted. Also embryos with inherited defects or diseases will not be implanted. A case can be made for not implanting embryos with genetic defects. But not implanting certain embryos for gender reasons is unjustifiable. If we believe that children are gifts from God, then we should receive the gifts as they are—little boys *and* girls. There are no grounds for predetermining the gender of the gift we receive from God, and then helping by removing those we do not want.

Conclusion

Reproductive technologies have made tremendous advances in the last two decades. Preventing pregnancies and allowing couples to plan when to have children, and how, is helpful in these times when things are changing so rapidly. They also allow a family some sort of control over their lives and make sure children are valued and wanted. Fertility technologies have also helped many infertile couples but they have also created new issues of excess embryos. Christian couples need to be aware of this before using reproductive technology for the treatment of their infertility but a frank discussion with their doctors about their religious beliefs may be helpful. The issue of extra embryos should be an important discussion point.

4

CLONING

Photocopying People

Star Wars Episode II: Attacks of the Clones hit the cinemas in June 2002 and became one of the most popular movies that year. In the story, Count Dooku commissioned a secret army of clones for the Republic. The clones were made of genetic material from Jango Fett, a bounty hunter noted for his aggressiveness and ruthlessness. As followers of the *Star Wars* saga would know, these clones became the storm troopers of the Empire. What is interesting about this movie and the discussions that arose from it is that nobody raised an eyebrow about the making of the clones. The general public seems to have accepted cloning as a fact of life.

Aldous Huxley, in his book *Brave New World* introduces a utopian world where the people are clones. These clones are contented with their similarities. Kazuo Ishiguro wrote a haunting novel about a boarding school for clones at Hailsham in *Never Let Me Go*. These clones are to be spare

part organ donors for their original. The author explores the emotions and thoughts of the clones, who know they are clones and whose one purpose in life is to be a source of organ replacement.

Fundamentals of Cloning

The word 'clone' is derived from the Greek word, *klon*, meaning 'twig', 'slip' or 'cutting'. The online Webster dictionary defines clone as 'an individual grown from a single somatic cell of its parent and genetically identical to it'. In nature, many lower organisms reproduce by cloning (asexual reproduction), for example, amoeba. In higher organisms, the development of monozygotic or identical twins, triplets or quadruplets, can also be regarded as a form of cloning. In this case, the fertilised egg immediately splits into two (twins), three (triplets), four (quadruplets) or more. All the resultant zygotes have identical genetic material and will develop into identical twins, triplets or quadruplets. We have no problems with natural cloning.

Dolly and Polly

In February 1997, Ian Wilmut and his research team from Roslin Institute in Edinburgh shook the world when they reported that they had created a cloned sheep named Dolly. Wilmut reported that they had successfully transplanted a nucleus (C) from a somatic cell (mature cell) from the udder of a sheep into the enucleated egg (E) (an egg where the nucleus has been removed) of another sheep. During this

process, the egg (C+E) became a fertilised egg and was implanted into the womb of the second sheep and grew to maturity. This process, called 'nuclear transfer technology', resulted in a lamb that was genetically identical to C. Wilmut reported that it took 277 'C+E's to produce Dolly. This scientific achievement was significant for two reasons. Firstly, it proved that cloning can be achieved by introducing a donor nucleus into an enucleated egg and the resulting clone has the identical genetic profile of the donor. Secondly and more important, it proved that with the necessary stimulation, it was possible to reprogramme a mature mammalian cell to differentiate and grow like 'germ or stem or egg' cell. Biology books had to be rewritten because it was formerly thought that only egg cells can differentiate into other cells thereby producing a baby, and that mature cells like bone cells or skin cells cannot differentiate anymore.

In July the same year, Polly was created by the same nuclear transfer technology in a farm in Scotland. Unlike Dolly, Polly also contains human genes. In biotechnological terms, Polly is a 'transgenic' animal. The presence of human genes in Polly enables her to produce valuable proteins in her milk. These proteins are extracted from the milk and used to treat a whole range of serious human illnesses such as cystic fibrosis and haemophilia. Research is being done to create transgenic animals to produce human plasma for transfusion. At present, a receiver of human plasma transfusion runs the risk of receiving plasma contaminated with viruses or prions that are not detected by normal standard screening protocols for donated blood. Plasma from a transgenic animal will be free of such risk.

Types of Cloning

With the available technology, it will not be long before someone proceeds to clone human beings. Although there are stringent laws and guidelines in some parts of the world, it is inevitable that someone will try. On 13 October 2001, Jose B. Cibelli, Robert Lanza and Michael West from Advanced Cell Technology in Worcester, Massachusetts, succeeded in growing a cloned embryo to a six-celled stage. Their aim was to grow the embryo to a blastocyte (100 cells). They intended to isolate the stem cells as a starter stock for growing replacement nerve, muscle and other tissues. However, they were unable to grow a cloned embryo beyond the six-celled stage. In February 2004, Hwang Woo Suk and Moon Shim Yong from Korea's Seoul National University published in the journal *Science* that they had successfully cloned 30 human embryos and grew them to beyond 100-cell blastocytes. This was a landmark study proving that it is possible to grow cloned human embryos beyond the blastocyte stage. Their aim was to establish a stem cell line for research purposes.

Cloning human beings is an emotive issue. Many people feel 'intuitively' that it is wrong but when pressed are unable to offer a reasonable explanation. They are unable to differentiate between science fiction and scientific facts. As Christians, we need to be clear in our thinking guided by a Christian worldview, which is formed by the Scriptures and wisdom from the Holy Spirit. We cannot appeal to tradition—a cloned creature is a new creation, something that never existed before, and we have no precedents to deal with this.

Broadly, there are three possible types of human cloning: ego

cloning, reproductive cloning and therapeutic cloning.

Ego Cloning

Many of us think of clones as 'xerox-ed' people, exact replicas of ourselves. Hence ego cloning is when people, especially the rich, the famous or the powerful think of producing a clone of themselves to take over and continue what they have started. Unfortunately, that is a fallacy. The clone may be genetically identical to the original. However, that is where the similarity ends. Supposing a 50-year old person decides to clone herself. When she is 55 years old, her clone will only be 5 years old. We are often misled by stories or movies that clones are produced immediately, full-grown, and are exact duplicates. It does not work this way. Clones, even though they may have the same genetic material will develop and grow differently. The clone will have different experiences and memories, different perceptions, and different likes and dislikes. It will not be identical to the original. The clone is a person, one with the ability or potential for independent thought, able to interact and influence, or be influenced by, other people and their environments. Clones are not 'xerox-ed' people. We must put away the idea of a number of clones looking and acting the same way as the original. This is not possible and truly the stuff of science fiction.

Studies done of identical twins have shown that even though they share the same genetic material, they are individual persons, having the ability for independent thought, are responsible for their own actions and relationship to God. Another question often raised is whether a cloned person has a soul. Theologians have agreed that twins, triplets and other multiples have souls, and they all have complete

souls, not half souls or one-third souls. Every person is an embodied complete soul. The argument can be extended to a clone, if one should ever exist (we are still dealing with the speculative). A clone with the complete genetic material of a human being would be a person and therefore should be accorded all the rights of a human being. Being a human being, he or she bears the image of God and will ultimately be responsible to God.

The other common perceived danger of ego cloning is the making of a 'master race'. With genetic manipulation, it is speculated that we can identify the features we want in our clones, for example, blue eyes, blond hair and high intelligence. The Human Genome, one of the greatest genetic projects in our time has studied the 24 chromosomes (22 autosomes and two sex chromosomes) of a human being. The project has, out of 3.1 billion base pairs in one chromosome set (two sets per genome), decoded 50,000 to 100,000 genes, representing less than five percent of the total sequence of base pairs. Genes determining physical characteristics such as blue eyes or blond hair have been identified. But genes dealing with intelligence are more illusive. Furthermore, it was discovered that the genes interact with each other in ways we still do not understand, so changing a gene in one region may develop unexpected changes in other areas. Cloning is different from genetic manipulation. In cloning, the same genetic material of the original is used. In genetic manipulation or gene therapy, specific sites of certain genes are identified. These genes are either 'switched on' or 'switched off' or else, new 'programmes' are introduced. We are still a long way from ego cloning a celebrity or creating of a master race of superhumans.

Reproductive Cloning

Reproductive cloning is the introduction a cloned embryo into a woman's womb leading to the birth of a cloned baby. Once the technical problem of nurturing a cloned fertilised cell beyond the eight-cell stage has been overcome, reproductive cloning may become a reality. There are some reasons why people may opt to clone themselves. Firstly, infertile couples who have attempted the various latest reproductive technologies and still fail to produce a child. The couple may, as the last resort, ask to clone one of themselves. Secondly, the couple may have an inherited untreatable genetic disease such as Huntington's disease. Wanting a child, they may opt to clone the unaffected partner. Thirdly, a family with a child needing a bone marrow transplant but are unable to find a compatible donor may elect to clone a child. The clone's bone marrow will definitely be compatible while bone marrow transplant is a safe procedure. There are also single persons or gay/lesbian couples who may want to clone either themselves or one of their partners. It should be borne in mind that in each of the above scenarios, the clone is a child, a person who is wanted and loved.

Therapeutic Cloning

In therapeutic cloning, instead of cloning the whole person, the technique of nuclear transfer is used to create certain tissues or organs to be used by the person himself. One has only to look at the long waiting list of people waiting for kidney and heart transplants to appreciate the problem. Aside from the lack of donors, organ rejection is a major problem with the recipients having to take anti-graft rejection medication for life. Therapeutic cloning uses genetic material from the patient's own cells to generate pancreatic islets to

treat diabetes, nerve cells to repair damaged nerve cells, skins for burns and even organs like kidney for replacement. The benefits from this type of cloning are tremendous.

At this moment, the technology remains at the experimental stage. The research deals with embryonic stem cells which are immature, undifferentiated cells with greater potential to grow into differentiated mature cells to form tissues or organs.

Christian Concerns on Cloning

When considering Christian concerns about cloning, we must be clear on the issues; otherwise the discussion will become confused and muddled. Issues on cloning are different from issues about embryonic stem cell research. They need to be discussed separately. The issue of embryonic stem cell research will be taken up in the next chapter. What then is the Christian response to cloning?

Firstly, how should the Christian view a cloned human being (should that ever be a reality)? The Bible did not deal with cloning because it was not a technology available at that time. The Bible does, however, deal in depth with personhood—a person is a thinking individual who is responsible for his or her actions, including his or her response to the love of our Lord Jesus Christ. A clone, having the full genetic constituents of the origin human, is a person. Just as we accord full personhood to each one of a set of identical twins, we should also accord full personhood to human clones. A cloned human is a person with the self-awareness and potential for a relationship with God.

Secondly, we need to be aware that the technology for cloning involves great wastage of embryos. As the case of Dolly shows, 277 attempts were made before Dolly was successfully implanted. That means 276 embryos died in the attempt. Until clinical research and technology for cloning has improved, a moratorium should be placed on cloning experiments with higher mammals including humans.

Thirdly, it will be difficult for Christians to justify ego cloning. It is inconceivable that people would prefer cloning themselves to producing biological offspring. This is a selfish egoistic act. There is no advantage in cloning an offspring instead of producing one the natural way.

Fourthly, the issue of reproductive cloning is not so straightforward. For parents who have lost a child and want to replace that child with a clone, we should give them our compassion but advise them that each child is unique. The clone will never be able to replace the lost child even though he or she may look the same. For those in a marriage with one spouse carrying a lethal hereditary disease, adoption or waiting for a cure may be a wiser choice than cloning. In the case of a gay marriage, there is no strong reason for cloning a member of the union.

Finally, Christians should affirm the sanctity of human life because we are made in the image of God. We should also affirm our stewardship of the created order in which we are called to be co-creators with God. We live in a fallen world where sin, suffering and disease abound. It is part of our stewardship to overcome sin, relieve suffering and cure disease. Therapeutic cloning has the potential to be a

powerful medical tool in the treatment of diseased organs or replacement of such organs. Cloned from the patient, such organs will not be rejected. One of the major problems in organ transplants at the moment is organ rejection. Recipient bodies usually reject transplanted organs and require lifelong treatment of powerful immunosuppressive drugs. Even then, most transplanted organs remain in their new host no more than five years. Cloning may be one of the instruments we can use to overcome this problem.

Conclusion

In this chapter, we have examined various aspects of cloning of human beings and explored some concerns Christians have towards cloning. We have also examined which areas of cloning may be acceptable to Judeo-Christian ethics and which are problematic. This discussion is based on the presupposition that it is possible to clone a human being.

More research needs to be done in this area. It may be possible to clone animals but cloning higher mammals like primates may not be so easy. We also do not know the possible lifespan or outcome of the clones. Dolly died young but before dying she had arthritis, which is common in older sheep. We also do not know the role of mitochondrial DNA which is not in the nucleus and was not transferred in the cloning process. There are still many unanswered questions. It is my belief that until we have more knowledge and better techniques to reduce embryo wastage, we should impose a moratorium on human cloning.

In his book *Valuing People*, Gareth Jones of the University of Otago, New Zealand, states that cloning "fits in at one end of a well-known continuum, that extends all the way to contraception at the other end. Like all technological procedures, it confronts us with human responsibility and irresponsibility, with human wisdom and foolishness, and with the ever-present message that we are to look to God for guidance and direction. The danger in the end is that human beings think they are omnipotent and all wise, able to do anything. Clones remind us that it is a dangerous and foolhardy illusion."

Cloning Timeline

- 1952 Briggs and King clone tadpoles.
- 1953 Watson and Crick discover the structure of DNA.
- 1963 J.B.S. Haldane coins the term 'clone'.
- 1984 Steen Willardsen clones sheep from embryo cells.
- 1985 Steen Willardsen clones cattle from differentiated cells.
- First, Prather and Eysteine clone a cow from embryo cells.
- 1990 Human Genome Project began.
- Wilmut and Campbell clone sheep from undifferentiated cells.
- 1995 Dolly, the first animal cloned from adult cells, was born.
- 1996 Wilmut and Campbell created Polly, a cloned sheep with an inserted human gene.
- Richard Seed announced his plans to clone a human being.
- 1997 Teruhiko Wakayama creates three generations of genetically identical cloned mice.
- 2000 Human Genome Project completed.
- 2001 Gibelli, Lanza and West succeeded in growing a cloned embryo to a six-celled blastocyte.
- 2002 Claims of cloned human babies by Clonaid and Raelians.
- 2003 Dolly died.
- 2004 Hwang Woo Suk and Dr. Moon Shin Yong successfully cloned 30 human embryos and grew them to beyond 100-cell blastocytes.
- 2005 Hwang Woo Suk was unable to produce any stem cell lines but falsified results to claim that he has 11 successful cell lines. This fraud was exposed by an independent research panel.

5 STEM CELL RESEARCH

Cells, Cells, Cells

Embryonic and Adult Stem Cells

Embryonic stem cells are cells present in the embryo just before it begins to differentiate. Hence stem cells have the potential to differentiate into any tissue, organ or structure of the human body. When the embryo begins to develop, each stem cell receives its instructions and follows its programming to develop into the different parts of the human body.

After the spermatozoa enters the ovum and fertilises the egg, an embryo is formed. This then begins to divide. When it reaches the 100-cell stage, it is known as a blastocyte. The blastocyte is a circular mass of cells. When the blastocyte is implanted onto a favourable environment such as the uterine wall, it begins to differentiate. The outer wall of cells will differentiate into the placenta and umbilical cord. The cells at the centre are the embryonic stem cells or, to be more specific,

human embryonic stem cells (hES). This is to differentiate it from embryonic stem cells harvested from the gonadal ridge of aborted fetuses, which are termed human embryonic gonadal stem cells (hEG). This discussion will centre on hES cells. In November 1998, researchers at the University of Wisconsin and John Hopkins University in Baltimore found a way to harvest the stem cells. Researchers have estimated that stem cells have the potential to differentiate into 110 types of human cells, which can turn into the different organs that make up our body.

It was discovered recently that contrary to decades of biological knowledge, adult differentiated cells can also be stimulated to revert to its undifferentiated state with the potential to develop into other tissues or organs. The undifferentiated adult cells are called adult stem cells. While there are possibilities that adult stem cells can be used, recent studies are not too encouraging compared to the embryonic stem cells. The adult stem cells are not so easily cultured and not so versatile in differentiation.

Embryonic stem cells are more versatile. It would solve a lot of ethical problems if adult stem cells were equivalent to embryonic stem cells. As noted earlier, embryonic stem cells are harvested by destroying an embryo or blastocyte. Adult stem cells are obtained from cells from umbilical cord blood, placenta, bone marrow, brain of cadavers and skin (Fibroblasts).

Potential Applications of Stem Cell Research

Stem cell research offers a radical shift in the way research is

conducted due to the properties of the stem cells. Firstly, stem cells are pluripotent. This means they are able to grow into any tissue in the human body. It is a matter of programming the cell to differentiate into any one particular tissue. Secondly, stem cells are immortal. Given the right environment, they will continue dividing forever without loss of their genetic structure. Thirdly, they are malleable. This means they can be manipulated without losing their cell functions. In animal experiments, stem cells can be inserted into an animal blastocyte and they will continue to grow.

Stem cell research can provide significant contributions in the areas of medical research. It can be used to identify potential teratogens. Pregnant women are exposed to many agents that can kill or maim the growing foetus. For example, thalidomide, a sedative given to pregnant women, can cause them to produce babies without limbs. At this moment, there are not many ways to determine which are the teratogens which are harmful to human foetus because obviously no one will expose human foetuses to them to find out. Most of our knowledge comes from research on animals. Stem cell research offers a way to identify and study the environmental toxins as well as drugs (medications) directly harmful to a growing foetus. Exposing some stem cells to a suspected teratogen and observing its development can give us information on its harmfulness to a human foetus.

Secondly, one of the problems when developing new drugs or medication in the pharmaceutical industry is drug toxicity. These days with the pharmaceutical industry custom-designing the molecules of new drugs, they need a fast and safe way to test these compounds. Stem cells offer such an avenue. For example, recently the Food and Drug Administration (FDA)

approved a drug for general use only to withdraw it later after the discovery of liver toxicity in the drug. This was in spite of human drug trials being carried out. With stem cells differentiated into liver cells, it is possible to test these drugs for liver toxicity even before human trials. This means that new drugs can be made available for general use earlier. Normally, it takes about five years for a new drug to reach the general public. Animal trials are conducted first, then human drug trials in multiple medical centres. With stem cells, it has been speculated that a new drug may be made available as quickly as six months.

Thirdly, the present approach in medical care is mainly preventive and limiting the damage done in response to diseases. One example is myocardial infarction or heart attack. A myocardial infarction occurs when blood flow to a certain part of the heart is stopped, often the result of a blockage of one or more of the coronary arteries. Without blood supply, oxygen and glucose, the heart muscles die. The aim of medical treatment is to restore blood supply to the affected part of the heart as soon as possible either by medication, balloon angioplasty or open-heart surgery. When blood supply is restored, the patient survives. Unfortunately, in the area where the heart muscles have died, new muscles are not formed because existing heart muscles cannot divide to form new heart muscles. They can only be replaced. Hence the functional tissue in this area is replaced by non-functional scars or fibrous tissue. As a result, the functional contractibility of the heart is compromised. Stem cell research holds the promise of creating new heart muscle cells and introducing them into the damaged portion of the heart to re-populate it. Similar procedures may be possible to treat diseases like

insulin dependent diabetes mellitus, stroke, Alzheimer's disease and Parkinson's disease. Stem cells herald a new phase of medical care called regenerative medicine.

Stem Cell Research and Therapeutic Cloning

One potential of embryonic stem cell research is to grow entire organs. So far, scientists have been able to grow liver cells around a supportive structure. Would it not be possible to grow a new kidney, liver or some other organs? Organ transplant has always been the last option. There is a long wait list for patients requiring kidney, liver or heart transplants. It is difficult to get donors and even more difficult to get matching or compatible organs. Patients who have received organ transplants will need life-long immunosuppressant drugs to stop their bodies from rejecting the donated organ. One result of this is that most donated organs will have a lifespan of about five years after which another organ will be needed. So it would be wonderful if an organ grown from the person's own stem cells was available for transplant. There would be no problems with organ rejection. This sounds like science fiction at present but the prospects are exciting. On 6 April 2006, the first stem cell surgery in the world was performed at the Royal Melbourne Hospital in Australia. The patient had lost a large segment of his leg bone in a motorcycle accident. Stem cells harvested from his bone marrow were introduced to the gap in his leg bone to produce new bones.

Therapeutic cloning is made possible by the process of nuclear transfer, the nuclear coming from the recipient. Being of the same genetic material, there will be no problem of

organ rejection or incompatibility. The stem cells can then be reprogrammed into replacement cells for the damaged organ or even grow into an organ itself.

The Current State of Embryonic Stem Cell Research

In 2004, South Korean scientists from Seoul National University announced that they had cloned 30 human embryos. From these 30 cloned embryos, they managed to establish 11 cell lines. Cell lines are the culture of a colony of cells from a single original cell. Unfortunately, it was later discovered that Dr. Hwang had falsified the results. In an investigation concluded in December 2005, a Seoul National University Panel found that all 11 stem cell lines were forgeries. The discovery was a major blow to stem cell research. It also damaged the reputation of scientists and their claim of objectivity in scientific research.

Two proposals to use cloned human embryos to create stem cells for research were submitted in the United Kingdom in 2004. One was from the Newcastle Fertility Centre while the other was from Roslin Institute, famous for the cloning of Dolly the sheep. Roslin Institute's proposal was for research on motor neurone disease while the proposal by Newcastle Fertility Centre was for research on diabetes. The Newcastle research proposal cited that stem cell research would eventually lead to therapeutic cloning.

Such research on human embryos is legal in the United Kingdom. The Donaldson Report from the Ministry of Health in the United Kingdom in the year 2000 recommended

extending the limits of human embryo research to allow human embryos to be used as a source of stem cells. It also called for the creation of cloned human embryos which could be reprogrammed to become replacement body cells for a wide range of degenerative diseases. It proposed research into mitochondrial disease using parts of the cloning process.

While research using stem cells has been authorised in Britain, in the USA, it was initially halted by President George W. Bush. In 2001, Bush allowed research to resume in government labs, but researchers were restricted to 72 existing lines of stem cells. In June 2003, the American Medical Association announced its support for human cloning for research purposes. Later that year, one of the states in the USA passed a law permitting stem cell research and the House of Representatives passed a bill that banned reproductive cloning.

On both sides of the Atlantic, Christians are actively involved in the ethical debate on cloning and stem cell research. The Church of Scotland has issued several joint statements on the issue of stem cell research since 1996. The Conference of European Churches calls for a ban on all cloned embryo research until a ban on reproductive cloning is in place in the United Nations. These concerned church leaders are not against therapeutic cloning but they want a ban to be in place to prevent maverick scientists from attempting reproductive cloning. The churches are also against creating human embryos for harvesting of stem cells but would allow extra embryos created for in-vitro fertilisation (IVF) to be harvested for stem cells. The justification is that these extra human embryos are scheduled for destruction anyway.

The Center for Bioethics and Human Dignity in the USA in its statement *On Human Embryos and Stem Cell Research* concludes, "We call on Congress to (1) maintain the existing ban against harmful federally-funded human embryo research and make explicit its application to stem cell research requiring the destruction of human embryos, and (2) provide funding for the development of alternative treatments which do not require the destruction of human embryonic life."

The public reaction to these statements are mixed. Several surveys in the United Kingdom and USA show that while many people are clear in their stand against reproductive cloning, they are confused in their understanding of stem cells and therapeutic cloning. Stem cell research is still a very new and developing field. In 1999, stem cell research was named 'Breakthrough of the Year' by the prestigious journal *Science*.

Christopher Reeves, the 'Superman' actor who became a paraplegic due to spinal cord injury in 1995, said, "Stem cell research holds the promise of hope for 100 million people living with incurable diseases from diabetes to heart conditions to Alzheimer's, Parkinson's, ALS, MS and spinal cord injury. It will affect the entire American family. I believe this is why we find in surveys such strong support from people with such diverse religious and ethical beliefs."

Colleen Parro, spokesperson for the Republican National Coalition for Life said in 2001, "We do not believe that human beings should ever be sacrificed for the benefit of another. We thought we left that at Nuremberg more than fifty years ago."

Christopher Reeves and Colleen Parro are on opposite

sides of the wide spectrum of views on stem cell research. Unfortunately, Christopher Reeves died before any of the research in stem cells bore fruit.

Some Christian Ethics Considerations

One of the key ethical concerns with respect to stem cell research is the human embryo, which is a major source of stem cells. In this regard, there are two opposing views. Those who hold that human embryos, especially 'pre-implantation embryos', are nothing more than a mass of cells have no problems teasing these mass of cells apart and using the core cells, which are the embryonic stem cells, for research purposes. At the other end of the spectrum are those who hold to the principle that all embryos are human beings and should be accorded the rights of human beings. To them, taking apart an embryo to harvest embryonic stem cells would be equivalent to murder.

Then there are a number of intermediary positions. One is held by the Church of Scotland, which in 1995 affirmed "the sanctity of the human embryo from conception but granted that there are limited circumstances under which such research might be reluctantly allowed prior to the 'primitive streak' stage, bearing in mind the seriousness of certain medical conditions especially infertility and genetically transmitted diseases." Its think tank, The Society, Religion and Technology Project and the Working Group on Bioethics and Biotechnology of the Church and Society Commission of the Conference of European Churches are against the creation of human embryos as a source of stem cells but will allow extra

embryos from IVF which are targeted for destruction to be used as a source of stem cells. The argument is that these 'left behind' embryos will be discarded anyway. Some 'parents' of these embryos have since completed their families and do not want them anymore. Other embryos can be considered 'orphaned' as their parents had died. On 21 September 2005, *The Age* newspaper in Australia reported that The National Health and Medical Research Council had granted licences allowing research on 1,731 'unwanted' spare embryos since the law was passed in 2002 allowing research on such embryos. This seems to be a pragmatic approach to a bad situation. Is it acceptable? If these 'unwanted' embryos are considered to have the status of human beings, then do we have the right to experiment on them on the premise that they will be destroyed anyway? At this moment, we do not allow any experimentation on humans, not even on convicted criminals awaiting execution. One could extend the same argument to 'unwanted' embryos.

There are other suggestions. One is to concentrate research on adult stem cells so that these can be reprogrammed to be as versatile as the embryonic stem cells. Nobody has any objection to the creation of adult stem cells from differentiated adult cells so it is a non-issue. One novel suggestion, which is being explored at this moment, is the creation of non-viable human embryos with cow eggs. The idea is to transfer a human cell nucleus into a cow egg. Passing an electric current will fuse the two and stimulate the human nucleus to divide like an embryo. At the appropriate stage of the blastocyte, the embryonic stem cell will then be harvested. This interesting idea avoids the creation of a human embryo but opens a new frontier of concern: the formation of transgenic animals

with the mixing of human and animal genetic materials. Still another novel alternative is to create human embryos for stem cell research by pathogenesis. This involves chemically inducing an unfertilised human egg to divide as if it was an embryo. These are possible alternatives to using cloned human embryos as a source of stem cells. Meanwhile, Christians should be supporting research in finding and refining the production of adult stem cells.

There have been concerns that stem cell research is human experimentation. It has been likened to experimentation on inmates of the concentration camps in Nazi Germany during the Second World War. The analogy, however, may not hold. The victims of the Nazi experiments were children and adults. Stem cells on the other hand are clusters of cells. There is no comparison. Human experimentation has always been done. Every new drug or medical treatment module has been subjected to animal testing, and when found to be safe and effective, were tried on humans (with the participants' consent, of course). It is by this form of human experimentation that we are able to enjoy the better healthcare we have today. Christians, fulfilling the mandate to 'love our neighbour', should consider supporting and even taking part in such clinical trials or human experimentation because the data obtained will benefit humankind.

Another area of ethical concern is the patenting of human cells. Commercial organisations are bound to patent their inventions or discoveries for monetary profit. This is especially so in the pharmaceutical and biotechnological companies. Patents have always been awarded for inventions. Whether a discovery can be patented is questionable but the distinction

has been blurred for some time, again because of financial goals. Whether one can claim exclusive rights to something natural is debatable. A USA patent has been granted to a company for 'cells which come from the early human embryo and are pluripotent'. What this means is that in the USA, all embryonic stem cells are the monopoly of one company. The question must be asked whether anyone can patent a part of the human body. The human body is God's creation. This applies to stem cells which are also part of the human body. That we know more about them and their potential is a discovery, not an invention. One may patent the techniques of nuclear transfer technology but can anyone patent stem cells?

The patenting of stem cells also creates another problem. It limits the opportunities for other researchers to do stem cell research. Stem cell research is in its infancy stage, so it is in the interest of humankind that as many researchers and institutions as possible be given the freedom to be involved.

Finally, the patenting of stem cells and its research will result in only the rich reaping the benefits. Basic healthcare data and use should be available to everybody. The Christian response should be to fight against such exploitation and commercialisation of our natural resources. Even though some may not agree with stem cell research, all must fight against the commercialisation of pure science research.

Conclusion

Stem cell research is new and many people confuse the

issues of stem cell research with cloning. We must be able to differentiate between the two issues and respond appropriately. The potential benefits from stem cell research are enormous. Its clinical application through therapeutic cloning is even more awesome. Doctors will be able to treat cell degeneration diseases with cell replacements and circumvent organ donor rejection with the patient's own cloned tissue and organs. Most Christians would agree on the potential of the applications of stem cell research. The main point of contention is the source of the stem cells. While there is room for a range of views on the source of stem cells, depending on one's belief on when human life begins, Christians should continue to pray for adult stem cell research to advance rapidly to make adult stem cells as pluripotent as embryonic stem cells.

The editors of *The Embryonic Stem Cell Debate* described the contributors to the book in the following manner: "All of them take the status of the embryo as critically important, but some hold that status in tension with other values such as the mandate to heal, whereas others maintain that a theological view mandates particular commitment to the weak and vulnerable or to new understanding of the origins or respect. Others, finally, believe that respect must be nuanced according to the nature of what is being respected...it is, in large part, a conversation about the ethical, scientific, philosophical, and religious meaning of who we are as human beings and what our fate will be in the new century."

6 HUMAN BEINGS 1.2

Upgrading the Design

If you were given a choice to change your height, body built or general intelligence, would you jump at the opportunity? How about a chance to avoid diseases like diabetes and heart disease which your parents are prone to? And what about your children? What if you could arrange for them to have higher intelligence, better brain function and an excellent memory? Would you do it even if it meant genetic manipulation? Would you subject your unborn child to genetic tests so that he would be born without genetic abnormalities? What if you knew that you were a carrier for Huntington chorea, a muscular disorder with no cure, or thalassemia, a blood disorder that needs frequent blood transfusions or Tay Sachs disease, a metabolic disorder that results in retarded growth and early death? These what-if questions may no longer be abstract theory but real dilemmas we face by the middle of this century.

Current progress in genetic engineering should compel us to

come to terms with what it means to be a human being. How much change can we make to our body and mind before we are considered no longer human? What does it mean that we are made in the image of God? If we modify our body and mind, would we still be reflecting the image of God? These are tough questions especially as we may soon have the means to become more than what we are now. With new technologies, we may become transhuman or post-human.

Transhuman

Transhuman comes from the term 'transitory' human. In the last decade, a few scientists have coined the word 'transhuman' or 'post-human' to denote the ability to develop or evolve our body from its present state to a new and better state. This would be achieved through genetic manipulation, new lifestyles, anti-ageing techniques, organ replacements, enhancement of our body with the help of drugs, prosthesis, human-machine interface, nanotechnology, regenerative medicine and new forms of medical treatments for diseases and degeneration of organs due to aging. This may sound like science fiction but many of the new technologies are already at their infancy stages of development.

One such technology is reprognetics. This is a phrase coined by Dr. Silverman, a Professor of Molecular Biology at Princeton University in his book, *Remaking Eden*. With the present technology of pre-implantation genetic screening, it is possible to avoid having children with chromosomal or inheritable diseases. Dr. Silverman postulated that this technology will have great ramifications and enact social

changes in the next two generations as inheritable diseases like Tay Sachs disease, thalassemia, cystic fibrosis and Down's Syndrome (a chromosomal disorder) disappear from the general population. We have been trying to eradicate certain diseases for many years. To date, we have succeeded in the eradication of smallpox while for the last two decades, we have been trying to eradicate poliomyelitis and hepatitis B. The technology we are using is immunisation. These successes have changed our outlook. No longer do large populations die from smallpox outbreaks and iron lungs, or children limp with deformed legs due to poliomyelitis. Within this decade, through immunisation of all newborns in Malaysia and Singapore with hepatitis B vaccines, we expect to stop the vertical transmission of the virus from mothers to babies. This, in turn, will reduce the number of adult patients with hepatitis, liver failure and liver cancer. However, we have not had much success against inheritable diseases. Once a child is born with these diseases, there is often no curative but only supportive treatment.

Trying to improve the stock of the human race or the 'gene pool' is not a new idea. Plato suggested in his thesis, *The Republic*, that only 'fit and healthy' men should be allowed to have sexual intercourse as frequently as possible with 'fit and healthy' females in order to produce as many offspring as possible. The republic (government) was to ensure that those who were not so 'fit' were not allowed to reproduce. This same idea was also taken up by Sir Francis Galton, cousin of Charles Darwin in 1865. Applying Darwin's 'survival of the fittest' theory to human population, Galton suggested that the government should act to ensure that only 'good stock' be allowed to reproduce. He called this 'eugenics'.

The Modern Eugenic Movement

The modern eugenic movement was very influential in the first part of the twentieth century especially in the USA, United Kingdom and Scandinavia, and later in Germany. The intention was to ensure improvement of the human race by retaining desirable traits and removing undesirable ones. Unfortunately, the definition of 'desirable traits' is influenced by the cultural, social, religious and political milieu of the period. Often, desirable traits are used to mean 'healthy white people'. Positive eugenics aimed to encourage people with positive traits to marry and produce many children. Negative eugenics involved preventing people with undesirable traits from marrying and producing children. The means by which this is accomplished is through forced sterilisation; immigration control; segregation; infanticide; euthanasia of the elderly, sick, mentally retarded, criminals, prostitutes and homosexuals.

Negative eugenics was carried to its extreme in Nazi Germany when attempts were made to produce a pure Aryan race. Awards were given to 'Aryan' women to have large families and a service was developed in which 'racially pure' women were impregnated by SS officers (Lebensborn). Negative eugenics became the 'racial hygiene' policy of the Nazi government. There was systematic elimination of 'undesirables' including Jews, gypsies and homosexuals in the Holocaust. They also sterilised over 450,000 people in a decade. During the Nuremberg trials of war criminals, some of them said they received their inspiration of mass sterilisation from the USA. Between 1907 and 1963, over 64,000 individuals were forcibly sterilised under eugenic legislation in the USA.

Forced sterilisations were carried out in some countries like Canada, Sweden, Australia, Norway, Finland, Denmark, Estonia, Switzerland and Iceland until the 1970s. The idea of eugenics is not dead. It is still around, only in different forms. In China, the 1994 Maternal and Infant Health Care Law Act mandates pre-marital screening for 'genetic diseases of serious nature' and 'mental illnesses'. The Chinese government uses coercion, threats, forcible abortions and infanticide to achieve their policy. Canada, USA and Australia still have restricted immigration policies that favour 'whites' over other races. Singapore has a government matchmaking agency to encourage graduate single females to marry.

What should be the Christian response to all these? We must recognise the rights of the individual which include the right to marry and have children irrespective of race. The biblical mandate is for humans to go forth and multiply. There is no restriction that only a certain group of people or race can be allowed to multiply.

Secondly, it is wrong to single out people with 'desirable traits' for survival and deny the rest the right to live. We must again affirm the right and worth of the individual. All human beings bear the image of God and have equal value. The Bible has always affirmed the worth of the individual. Take the example of Abraham, Moses, Elijah and Peter—God has always dealt with the individual. There is no indication that any individual is worth more than others.

Thirdly, governments exist by the authority of God to protect and provide for the sick and needy. These can be achieved through better and universal access to healthcare services and

preventive medicine. God does not condone a government or society that kills off the sick, weak, criminal and homosexual just because they are a drain on resources.

Finally, we must question the idea of a transhuman or post-human. No matter how much modification we make to the human body, it is still a human body. The definition of a human being is tripartite: body, spirit and soul. Changing or modifying the body does not change the equation because the spirit and soul remains constant. As God's steward on earth, we are to take care of God's creation which includes our bodies. As stewards, we are also called to take part in God's plan of redemption for his creation. This means that we must use whatever means in our power to improve the life and health of our society. Advances in science and technology have made this possible in ways we could not imagine 50 years ago, while the coming years promise more changes. What we accept and embrace must be guided by our respect for the sanctity of human life; the mandate to protect the poor and helpless, and relieve pain and suffering.

Transgenic Humans

The Human Genome Project has tremendously increased knowledge of our human makeup at the molecular level and our DNA. It was to the surprise of all concerned that at the end of the project, it was discovered that there are only 30,000 genes that we humans use. These make up about two percent of the human genome. The rest of the long chains of DNA are called 'junk' DNA because they do not have any useful function. Equally surprising, 99 percent of the 30,000

genes in human beings are similar to those of the rat. We may have closer links to the 'rat race' than we think. These 30,000 genes are activated or deactivated by proteins and RNA. The growth of a human being and her subsequent development is the result of activation and deactivation of certain genes for a certain period until the requested manifestation of the genes has done its work. Scientists have found that the activation and deactivation of the gene is a very complex programme. However, the insertion of certain protein or RNA interference (RNAi) can activate or deactivate certain genes. In this way, scientists can study the effect of these genes in animals like rats and pigs.

Another development is that scientists found that they can insert and incorporate genes from one species to another to effect certain changes. Animals with genes of another species are called transgenic animals. The insertion of a human DNA gene into a cow may cause the cow to produce human transferrin. The same procedure with a pig might yield human anti-clotting factors. In 2001, a gene sequence from a jellyfish was incorporated into a Rhesus monkey named ANDi (iDNA in reverse) proving that it is possible to be done in higher primates.

Most people would not have any ethical problems with human genes being incorporated into animals because this could cheaply produce certain hormones or factors which are of health benefit to humans. Bacteria have been used to create insulin for some time. Now clotting factors, transferrin and some hormones are being obtained from these transgenic animals. Some organs from transgenic animals are also suitable for transplantation. The heart and liver of pigs are appropriate

for use in humans.

But what if animal genes are incorporated into human beings? Would a human being with animal genes become less than human? So far, research has not been done in this area but it is only a matter of time before this happens. Would we allow such research to take place? Our knowledge of gene and gene interaction being still rudimentary, it would be a good place to highlight the questions of control and limitations of research and technology. Would we allow research and technology development to proceed in any direction without consideration for moral and ethical values? Or should there be some control over what is being done?

Some check and control over 'pure science' research should be in place at the level of institutions or corporations that sponsor the research. The government also has a role in monitoring and controlling types of research. In the United Kingdom, the requirement for registration and other laws are used to direct research along ethical guidelines. In the USA, restraint is by means of government control over research funding. Unfortunately, there are some countries which, for economic reasons, have allowed research without regulatory controls. In such places, the church could act as the conscience of the people.

Professional self-regulation is also crucial in the control of research. One of the unspoken rules of genetic research accepted by geneticists is that experiments should only be done on the somatic or body cell lines (non-reproducing) and never on the germ cell line (egg, sperm and stem cells). The reason is that the germ cell line could lead to the reproduction

and transmission of a trait onto the next generation, an area researchers do not know enough to step into. This is a good example of peer professional monitoring and control.

There is the case of a clinical trial of an aerosol delivery of a gene therapy agent for cystic fibrosis. Cystic fibrosis is an inherited disease of the lung, which leads to destruction of lung tissue. The aerosol delivered a protein that deactivated the cystic fibrosis gene. When the clinical trial was planned, there was fear of the protein affecting the germ line. So only male children were recruited for the study. This led to a public outcry of discrimination resulting in the research protocol being modified to include young women provided they were on contraceptives.

Genetic Testing and Screening

Genetic testing has always been a moral minefield. Pregnant women aged 35 and above are often advised by their doctors to have an amniocentesis done. This procedure is to syringe out some amniotic fluid which are sent for chromosomal analysis. Women who are 35 and above have a higher chance of producing children with Down's Syndrome, a chromosomal disorder involving chromosome number 21. Amniocentesis is usually done about two to three months into the pregnancy. The question facing Christians is what to do with the results of the genetic testing. If it came back positive that the baby has a chromosomal abnormality, would the couple abort the baby? That would go against the ethical and moral standards we raised in the chapter on abortion. Would the mother then go through the agony of carrying a child to term whom she

knows will be abnormal? There is a need for counselling and informed consent in genetic testing. Knowing may not necessarily be good. There are currently more than 900 genetic tests available.

A similar moral problem arises with genetic screening. Certain communities are known to have higher incidences of certain conditions. The Africans have a higher incidence of sickle cell anaemia, which paradoxically protects them from malaria. Communities around the Mediterranean are prone to thalassaemia while the Jews are more likely to have Tay Sachs disease. The Nuffield Council of Bioethics suggests that there is no point in doing screening unless there is a cure for the disease. This is true in a certain sense.

Some communities have taken upon themselves to conduct and act on the screening. In Cyprus, Orthodox priests require couples to be genetically tested before the marriage ceremony. They will not be married if the tests show that their children will be affected by thalassaemia. In New York and Israel, an ultra-orthodox organisation, *Dor Yeshorim*, requires every child at 16 be given a test for Tay Sachs disease, the results of which are collated into a database. Matchmakers will consult the database when making a match. If a couple are both carriers of the Tay Sachs disease genes, the marriage will not be allowed to take place.

Genetic screening discriminates against certain individuals. The principle here is the welfare of the offspring from a marriage. The unborn children need to be protected. It is not compassionate to produce children with thalassaemia or Tay Sachs disease and watch them suffer and die. The alternative

is for these couples to marry but not have children, and to undergo voluntary sterilisation. Genetic screening is a double-edged sword.

Many medical professionals are also concerned about the reliability of genetic testing, the difficulty in interpreting results and the possibility of laboratory errors. In some diseases, it is not a single gene but other factors as well that determine the manifestation of a disease. One example is Alzheimer's Disease (AD). AD is a complex disease characterised by deterioration of mental function after the age of 70. Scientists believe that AD is caused by a combination of gene and environmental factors. There are three different forms (alleles) of a gene called ApoE which control the onset of AD. ApoE2 carries the lowest risk of developing AD while ApoE4 bears the highest. A gene test for ApoE4 has been marketed since 1995 but the test is difficult to interpret because there are AD patients without ApoE4. The non-specificity of the test can lead to interpretations that may cause unnecessary anxiety, psychological trauma as well as insurance and employment discrimination.

Control of Genetic Information

There are signs that certain governments may push through registration for compulsory genetic screening. Apart from identifying carriers of diseases like thalassaemia, chromosomal disorders and Tay Sachs disease, genetic screening can also detect diseases or disorders patients may suffer in the future. It may reveal Huntington chorea or spot higher-than-average risk for breast or colon cancer, diabetes or heart disease.

Such information though useful may, however, have negative repercussions and raise ethical questions.

First of all, privacy and confidentiality are important issues. Whoever holds this type of information about a person can make decisions that will affect him in many ways. Who should have access to our genetic information? Should it be the family, insurers, employers, courts, school, adoption agencies or the military? How secure are these data? As we know, there is decreasing respect for privacy in our society. As we surf the Internet and shop online, there are programmes that are collecting data on what our preferences are and profiling us. When we apply for a credit card, open an account in the bank, join an organisation or send an email, we are revealing a lot of personal information which are collected and collaborated. One wants to know how secure is the information stored in a government database. Or how secure are our medical records.

Secondly, should genetic screening be done only when there is a family history? Should general population screening be carried out, such as screening all newborns for genetic disorders? Should genetic screening be done when there is no treatment available? If there were no cure for a certain condition, how would a positive test be beneficial to the affected person? We may be doing the person a disservice. One example is Huntington chorea. This is an adult-onset disease which results in abnormal muscular movement and is crippling. There is no treatment or cure. Do parents have a right to have children tested for adult-onset diseases which have no cure?

Thirdly, how would knowledge of genetic test results affect employment? Would an employer hire a person whom he knows will suffer from Huntington chorea in 10 years? Would a person who is at high risk of cancer be recruited? Employers have to keep in mind their overheads while healthcare for staff and productivity are important considerations.

Fourthly, insurance companies may not insure persons who are at high risk for certain conditions. Insurance is a business where the bottom line is to make profits i.e. collecting more premium payments and paying out fewer claims. And insurance companies have access to medical records. Most people do not realise that when they buy an insurance policy, they are actually giving consent to insurance companies to access their confidential medical records. At present, insurance companies are penalising people with known medical conditions by excluding them from making claims involving these organs. For example, if you have a history of asthma, the insurance company will sell you a policy that excludes you from claiming for medical conditions that involve the nose, throat and lungs. What would be the ramifications if they found out that you are genetically prone to certain diseases or cancer? Most genetic diseases are hereditary so the insurance companies may not insure your family as well.

Fifthly, public policy and perception will also be affected by genetic tests. For example, in Malaysia, there is a move towards a National Insurance Policy to help relieve the government from the burden of subsidising healthcare. What will be the consequences for people who are at high risk for certain diseases and disorders? What will the public perception be towards people who will develop diseases like Huntington chorea, Alzheimer's disease and motor neurone disease?

Sixthly, there are personal and family issues. If a woman discovered that she has a high risk for breast cancer, would she share the information with her sisters and make them anxious about their future? Or would she keep quiet but make sure they go for regular breast checkups? If you were detected to have a high risk of Alzheimer's disease starting at an early age, how would that affect your life? And that of your family? These are important personal questions that need to be addressed when genetic screening is done.

Finally, ownership of genetic information. Suppose a doctor took a piece of tumour from you and developed a cure for that cancer. He goes on to patent the cure. Do you have a right to that patent since the genetic information from which the cure was developed belonged to you? This may be an unusual example but the issue of ownership of genetic information may arise in the near future.

Genetic Treatments

Medical treatment modalities have been moving at a tremendous pace in the last few decades. Infectious diseases have been kept at bay with the discovery and synthesis of antibiotics. Treatment for cancer has improved with survival rates improving every year. New protocols have improved survival rates but often at the cost of severe side effects to patients. So far, medical treatment is like using a hammer to kill an ant. With the introduction of molecular medicine, doctors are refining the treatment modalities to be more specific to the cause of the condition, thus reducing the side effects of the treatment while improving its efficacy.

Genes, which are part of the chromosomes, are the software that encodes the physical makeup of our bodies. It is the mould that encodes the proteins that make up the rest of the body. When the genes are altered, the encoded protein is unable to carry out their function resulting in genetic diseases. One example is Severe Combined Immunodeficiency Syndrome (SCID), which is inherited, in which the gene of the offspring is unable to encode proteins to produce B and T lymphocytes. B lymphocytes produce antibodies and T lymphocytes produce the killer cells that destroy bacteria and viruses. Because the body cannot produce antibodies and killer cells, it is easily infected by bacteria and viruses. SCID children usually die early unless they live in a sterile environment.

Gene therapy is a technique of correcting defective genes. There are several ways in which genes can be corrected. The commonest way is to insert a normal gene into a non-specific location in the chromosome. This normal gene will start taking over the function of the original defective gene. Other methods include swapping the flawed gene for a normal gene through a recombinant technique, which repairs the defective gene by selective reverse mutation and altering the regulation of the impaired gene.

What is interesting about gene therapy is the way the normal gene is delivered to the chromosomes of the defective genes in the cells. The cells with the abnormal gene are called the target cells. It may be liver cells or lung cells. The carrier of the normal genes is called a vector. In gene therapy, the commonest vector used is viruses. Viruses reproduce by using the genetic duplication mechanism of the infected cells. Once a virus infects a cell, it incorporates its RNA or DNA into the

victim cell's DNA. Thus when the victim starts duplicating its DNA, it is actually producing the virus' DNA. Scientists make use of this information in gene therapy where initially, the 'normal gene' is incorporated into the genome of the vector virus. Then the patient is infected with this virus. The vector virus incorporates the 'normal gene' in the genome of the target cells. When the target cells start duplicating, they will duplicate their own DNA with the 'normal gene'. The 'normal gene' then starts to function thus restoring balance to the patient or curing the disease. The commonest viruses used as vectors are retrovirus (the Human Immunodeficiency Virus or HIV is a retrovirus), adenovirus (which causes the common cold), adeno-associated viruses and herpes simplex virus (which causes cold sores).

Apart from using vector viruses to carry the normal genes, there are other non-viral methods. One is to introduce the 'normal gene' directly into the target cells. This is difficult because it can only be used in certain tissues and needs large amounts of DNA. Another method is to use an artificial lipid sphere (liposome) to carry the 'normal gene' to the target cells or to bind the 'normal gene' to the target cell receptors. The most ingenious way devised so far is to create an artificial chromosome—47th chromosome (Normal humans have 46 chromosomes). This 47th chromosome is introduced into the target cells. The problem is how to deliver such a large molecule into the target cells.

So far, gene therapy has not been approved for general use. Though promising, little progress has been made since clinical trials began in 1990. In 1999, an 18-year-old patient who was suffering from ornithine transcarboxylase deficiency (OTCD)

died of multiple organ failure four days after starting gene therapy. His death was believed to be due to a severe immune response to the adenovirus used as the vector. This was a major blow to gene therapy studies. Another clinical trial using gene therapy to treat severe combined immunodeficiency disease (SCID) was halted in 2002 when it was discovered that one of the patients developed leukemia. It was postulated that the 'normal gene' started overproduction of lymphocytes that led to leukemia.

There is still a tremendous amount of work to be done before gene therapy becomes a standard form of treatment for genetic diseases. The body's immune response, the type of vector viruses used and the complexity of the genome are some of the problems to be solved. In general, there is no ethical problem with gene therapy except for the need to run more animal trials before human clinical studies are carried out. The ethical issue is more in the nature of a caution. The use of gene therapy must only target body or soma cells but never germ line cells. There must be sufficient safeguards against infection of germ line cells or else, the 'normal gene' will be transmitted to subsequent generations. We do not have enough information to guess what will be the consequences if that happened. It may be nothing at all or it may be a genetic catastrophe.

Conclusion

In this chapter, we have documented advances in biotechnology that sound like science fiction. Humans have always wanted to improve on the design of the human body.

Today, we have the means to do that. Yet we must be aware of the price that needs to be paid for every advance in science and technology. The development of agricultural technology and husbandry has changed human society from a nomadic to a communal existence. Industrialisation has given rise to cities and consumerism. Humanity has lost its personal worth and become a cog in the machine. The development of the information age has removed national barriers and shrunk the world. Humanity has lost its uniqueness and become a cluster of properties that can be modified. What will humanity lose in the biotechnology era? Can humanity remain human after all the genetic modifications? No doubt there are many benefits of genetic engineering that will make our lives easier and more comfortable. We must be alert to the dangers modifications to body design, genetic screening and engineering can pose to us personally and to society. Yet we must not reject their obvious benefits. We need to be like the men of Issachar who were able to discern the sign of the times.

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