

Solutions

2.1 Genes inherited; conditions in which the individuals developed; a combination of genes and environment.

2.2 Choose parents with the desired characteristic, breed them, select the best offspring and breed those – repeated over many generations.

2.3 The carrier that transfers the gene into the cells; a bacterial plasmid; a virus.

3.1 The rabbit population shows variation in fur thickness – a genetic variant; in the cold winter, rabbits with thicker fur are better suited to the environment and are more likely to survive to breed; they pass on the alleles for thicker fur; over generations the population's inherited characteristics change – evolution by natural selection.

3.2 The nucleus is removed from an unfertilised egg cell; the nucleus from an adult body cell (e.g. skin cell) is inserted into the egg cell; an electric shock stimulates the cell to divide and form an embryo; the embryo cells contain the same genetic information as the adult skin cell; once a ball of cells, the embryo is inserted into the womb of an adult female to develop.

3.3 The human insulin gene is cut out using enzymes; it is inserted into a vector – a bacterial plasmid or virus; the vector transfers the gene into bacterial cells; the bacteria are grown in large fermenters and produce human insulin, which is harvested and purified. Benefit – an exact match to human insulin, so it works better/no rejection, unlimited supply, no pigs needed. Concern – ethical objections to transferring genes between species; possible effects if engineered genes spread – accept a justified risk or objection.