

# Genetic Engineering

## Human Genetic Engineering

### Somatic-cell gene therapy

Definition – modifying the genes of a particular person without affecting the next generation

- *Retro viruses have been used to insert functioning genes into defective bone-marrow*
- *Diabetes sufferers can be given gene therapy to control production of insulin*
- *Potentially, a self-destruct gene could be added to cancer cells to provide a cure*

The Cloutier committee 1992 said “the development and introduction of safe and effective means of somatic cell gene modification directed to alleviating disease in individual patients is a proper goal for medical science.”

Concerns:

- Very few really, except where people have misunderstood what is happening
- Some people complain about this being ‘unnatural’ and doctors ‘playing God’ – just as they did when blood transfusions and organ transplants were first introduced
- While it is still new, there will of course be unknown risks to some individuals and false hope to others, but the long-term consequences should easily outweigh these

### Germ-line gene therapy

Definition – making changes to the reproductive cells that will affect future generations

- *Could be used to eradicate any inherited disease*
- *For example, Down’s Syndrome, Haemophilia, Huntingdon’s etc. etc.*

Bernard Hoose said that we should first: 1. Study somatic cell therapies for years to see the indirect effects of genetic changes; 2. Study the effects of germ-line changes in animals; 3. Secure widespread public approval, as this will affect future generations as yet unborn

Concerns:

- Germ-line changes will affect large numbers of future generations, so any mistakes could have disastrous effects
- You could make people susceptible to viruses that have only affected animals in the past
- The risks are unknown, potentially huge and possibly irreversible
- There is also the problem of discrimination of minority groups because of reduced numbers and seeing a disability as a defect – see Eugenics below
- Reduces the variety in the human gene pool

### Enhancement genetic engineering

Definition – using germ-line gene therapy to improve a person rather than rectifying defects

- *It’s hard to say when a genetic trait is a defect – is correcting bad eyesight an ‘enhancement’?*
- *Could be used to make ‘designer babies’ as in the film ‘Gattaca’*

Concerns:

- This is unnecessary, therefore not worth any risk
- You might argue that germ-line gene therapy restores our natural design – no such defence is possible for enhancements (although you could argue that evolution is natural)
- Driven by companies trying to make money, not improve humanity
- Humans are a poor judge of what constitutes ‘improvement’ (we would be design more Peter Andres and Jordans rather than Mother Teresas and Martin Luther Kings)
- Could lead to more diversity in human gene pool (but probably wouldn’t)
- These techniques would be available to the rich, widening the gap between rich and poor
- Reduces the worth of humans and replaces God as creator

## Eugenic genetic engineering

Definition – using germ-line therapy to create a better ‘race’ of people

- *Some people already think we are performing eugenics with screening for Down’s Syndrome*
- *Eugenics has been the policy of corrupt dictatorships, but we should be wary of subtler attempts*

Concerns:

- Encourages discrimination of anyone not seen as ‘perfect’
- Values humans for the wrong reasons (no ‘innate’ value)
- Focuses on strength and intelligence – often qualities of very disturbed, evil people
- Usually misused for social, racial or political ends
- Attacks basic freedoms and rights
- However, if being psychotic or abusive is genetic, why not protect society by using eugenics?
- Further, why make society pay for people with disabilities if their problems can be eradicated?

## Animal Genetic Engineering

Has been happening for years through selective breeding. It makes sense to save money developing ‘fatter’ chickens, but is a problem when their legs break under their body-weight. Technology merely complicates things by allowing more transgenic breeding and a wider range of potential uses:

- *‘Pharming’ – used to produce drugs or vaccines:*
  - *Sheep producing alpha-1 antitrypsin in their milk – used in treating cystic fibrosis*
- *Xenotransplants - Pigs bred to grow human organs*
- *Agriculture – leaner meat, better yield, greater resistance to disease*

Concerns:

- Involves embryos
- Very inefficient – of 7,000 eggs injected to produce transgenic pigs, only 0.6% were successful
- Unnatural – attacks God’s role as creator
- Consequences are unknown and potentially very harmful
  - Could affect entire ecosystems by upsetting the balance
  - Could introduce e.g. pig viruses into humans (AIDS may have come from monkeys)
- Mistakes result in great suffering for animals
  - e.g. calves engineered for muscle growth were unable to stand and had to be euthanised
- Companies are now patenting cross-breeds and making money from them
- Transgenic animals may be made for the wrong reasons – e.g. glow-in-the-dark rabbits
- Any developments will favour rich countries and further disadvantage developing countries

## GM Crops

As with animals, could be used to increase yields, increase resistance to disease and pests and make some plants immune to certain artificial pesticides and herbicides. However:

- Effects unknown – environmental, health etc.
  - e.g. Brazil nut gene was put into soy beans but caused nut allergy
  - A type of corn producing allergies was used for animal feed – but was later found in tacos
  - Antibiotic resistant genes used in crops could get into bacteria
  - BT corn pesticide killed the harmless Monarch butterfly
- Removes choice, as GM seeds travel over to non-GM crops or even weeds (making them stronger!)
- Could improve environment, but is driven by profit not concern for the environment
- Could provide an answer to world hunger (Kenyan researchers developed a GM sweet potato with an 80% improvement in yield)
- Charities think the opposite – it costs millions to develop these crops, so rich countries will do it first
- Traditional farming re-uses seeds, but biotech companies charge on a yearly basis
- Developing countries are going it alone, but their safety tests aren’t as thorough