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Short Communication

Development of transgenic wheat (*Triticum aestivum* L.) for *diabetes mellitus*

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Diabetes mellitus **(Diabetes) is a genetic disease that is due to single gene mutation. If we transfer that gene into the human genome through gene therapy or genetic engineering, we can control *Diabetes mellitus* but quite difficult and expensive except we transfer that gene into the wheat (staple food for more than 70% population of the world) genome. If successful in producing transgenic wheat with *Diabetes mellitus* gene then we can control disease manually, cheaply and efficiently without any harmful effect of medicines or vaccinations; insulin produced by bacteria through genetic engineering. It is concluded that the production of transgenic wheat for *Diabetes mellitus* is very important for good and healthy life of nations.**

Key words: *Diabetes mellitus,* transgenic wheat, gene therapy, genetic engineering

INTRODUCTION

Diabetes mellitus (Diabetes) is referred as a metabolism anarchy. Metabolism is a complex chemical progression that refers to the way our bodies use digested food for energy and growth. Most of the ingredients of food materials that we eat are conked out into glucose. Glucose is a chief source of sugar in the blood. It is the prime source of fuel for our bodies. When our groceries are digested the glucose makes its way into our bloodstream. Our cells utilize the glucose for energy, development and growth of our body. Yet, glucose cannot penetrate our cells without insulin being present seeing that insulin makes it promising for our cells to take in the glucose. Insulin is a hormone that is created and secreted by the pancreas. After eating, the pancreas robotically releases an ample quantity of insulin to stir the glucose present in our blood into the cells, and swing the blood sugar level. The person with *Diabetes mellitus* has a situation in which the extent of glucose in the blood is too eminent (hyperglycemia). It is so as that the body either not generating adequate insulin, generate no insulin, or has cells that do not counter appropriately to the pancreas to produces insulin. This results in too much glucose accumulating in the blood. This surfeit blood glucose sooner or later passes out of the body in urine. Thus, still though the blood has bounty of glucose, the cells are not getting it for their crucial energy and growth necessities. A 14-kilobase fragment indicates that the insulin gene resolves on chromosome 11 in humans (Owerbach*et al*., 1980).

Diabetes is actually a condition that leads towards the excretion of huge amounts of brutally diluted urine and it also cannot be abridged due to reduced fluid intake. It is due to low concentration of antidiuretic hormone (vasopressin) secreted by the posterior lobe of pituitary gland. The usual symptoms of *diabetes mellitus* are excessive loss of weight, increased polyuria (urge for urination), polydipsia (increased thirst) and an excessive polyphagia (desire to eat) (Kuzuya*et al*. 2002). There are two types of *diabetes mellitus*, Type 1 (insulin dependent diabetes) and Type 2 (non-insulin dependent and Gestational diabetes). Type 1 *diabetes mellitus* is caused due to the loss of insulin-producing beta cells of islets of Langerhans (pancreas), in that way leading to dearth of insulin. The most important reason of this beta cell loss is T-cell mediated autoimmune attack. In children Type 1 is termed as youthful diabetes. Reduced insulin sensitivity and secretion caused Type 2 diabetes mellitus. The

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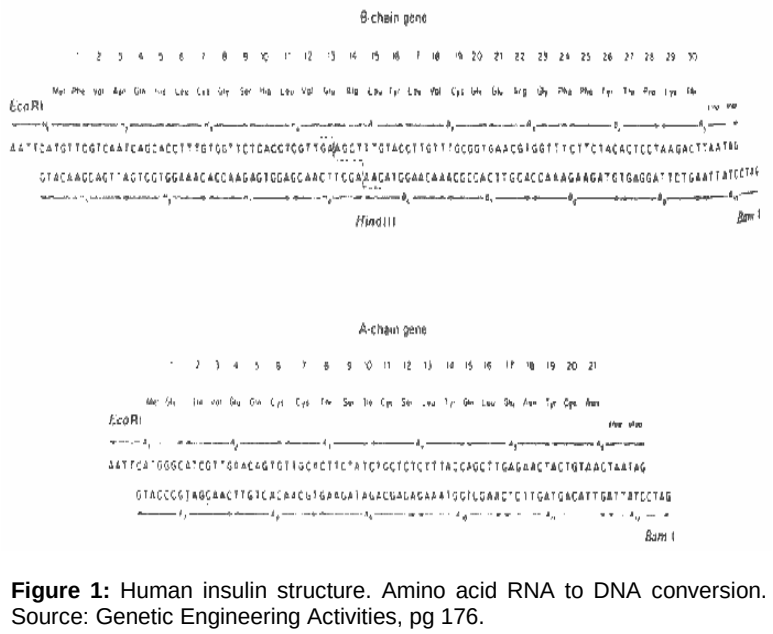

Figure 1: Human insulin structure. Amino acid RNA to DNA conversion. Source: Genetic Engineering Activities, pg 176.

receptors in the cell membranes are involved in the response of boy tissues to insulin production. The *gestational diabetes* usually occurs in women without formerly diagnosed diabetes who reveal high blood glucose levels during pregnancy. There is no specific reason that has been acknowledged but it is assumed that the hormones produced during pregnancy reduce a woman's feeling to insulin, resulting in high blood sugar Blood sugar level IS controles through modified dietary sugar intake, physical exercise, insulin therapy and oral medications have been advised for control of Type 1 diabetes mellitus (Yih, *at al*. 2006). The Nanomedicine research over the past few decades have been aimed at the applications of nanoparticles for Type 1 *diabetes mellitus* treatment through effective insulin delivery. The various types of nanoparticles that are currently studied for their use as drug delivery Systems [Attvi, 2004] are as follows: Polymeric biodegradable nanoparticles that include nanospheres and nanocapsulesm Ceramic nanoparticles, Polymeric micelles, Dendrime Liposomes.

Wheat is a member of the family Gramineae which includes major cereal crops of the world such as maize, wheat, and rice. Wheat is the most extensively grown and consumed food crop. Conventional breeding practices led to a significant increase in wheat production. But such improvements are difficult to muddle through increasing food demands of rapidly growing world population that will cause 40% greater demand for wheat than the existing level in the year 2020 (Rosegrant*et al*., 1997). So the world wheat production will have to increase 1.6% to 2.6% annually. This does not seem possible with conventional plant breeding methods that are limited due to gene pool accessibility, species barrier and other biological restrictions in addition to being a slow process. Application of recombinant DNA technology and its allied disciplines certainly hold a great promise to augment wheat production. The improvement of wheat (*Triticum aestivum* L) for *Diabetes mellitus* through genetic engineering requires the delivery, integration and expression of defined foreign genes into suitable regenerable explants. Initial efforts at introducing transgenes into wheat employed protoplasts as explants due to the absence of cell walls. The introduction of marker gene constructs into protoplasts provided precious information regarding the expression blueprint and tissue specificity of diverse promoters and regulatory elements in the transformed tissue (Bajaj, 1990;

Maheshwari*et al*. 1995; Roco et al., 1999: Vasil and Vasil, 1999; Cooper et al., 2004; Shinozaki and Yamaguchi-Shinozaki, 2007).The required DNA sequence can be determined because the amino acid compositions of both chains have been charted. Sixty three nucleotides are required for synthesizing the A chain and ninety for the B chain, plus a codon at the end of each chain, signaling the termination of protein synthesis. An anti-codon, incorporating the amino acid, methionine, is then placed at the beginning of each chain which allows the removal of the insulin protein from the bacterial cell's amino acids. The synthetic A and B chain 'genes' (Figure 5) are then separately inserted into the gene for a bacterial enzyme, B-galactosidase, which is carried in the vector's plasmid. At this stage, it is crucial to ensure that the codons of the synthetic gene are compatible with those of the B-galactosidase. The first step is to chemically synthesise the DNA chains that carry the specific nucleotide sequences characterizing the A and B polypeptide chains of insulin (Figure 1).

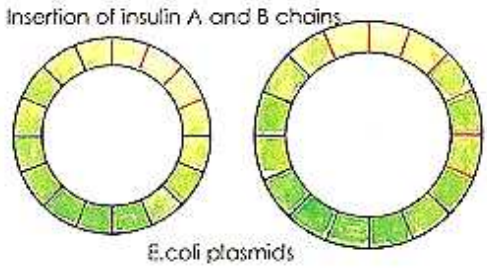

Figure 2: Watson, J.D., Gilman, M.,Witkovski., Zoller, M. - Recombinant DNA, pg 456.

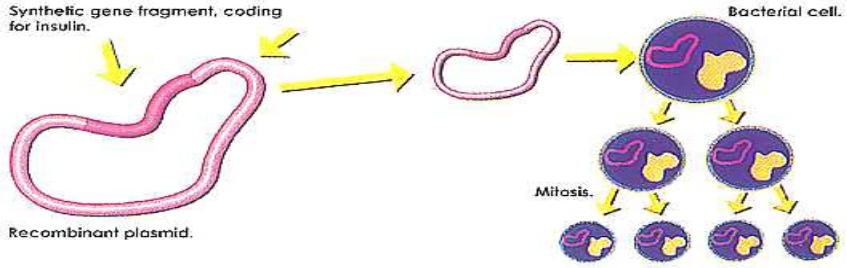

Figure 3: The process of mitosis. Source: Novo-Nordisk promotional brochure, pg 11.

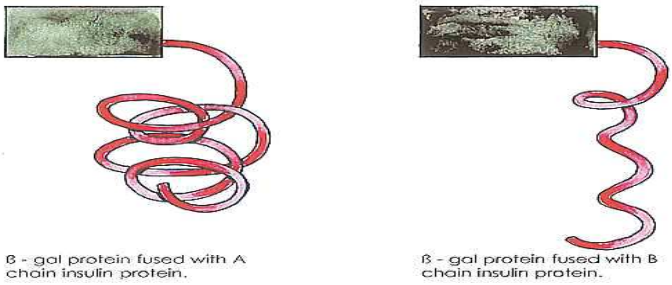

Figure 4: Source: Watson, J.D., Gilman, M., Witkovski, J., Zoller, M. - Recombinant DNA, pg 456.

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The recombinant plasmids are then introduced into E. coli cells. Practical use of Recombinant DNA technology in the synthesis of human insulin requires millions of copies of the bacteria whose plasmid has been combined with the insulin gene in order to yield insulin. The insulin gene is expressed as it replicates with the B-galactosidase in the cell undergoing mitosis (Figure 3).

The protein which is formed consists partly of B-galactosidase, joined to either the A or B chain of insulin (Figure 4). The A and B chains are then extracted from the B-galactosidase fragment and purified.

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