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 Clothier 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, Huntington’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