The Genetic Revolution

Now we have seen what the new technology can do and what it is likely to be able to do in the future we are now in a position to consider urgently some of the issues involved.

There are two main questions we need to apply to each area of genetic engineering and to each technique used.Firstly is it safe, and secondly is it right?Having done this and decided what regulations are necessary we need to see them introduced in every country of the world, otherwise scientists and factories will simply relocate and set up elsewhere.

Is it safe?

There is a real danger of an instant response to the possible dangers of genetic engineering based on emotion and fear rather than reason. The first thing that is obvious is that there are a number of aspects of genetic engineering which are merely direct extensions of long established practice.Cross-breeding and propagating plants using cuttings are but two examples.

However as we have seen there are a large number of new areas where massive strides

forward are being made with very littlecontrol particularly in the areas of food production, environ -mental release of altered species, viral contamination and spread, and biological warfare research.

Public needs to be informed

Most people have little idea of what is really going on. Even when reports appear, they can be confusing to the non-expert and be hard even for scientists in unrelated specialties to under -stand.

The truth may not be told

Almost the only sources of information about the new technology from the very people who have the most to loose from regulations, not just in limits on research, but also because an increasing number of genetic engineers have large commercial interests in the application of their technology, particularly in the US. It is inevitable that risks will be played down, that accidents will be kept very quiet and experiments likely to trouble the public conscience will continue to be done quietly, without necessarily publishing results.

Lessons from the food industry

The food industry is an example where there is great consumer sensitivity - especially in the West with an increasing emphasis on "natural" foods.An example was the huge consumer reaction seen recently over the proposed introduction of food irradiation.The technique involves blasting pre-packaged foods with a large dose of radiation using X-rays.The doses used are enough to kill any bacteria so the food inside the sealed packet becomes effectively sterile.

At first there were natural anxieties about whether any surviving organisms might be likely to mutate into a more dangerous form. That fear has been largely laid to rest by extensive tests which show these germs cannot survive the process.The next fear was that the treatment would be used to sterilise decaying or contaminated food which would then be sold in supermarkets having been passed as safe.

Public fear leads to caution

However the biggest problem has been that people are afraid of radiation following such things as the contamination of Welsh sheep by the Chenobyl nuclear disaster in the Soviet Union.Radiation to the public means one thing: contamination with invisible particles which can be absorbed into the body and which can cause cancer in the future, for which there may be no cure.

Irradiation of food is probably completely safe, and would probably have been in wide use by now if food manufacturers had been able to introduce the technique without any publicity.Instead, after big media coverage, manufacturers were forced to indicate on the labelling if radiation was used. The regulation killed the process stone dead as far as many suppliers were concerned.

Unless there is a regulation, you and I will discover we have been buying genetically engineered foods after we have eaten them rather than before. Who wants to advertise the fact and risk a massive loss in sales ?

A possible response

So what response should there be? Firstly we have to be realis -tic: although I am very doubtful about the ability of any single government or group of governments to control this technology effectively - even if they agree to do so, and how to do it - nevertheless I think it is important to think through what should happen,and highlight the biggest problems.

a) Food production safety

1) The government should set up a licensing authority to approve geneti -cally engineered foods for human consumption, including those derived from plants and animals.The licence should cover not only where germ cells have been reprogrammed but also where the organism

contains a subgroup of infected cells.Particular attention needs to be paid to the possibility of introducing substances into the human diet on a large scale which could turn out to have cancer inducing, foetus damaging or other toxic effects.Genetically engineered foods should therefore be subject to a rigorous chemical analysis to determine what new or unfamiliar compounds may now be contained in the food. The ammount of analysis needed will depend on the degree of reprogramming.

2) Genetically engineered foods should be labelled clearly as such so that consumers can make a choice.

b) Environmental release of new organisms

The government should introduce strict regulation of the environmental release of new organisms.In some countries such controls already been in existence for some time, albeit as part of a voluntary code of practice (1860).These controls should apply especially to micro-organisms, to plants, fish, birds and animals which could survive quite easily if they escaped from a contained area on a farm.Controls do not need to be so strict with conventional farm livestock although such stock should be indelibly marked in such a way as to make their origin and nature instantly recognisable.Breeding of fish in a confined pond with no water outlet from it might be a borderline area.

c) Viral contamination controls

Viral spread outside the laboratory as a result of genetic research is a serious possibility - whether spread of plasmids, of plant viruses, of animal viruses or of viruses infecting humans. In the absence of effective anti-viral cures we have to recognise the great vulnerability humans have to a second plague like AIDS, but this time maybe of an even worse nature, spread - say - by respiratory droplets rather than by sexual intercourse or through the blood, and killing people in weeks or months rather than years.

We need to acknowledge that many countries of the world do now have all the resources to make by laboratory accident even more dangerous viruses than HIV.

All procedures involving the reprogramming or reassembling of viruses should therefore be strictly controlled. In particular there should be some kind of licensing authority for experiments where animals or plants are being infected by synthetic viruses. Less controls are needed for test-tube infections except where infected cells are replaced in plants or animals.It should be recognised that there is already evidence that genetically engineered viruses given to animals have the potential to mix uncontrollab -ly with other viruses already present with unpredict -able and possibly disastrous effects (1870).

d) Ban on biological warfare research

There should be an immediate world ban on developing biological weapons of any kind.All biological weapons stations owned by the military or by secret services in different countries should be closed and their supplies destroyed.

e) World monitoring of code of practice

At the moment it is too easy for those wishing to avoid any controls to move the base of their operations from one country to another.There needs to be a global consistency in the regulations applied from country to country.The World Health Organisation might be the appropriate vehicle to do this.

2) Is it right ?

Having considered some urgent issues relating to safety of this new technology we now need to turn to the more subjective area and look at where some of the most difficult ethical issues are. Broadly speaking they seem to fall into two groups: those concerned with the development of humans from egg to embryo to birth and those concerned with the radical changing of species.

Each of us has a view of the world which will colour our response to these things - and I have my own.However it is helpful first to establish a few common principles that a large number of people would probably accept.The first principle is an aesthetic dislike of creating the grossly

unnatural, or monsters.In the travelling fairs of some countries, for a small charge you can enter a tent and see some of the strange wonders of the world: animals with two heads stuffed in a glass box, or a baby with two heads and four arms.The Elephant man of the last century was not a loved or popular public figure.Going to the zoo to see cages full of animals mutated beyond all recognition is hardly likely to be a money spinner for the owners.

What is a human being ?

The second principle is a strong sense of what a human is - we recognise other human beings instinctively without necessarily being able to analyze all the reasons why.Our whole civilisation rests on social interaction and respect between individuals and groups of other people.Therefore a language speaking chimpanzee with reasoning powers, will, personality and artistic ability, is likely to be disturbing to most - especially if the chimpanzee talks fluently, with a large vocabulary, dresses in human clothes and adopts human mannerisms.

When it is realised that the cause of this genius is that the human genetic code for the brain's development was programmed into the developing embryo there may well be some who begin to wonder if the creature is not in fact more human than animal. After all, many owners of pets have similar feelings of identity with their dogs or cats for example.

I think there is a natural curiosity about such possibilities but a revulsion against having to live with the consequences on a daily basis.

A personal view

However once we go beyond these basic areas of intuitive agreement we quickly land up if we are not careful in a sea without any bearings or boundaries at all.I am going to share a personal view - not necessarily thinking that you will agree with me, but partly to throw into sharper focus what you yourself are comfortable or uncomfortable with.

Pause for thought

As I have gathered the material you have read, gleaned from sources in many countries of the world I have at times been stopped in my tracks by a particular discovery, piece of information or application.Sometimes it has been because of surprise at some remarkable piece or research, or a new piece of information that had changed my perspective on things.

However at other times I have had to stop and think not about what had been written about what had been done, but about what lay between the lines of what I had read.The very next chapter in the developing story seemed likely to contain huge implica -tions for our future world.I am sure you too have reacted at times quite strongly to information here about what is already happening and the obvious implications for the future.

Scientific faith

My own reactions have been very much influenced by the experimen -tal approach to science we were given at Cambridge, where no fact was ever taught without describing the experiments and the results on which this understanding was based, and then by my experience completing medical training and practising as a doctor.

My thinking has also been influenced as you might expect by my Christian faith.I was brought up as an Anglican but most of what I learned about the Christian faith as a teenager and young adult came from those in the Free Churches, especially from those taking the bible very seriously as an authority to be trusted.

As I have studied the bible over the years, and researched some of the enormous weight of archaeological and historical evidence for it's accuracy, I have become more convinced than ever of it's authority and authenticity as God's special message to us written through the hearts and minds of his servants.So as the book has developed I have been asking what the bible has to say to the Christian about genetic engineering.

The mystery of life

As a doctor with experience of caring for the dying I find that my respect for human life continues to increase over the years. There is an amazing mystery here which I do not wish to tamper with.Having been present during the birth of all four of our children and at the death of many people I feel privileged to have witnessed profoundly moving events.The existence of an added dimension is particularly obvious to me when caring for those who are dying.

In 1987 I was asked to write a book about how the church should respond to the AIDS epidemic.It's working title was "AIDS in your Church" because it was obvious to me that any church having a real impact on the local community was going to find AIDS and HIV infection were important pastoral and practical concerns. Concerns then needed to be channelled into effective practical care and prevention.

Caring for those with AIDS

In the event the extensive research for the book threw up so many things about AIDS few were aware of, that the publishers retitled it "The Truth about AIDS".The first print run sold out in months and US, Polish and other editions followed as well as another book aimed more at young people.As a direct result a new AIDS initiative was born in 1988 called ACET (AIDS Care Education and Training).It was set up as a Christian response to the AIDS epidemic, providing homecare and prevention pro -grammes both in the UK and overseas.

We use volunteers extensively alongside professional full-time staff to provide whatever is needed for someone ill or dying with AIDS to stay at home.After just three years we had grown to the point where we were involved in visiting at home up to one in four of all those dying with AIDS in the UK.

An increasing number of our volunteers are being asked to help as night-sitters.Their job is often to stay awake with the person who is ill, so that the main carer can go to sleep. However for half of those we care for there is no-one else with them in the home to care for them.

A life-changing experience

For a volunteer, to be present for the first time at the moment of death can be a life-changing experience.However much training and preparation has been given, nothing can take away from the full impact of the event itself.Perhaps for several hours the person has been very weak and sleepy - although orientated and able to talk if roused by a visitor.

Maybe for the last hour or two the volunteer has noticed how the breathing pattern has gradually changed.When the ACET nurse visited she had confirmed that his pulse was becoming weaker.

As the volunteer stays - perhaps holding the person's hand or mopping the sweat from his brow - it seems at times that his breathing is fading away altogether.Eventually the volunteer becomes aware that the breathing has finally stopped. The house is quiet and still.The person dying is still there - whatever they say death is far from instant.After a further minute or two there is another sharp intake of breath and then all is still again.

The volunteer is still sitting quietly at his side, now perhaps thinking about some of the things that may need to be done and the people who need to be contacted.Being present and involved at such a time is a special privilege and leaves a deep impres -sion.

Something is missing

Here is an individual bounded in space and time, usually full of vitality, personality and fun.The previous day he had been sorting out some of his personal affairs and had appreciated visits from one or two close friends.Just an hour or two ago he had been very much alive, but now he was gone.

His skin cells are still alive.His heart muscle is still alive. His gut is still digesting food and his bone marrow is still producing red blood cells.Almost all the cells in his body will continue to live if they are removed quite soon and if they are cared for appropriately.But he himself has gone.All the chemicals, proteins, sugars, and gases are present still in each cell - but something is missing.The conscious, caring, laughing, crying individual person has gone, with echoes left vividly in the memory and reminders of his life and activity all around the room.

More to life than life

This mystery has had a profound effect on the way I view life. There is more to life than life.You and I are more than the sum of our constituent parts.There is more to a human consciousness and individuality than just a bunch of chemicals.There is more to it than just a complex bio-machine driven by a few long strips of genetic code.It is the experience of almost all those involved in the care of the dying - whether the cause is cancer, AIDS or any other illness - that approaching death tends to heighten spiritual awareness in many people.So-called death-bed conversion is therefore not surprisingly quite common, even in situations like the ones our volunteers are involved in, where we are asked by hospitals and clinics to go in to provide practical help on the understand -ing that we will not abuse that privilege by seeking to use it as an opportunity to actively promote the Christian faith.

This mystery is seen again in the study of how a single fertilised egg develops so rapidly, so predictably and so perfectly into a whole new being which is then born into the world.

Whatever my own religious beliefs I then find myself compelled to take human life seriously, to resist the temptation to medical heroics when someone is reaching the end, and to be very cautious indeed about interfering with someone's beginning.

So how does this all affect an approach to the ethics of genetic engineer -ing?The answer is that it lays a context in which Christian beliefs can be more easily understood in terms of how they relate to these issues.

Cloning destroys individuality

I feel very uneasy about any aspects of human cloning that produce a twin where the twin will be born either at a different time, or to different parents.The essence of being human is our individuality.Identical twins or triplets are a special exception.They are literally from one flesh - caused by cells splitting off after fertilisation.Twins are usually very close and develop their own individuality within a family.The most basic unit in any society is the family, however that is defined.

The appearance of identical clones born into many different households seems to me to be at great risk of undermining what family is all about. To me, family is about the stable happy partnership of a man and woman, who hopefully are able if they wish to conceive and care for children they know are their own, part of their own flesh and blood.

For those who cannot have children but are fortunate enough to be able to adopt instead, at least they know that the child they are adopting is unique and special to them.What would the feelings of all concerned be to go on holiday and discover there were three absolutely identical children - blood brothers or sisters to your own adopted child, who were also i the area as part of other families.

Sexing children affects a nation

I also feel very uneasy about the widespread availability of sexing children - even if it does not involve the selective destruction of rejected embryos.Even if it only involves separating sperm in the laboratory so only the right sex genes are used to fertilise, I do not trust society to make sure there is a proper balance between the sexes. In many countries the result could be more boys than girls being born.

I can see that parents who have had three boys and really want a girl or the other way round, may make a very strong case for interference.However for my wife and I the whole process of conception has been tied up with seeing each child as a special surprise and a unique gift from God.Neither of us wanted to know the sex of any of our children until the moment of birth - even when the information was clearly available from routine ultrasound scan pictures.Looking back, each time it was a tremendous joy and surprise.

Many think we are fortunate because we have had two boys and two girls but I know we would have been just as thrilled whatever sex they were.It is just such a tremendous relief to find that the child is physically normal and not grossly disfigured or malformed or mentally handicapped.I can see one big advantage of knowing the sex before birth and that is reducing by half the agony over choosing names.In all our married life I think the only serious disagreements we have ever had have been over trying to find names we both liked and felt would be good for our children!

Pre-birth screening dilemmas

The issue of pre-natal diagnosis is less easy than many Chris -tians think.Doctors are faced with difficult, complex and agonizing decisions which appear to defeat the cut and dried rulebook approach.Some aspects of pre-birth screening have been going on for years and are a normal part of everyday medical practice.

For example, mothers can be screened to see if they are immune to Rubella (German Measles).If not they can be vaccinated prior to conception to avoid the possibility of infection in the first three months of pregnancy with damaging results for the child. Screening during pregnancy can avoid a rare but serious complica -tion where a particular immune response by the mother to the babies red blood cells causes the baby to develop problems in the womb, or in severe cases to die before birth.Giving the mother specially prepared antibodies can prevent the problem (1880).

However the most sensitive issue is the detection of genetic abnormalities for which there is no genetic "refit" possible yet. As we have seen, the range of diseases for which genetic screening of foetuses is possible is growing rapidly, whether for Downs Syndrome, Tay Sachs disease, Thalassaemia, cystic fibrosis or other illnesses (1880).

Routine testing in the womb

These tests are being used routinely already. As a Christian couple my wife and I were appalled to find we were being more or less told that blood taken while my wife attended the ante-natal clinic was going to be used amongst other things for genetic screening - in this instance to test for alpha-foetoprotein.The only purpose of the test would have been to approach us with the suggestion of an abortion if the test showed up a possible problem (1880).In fact had my wife not objected the test would have been carried out as a matter of routine.

The reason for the test is to detect if the baby is developing with a problem known as Spina Bifida.This is where the tissues forming part of the brain and spinal cord fail to form properly. They form first as a dark coloured strip on the outside of the embryo, running from the bottom of the back up to the head.This strip forms in a similar way in all mammals and has been

studied extensively.It is known as the neural ridge or groove.In the malformed baby, part or all of this strip fails to roll up properly into a tube covered with skin.

When the baby is born, the part of the nervous tissue which is exposed to the outside world is quickly damaged.The severity of the condition can vary enormously from a pinhole at the base of the spine which is so minor as to be missed by the midwife and doctor at birth to a most severe malformation incompatible with life.

The blood test works by picking up alpha-foetoprotein circulating in the mother's blood, which has been released by the abnormally exposed tissues in the womb and then has crossed the placenta into the mother (1880).A high level indicates either defects such as Spina Bifida or Downs Syndrome (1880).Unfortunately the blood test gives little or no indication of the severity of the condition and can be unreliable.

A right to life ?

We chose not to have the testbecause we had already made a decision that any child of ours had a right to be born and to live - even if it did not fit into our intolerant society's views of what "normal" is.

For us then we would not welcome a massive increase in the number of conditions or tendencies to disease which could be routinely detected in blood tests offered to all pregnant women. Unfortu -nately, knowing trends in my own profession, I suspect that batteries of these tests will become as routine as testing for anaemia and people will only find out after the event what tests were done when a doctor asks to see them about a worrying result.

The reason I say this is because such screening is standard practice in most other areas of medicine.For example, someone admitted with a range of unexplained symptoms may well have blood taken to be analysed for over a dozen different conditions.The doctor taking blood will probably just comment that "we are just checking your blood for any abnormalities and to make sure you are not anaemic".A recent US survey of 295 geneticists showed over 75% were in favour of carrying out pre-natal blood screening even if the mother was not interested in having an abortion before the test (1890).

Problems at birth

One of our children was born with a very rare congenital malformation - one I had only read about in the textbooks but had never seen.She was born with no connection at all between her mouth and her stomach.At birth she was a normal beautiful baby girl, but as soon as she tried to feed she choked.Twice she nearly stopped breathing.I diagnosed what was wrong before those on the maternity ward.

Within a few hours she had developed a near fatal pneumonia, but the story had a happy ending.She was operated on at Great Ormond Street children's hospital where they reconnected the two ends of the tube after which with one or two small problems since she has been effectively cured.For us there was a happy ending to a condition not unlike one of the many genetic diseases where routine testing may encourage people to abort a higher percentage of pregnancies in the future.

How big is a risk ?

Even if you take the position as many do that in extreme cases of congenital malformations abortion is alright, where do you draw the line?How severe is severe?Some of these future tests might indicate - say - a twice than normal risk of breast cancer or a doubled risk of a heart problem before the age of 65.

We have looked earlier at the form of bowel cancer which is inherited with the polyposis gene.However this type of bowel cancer is very rare compared to the main types.Overall, cancers of the large bowel (colo-rectal) are the third most common cancers worldwide.As our understanding of the different risk factors has grown we have come to recognise that there may be a genetic component in a great many cases.The genetic change alone is not enough to form cancers without other nutri -tional factors as well which may include fat, excess calories, the amount of fibre or calcium, selenium and various vitamins in the diet (1900).

A recent report on bowel cancer by the World Health Organisation says "recent studies in genetic epidemiology and molecular biology have shown that inherited genetic factors play an

important role in colorectal carcinogenesis .... prevention ... should therefore be to all populations who are at risk because of dietary and hereditary predisposition" (1900). We will have a very long list of such mixed cause diseases before long.

Pedigree humans

Before we know where we are we could have begun a

serious process of transforming the genetic pool of the human species. Incidentally if we were to do this extensively then we would start to see other major problems from inter-breeding.We would be developing a new pedigree human as much prone to recessive gene problems as pedigree dogs we saw in an earlier chapter. So having fought to eliminate one set of inherited conditions we might land up with a stack more.

As a recently published report said: "for many of these dis -orders, the ability to predict the risk of disease will antedate preventive and therapeutic interventions by many years. During this lag phase, issues concerning the validity of the tests, the severity of the diseases for which screening is offered, the safety of the interventions, and the autonomy of the pregnant woman in deciding to be screened are important" (1880).

Living in the real world

You may feel that all abortion is wrong, whatever the circum -stances, and that in the words of the new Danish law passed in 1988 establishing an ethical council " human life takes as it's beginning the time of concep -tion" (1910).Such a rule may be simple but for those who have to work through the consequences in terms of individual tragedy, life can often be far less cut and dried.

Two different mothers my wife and I know well gave birth over the last two years knowing that the baby being born had a heart defect so severe that the baby was unlikely to live for more than a few days.In both cases the parents were informed of the problem during pregnancy following routine ultrasound, repeated a few weeks later.Both couples were offered abortions

which they were very unhappy about - especially as by the time the baby had grown large enough for the ultrasound to be accurate it was getting quite late in the pregnancy.

Both families felt their babies were already alive, and were already or about to be conscious.They felt their babies were comfortable, moving around contented and secure inside the womb, and had an existence of their own.In both instances the birth itself was relatively straightforward and mother and baby were quickly home.Some two or three days later the babies became weaker and died quite quickly.

Personal tragedy

Another friend of mine came up to me recently to tell me some sad news.I knew his wife was expecting another baby and had been delighted for them both.He is an evangelical church leader and has supported the pro-life anti-abortion campaign.With tears in his eyes he described how doctors had detected a major problem on the scan - a very severe form of spina bifida affecting the development of the brain.There was it seemed no chance of anything approaching a normal life for the child.Faced with the situation after much consideration, thought and prayer both he and his wife felt it right to have an abortion. When the baby was delivered at around 20 weeks, gross abnormalities were obvious affecting the brain as well as the spine.

Taking a risk

These are difficult areas.In a way life was much simpler before pre-natal screening.What about the couple who have an inheritable disease which is so serious that they will not consider having any children unless some guarantee is there that the child will not be affected?Two friends of ours got married some years ago.Amongst many other things they have in common, they share a common problem: both of them walk with a limp because of a congenital malformation of the hip joint so that the hip is dislo -cated.For them both it was incorrectly diagnosed and treated when they were children.

Their first child inherited the same condition, and has already had to spend some weeks in hospital with the prospect of possible operations in the future.Perhaps our friends would welcome some way of ensuring that their next child has normal hips, although at least here the

condition is not life threatening and is treatable.Unfortunately genetic engineers are a long way from being able to test sperm or eggs genetically before conception so the only option likely to be available in the near future is an embryo test accompanied by the offer of an abortion, or perhaps looking further ahead the offer of embryo reprogramming (1920).

However such action could introduce a new mutation and a new disease or condition.The risk of doing this may be much less acceptable to correct a defect in someone as yet unborn, rather than in someone who is already born and ill.The simpler and more predictable alternative is always likely to be testing of foetuses and selective abortions (1930).

Problems of infertility

Infertility is a particularly common problem these days for two reasons: the first is that many people are delaying getting married or thinking about starting to have a family.Fertility drops quite steeply from the age of around 28 onwards so many couples who would have had slight difficulties conceiving a child in their early twenties are now faced with a much greater problem.The other reason is related to the steadily rising numbers of cases of sexually transmitted diseases each year - over 560,000 new cases in the UK alone.

One complication can be Pelvic Inflammatory Disease which is often caused by a tiny organism called chlamydia.This can be very hard indeed to get rid of.Over a period of years, chronic infection leads to fibrous thickening in the pelvis, which damages the delicate fallopian tubes used to carry the egg from the ovary to the uterus.

In some cases the eggs can no longer travel down, nor can sperm travel up.In other cases eggs become stuck as they are gently propelled along the tiny tube, but sperm still swim up the other way with the result that an egg becomes fertilised in the tube where it remains as it divides.The developing ball of cells implants in the tube instead of in the womb.

The tube has no thick muscular lining to implant into and there are no large blood vessels to feed the developing placenta.The pregnancy that results is highly dangerous and is a common cause of a medical emergency in women, with acute pain and massive internal bleeding caused by the burrowing of the embryo through the tube wall and bleeding from large blood vessels.

Children for families

With increasing infertility, and a low threshold for abortion there are very few babies available for adoption these days - certainly nothing like enough to meet the hopes of over five infertile couples in every hundred.Therefore the pressure is on to use every available method to provide children for people. It is a strange irony that many who don't want babies are conceiving and aborting them while many others desperate to be pregnant continue to be childless.

I feel genetic techniques designed to enhance the ability of a couple to have a child inheriting largely or completely their own genetic code, are fine.I would not even have a major objection to reprogramming an embryo so long as it was absolutely necessary to avoid - say - death in early adult life, and the procedure was known to be safe.I would distinguish here between a genetic repair, almost like micro-surgery on a chromosome, and a genetic adaptation introducing genes that would never have been part of the code of those parents, to improve physique or intelligence for example.

Foetal transplants

I am very unhappy about the use of foetal tissue in transplants. It seems there are pressures enough on people these days to have abortions and the odds are more and more stacked against the survival of the embryo.Regulations state that there must not be any relationship between an abortion clinic and those doing research to try and avoid abuses that could arise in times of pressure to complete research.I do not feel happy about any kind of experimentation on embryos, although some could say straight away that without it, we will never make any progress in areas I have said earlier would be ethically fine to use as proven treatments.

The Genetic Revolution - free book by Patrick Dixon - published 1995