Synthetic Insulin

Theresa Kennedy, *Biomedical Engineering, University of Rhode Island*
BME 181 Second Presentation, April 8, 2013 theresa_kennedy@my.uri.edu

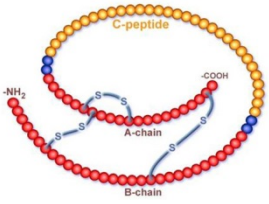
Abstract- One of the fastest growing diseases within our country is diabetes, requiring many patients to receive regular insulin injections. With the increase in cases came an increase for more effective insulin as well as greater production. Previously animal insulin was the main source of insulin for diabetics until synthetic insulin was created which was more beneficial. Using bacteria and the enzymes found within it scientists are able to construct DNA sequences that are used to produce the amino acid chains that are insulin.

I. Introduction

Diabetes currently affects 8.3 % of the U.S. population; the majority of these people are inflicted with the most common types of diabetes known as type 1 and type 2. Type 1 diabetes is an autoimmune disease where the immune system destroys the insulin producing beta cells of the pancreas. These patients do not produce enough insulin and require daily administration of insulin. 90% of diabetics are type 2, where the body ineffectively uses insulin which is largely the result of excess body weight and physical inactivity. Insulin is a necessary hormone that enables bodily cells to allow blood sugar to enter and be converted into energy. Previously, pig and cattle pancreas glands were the only viable method of production of insulin. While sufficient for most diabetics, the use of animals to produce insulin did cause some allergic reactions, as it was not a true human match to insulin. Because of this and the need for mass production of insulin, synthetic insulin was created. Synthetic insulin was first made in 1978 by scientists at Genetech, Inc. and City of Hope National Medical Center in California. This achievement was a giant step forward in insulin production for people with diabetes.

II. Methods

The discovery of enzymes that could cut and paste DNA made genetic engineering possible. These enzymes, restriction enzymes, are found naturally in bacteria, can be used to cut DNA fragments at specific sequences, while another enzyme, DNA ligase, can attach or rejoin DNA fragments with complementary ends. This recombinant DNA gene technology is used to synthesize insulin.Insulin is a protein hormone made up of two chains of amino acids known as an "A" chain which has 21 amino acids and a "B" chain which has 30 amino acids, they are linked together by two disulfide bonds. Proteins are made in cells by translating the genetic information carried in a cell's DNA. Scientists, using the restriction enzymes, make and link together small pieces of DNA sequences to form complete genes. Using special enzymes chains are then stitched into circular DNA strands called plasmids found within the cell. The newly constructed plasmids containing the transplanted genetic material were introduced into a benign E. coli bacterial strain. Once inside the bacteria, the genes translate the code into either the "A" chain or the "B" chain proteins found in insulin. The process is the same as that used by bacteria to produce its own proteins. The chains are then harvested to isolate them from the bacteria; a tetracycline is then added to kill off the bacteria. The two chains are combined chemically to form the complete insulin molecule which is identical to that produced by the human body.



Synthesizing insulin in a laboratory.

III. Results

Synthetic human insulin is largely regarded as a better substitute to animal insulin. It is less expensive, absorbed more rapidly by the body, has a shorter more manageable duration of effectiveness, and causes fewer allergic or autoimmune reactions than the animal insulin hormone. Synthetic insulin has the side effects of extreme lethargy, mental confusion, memory loss, joint and muscle pains, depression, general feeling of being unwell.

IV. Discussion

Currently debates have been arising over whether synthetic insulin should be used over animal insulin. While synthetic insulin provides more benefits than animal insulin, people deem animal insulin a natural treatment, and therefore a better choice for their body in the long run. Synthetic insulin is most widely prescribed and easier to come by, patients would like to be more readily given the information and choice for animal insulin.

References

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