Genetics

Health & Medicine

Genetic Engineering Genetic Engineering Genetic Engineering is a process involving the manipulation of an organism’sgenetic composition utilizing biotechnology. DNA is isolated and copied utilizing molecular cloning or other methodologies there generate new DNA material or result in DNA synthesis. This new DNA is then inserted into another organism’s genome. Other techniques of genetic engineering involve gene targeting or DNA “ knocking off”. Organisms that are derived from these methods are referred to as genetically modified. These methods have been used to alter the genome of individuals lacking genomes that are responsible for regulating certain physiological processes. This paper will focus on the utilization of genetic engineering in the production of insulin and the different steps that are involved (Genetic Engineering to produce insulin, 2012). Diabetes Mellitus is a metabolic disorder which involves the inability for glucose sugar removal and can occur due to the inability to produce insulin or the incapability of the body to produce sufficient insulin. These metabolic disorders are referred to as Type II and Type 1 diabetes respectively. In the past, insulin was obtained from cows via the purification of their pancreases and also from pigs which had been slaughtered in the food industry. However, there were some disadvantages from these processes as cows and pigs are not humans and there were often allergic reactions that were experienced and the whole method itself was very expensive. This procedure was further developed when the structure of human insulin was studied and identified in the year 1955. This gave birth to the process of genetic engineering as the demand and need for a constant and more reliable source of insulin was required (Genetic Engineering to produce insulin, 2012). Crick and Watson’s discovery of genes created a door for numerous scientific developments including

genetic engineering which was later utilized in the production of insulin. This process will be summarized into five steps. This first step involves obtaining the appropriate gene sequence from humans which is responsible for the production of insulin. This sequence is CCA TAG CAC CTA. It is almost similar to that of cows and pigs however there are some differences, hence further illustrating the reason why genetic engineering was a better option. Insulin gene is obtained from the double strand that is located on the 11th chromosome. To be more specific, recombinant DNA is cut off from the genomic DNA and these are then purified and prepared for insertion. The cutting of the DNA section is carried out by enzymes which are known as restriction enzymes (Recombinant DNA Technology in the Synthesis of Human Insulin, n. d). This genetic sequence is then inserted into a vector which is referred to as a plasmid. A plasmid is a circular variant of DNA. In order to create a place for the gene to be placed, enzymes are required to cut this vector and these are known as endonucleases. These enzymes are utilized on any part of the plasmid. Once a section of this plasmid has been cut and exposed by endonucleases, it is then mixed with the gene sequence present on the recombinant RNA. The rRNA is mixed into the plasmid with an enzyme known as ligase which is responsible for reparation of single DNA strands and hence helps in joining the two mixed components together. The goal of this stage is to ensure that the rRNA joins the plasmid before it closes (Assady et al., 2001). The above mentioned process results in the creation of a hybrid plasmid which is capable of producing insulin. This plasmid can then be placed into a host cell, and is now capable of performing physiological genetic functions within this new cell. In essence the cell also continues to perform its own functions along with the additional process of insulin

production. As mentioned above, there are several advantages associated with this process; however, there are also limitations involved which include environmental, social and economic factors. In addition the long term consequences of the procedures are yet to be established. Restriction Enzymes Source: Restriction enzymes. Chsweb. n. d Source: Restriction enzymes. Chsweb. n. d. Source: Genetic Engineering to produce insulin. Blogs. swa-jkt. 2012. References Assady, S., Maor, G., Amit, M., Itskovitz-Eldor, J., Skorecki, K. L., & Tzukerman, M. (2001). Insulin production by human embryonic stem cells. Diabetes, 50(8), 1691-1697. Genetic Engineering to produce insulin. (2012). Retrieved from http://blogs. swa jkt. com/swa/10822/2012/02/26/genetic-engineering-to-produce-insulin/ Humulin Production: Recombinant DNA used to produce human insulin. (n. d). Retrieved from http://www2. gvsu. edu/chm463/diabetes/Recombinant %20DNA%20and%20Insulin%20production. html Recombinant DNA Technology in the Synthesis of Human Insulin. (n. d). Retrieved from http://www. littletree. com. au/dna. htm Restriction Enzymes. (n. d). Retrieved from http://chsweb. lr. k12. nj. us/mstanley/outlines/biotech/restenz. htm