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The control of gene expression (AQA A2 Biology) PART 2 of 8 TOPICS

TOPICS: Alternation of the sequence of bases in DNA can alter the structure of proteins Gene expression is controlled by a number of features – most of the cell’s DNA is not translated Gene expression is controlled by a number of features – regulation of transcription and translation Gene expression is controlled by a number of features – gene expression and cancer Using genome projects Gene technologies allow the study and alteration of gene function allowing a better understanding of organism function and the new design of industrial and medical processes – recombinant DNA technology Gene technologies allow the study and alteration of gene function allowing a better understanding of organism function and the new design of industrial and medical processes – differences in DNA between individuals of the same species can be exploited for identification and diagnosis of heritable conditions Gene technologies allow the study and alteration of gene function allowing a better understanding of organism function and the new design of industrial and medical processes – genetic fingerprinting

# Gene expression is controlled by a number of features – most of the cell’s DNA is not translated:

Totipotent cells can divide into and produce any type of body cell. They are present in mammals in the first few stages of cell division.

During development, totipotent cells translate only part of their DNA resulting in a specialised cell:

* Stem cells all contain the same genes but not all the genes are transcribed and translated. This happens under the right conditions.
* mRNA made is shorter as only a few genes are transcribed.
* The mRNA is then translated into proteins.
* The proteins modify the cell as they determine the cell structure and processes that occur in the cell.
* Changes made by the proteins cause the stem cell to be specialised. Once a cell is specialised it cannot be reversed into a stem cell.

After the first few stages of cell division, the cells become pluripotent. Pluripotent cells can specialise into any body cell apart from placental cells. Pluripotent cells are used in treating human disorders.

In mature mammals there are multipotent cells (are able to differentiate into a few types of body cells) and unipotent cells (are able to differentiate into one type of cell).

An example of unipotent cells is cardiomyocytes which are heart muscle cells. It was thought that these cells could not divide to replicate themselves. This can be a major problem as if the heart muscle gets damaged there would no replacement. Recent research has proven that cardiomyocytes can divide and replicate. Scientists are able to come up with an explanation that the cells are replaced by unipotent cells differentiating into cardiomyocytes. They also believe that this process could be occurring constantly but there are disagreements as to how quick this is happening. Some believe that it is a really slow process where a possibility of some cells never being replaced may occur. Others believe that it is a really quick process so every cardiomyocyte is replaced.

IPSC (Induced Pluripotent Stem Cells) are cells created in the lab by scientists. They follow a process called reprogramming so that specialised adult body cells become pluripotent cells. The adult cells are made to express a series of transcription factors that are normally associated with pluripotent cells. The transcription factors cause the adult body cells to express genes that are associated with pluripotency. One way in which these transcription factors could be introduced to adult body cells is by infecting them with a specially-modified virus. The virus has the genes coding for the transcription factors in its DNA. When the virus infects the adult body cell (by injecting its DNA into the cell or by entering into the cell by endocytosis), the adult cell will be able to produce transcription factors as the virus will pass on its DNA to the cell.