B2.6 Genetic Engineering

Genetic engineering is when scientists remove a gene from one organism and insert it into the DNA of another organism. For example, the gene or human insulin can be inserted into bacterial plasmid DNA. This bacteria can then make human insulin, used by diabetics. Organisms like these are known as Genetically Modified Organisms (GMOs).

This production of human insulin has many advantages:

- Insulin can be used by vegans because it does not have to be extracted from dead cattle
- The supply of insulin is not affected by animal diseases or the numbers of animals slaughtered
- Using bacteria in fermenters, insulin can be made in vast quantities and cheaply

However, bacteria produce inulin slightly differently, and it does not suit everyone.

Plants and animals can also be genetically engineered, such as golden rice. This is normal rice plants with two extra genes inserted so that they make beta-carotene in the grain. Beta-carotene is needed by humans to produce vitamin A, and without vitamin A the immune system does not work properly or you go blind. However:

- GM rice could crossbreed with wild rice and contaminate wild rice DNA
- Eating GM could harm you (no evidence)
- Levels of beta-carotene are not high enough to make a difference
- Can be expensive or do not produce fertile seed

Scientists have also added genes to some plants to make them herbicide resistant. This reduces the amount of crop spraying needed, as the farmer just sprays one load instead of lots of little ones. However, cross pollination takes place resulting in the development of herbicide-resistant weeds, and there is a loss of biodiversity.

B2.7 Mitosis and Meiosis

Diploid cells have two sets of chromosomes, and most human cells are diploid apart from egg and sperm cells. Human diploid cells contain 23 pairs of chromosomes. To make more body cells, cells divide using a process called mitosis.

		Cloning embryos can be abused and used illegally by people like Dr Zavos to produce human clones

B2.10 Protein Manufacture

A cell uses the sequence of bases in DNA to build chains of amino acids. These chains form proteins, which is called protein synthesis. A specific order of bases in DNA produces a specific order of amino acids, and therefore a particular protein.

Transcription:

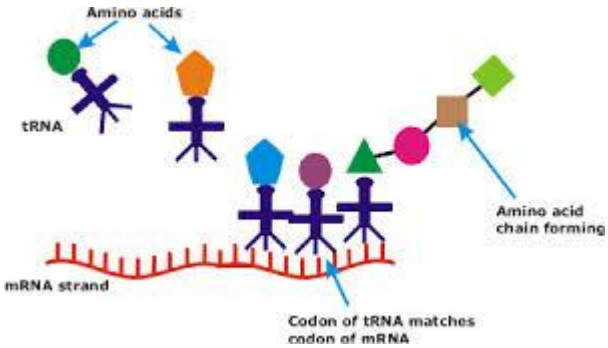
This takes place inside the nucleus.

1. The DNA in a gene unzips by breaking weak hydrogen bonds between bases in the double helix
2. One strand of the gene is used as a template strand
3. Bases complementary to this strand link together opposite it, forming the mRNA strand
4. mRNA has a base called uracil (U) instead of thymine (T)
5. the mRNA is small enough to move out of the nucleus and into the cytoplasm

Translation:

This takes place in the cytoplasm.

1. The mRNA attaches to a small structure called a ribosome
2. The ribosome moves from one end to the other of the mRNA strand, decoding bases into groups of three called base triplets, or codons
3. Each amino acid is attached to a tRNA, which comes and brings its amino acid to a codon
4. The two amino acids join together, and this process continues until the ribosome reaches the end of the mRNA
5. The chain of amino acids (polypeptide) is released and folds into a 3D shape
6. It is now a protein and will carry out its specific function



B2.11 Mutations

The number and order of amino acids in the chain is specific to each protein. For example, insulin has only a small chain of 51 amino acids, whereas haemoglobin is a large complex protein with four linked chains of 145 amino acids on each.