The evolution of diabetes treatments: from insulin therapy to synthetic biology

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Diabetes mellitus is one of the most prevalent diseases in the world and a leading cause of many cardiovascular diseases. Today, there is a wide range of options available to treat diabetes. Over the last few decades, the clinical field has gone through a major shift in the direction of genetic engineering and synthetic biology. This has led to many new techniques and treatments that can help manage diabetes. The purpose of this study is to summarize the advancement of diabetic treatments from old, conventional methods to new-age treatments which hold the potential to cure diabetes. While reviewing published research and review articles, we found that over the last few decades, there has been a surge in more handy devices to monitor and manage blood glucose levels. With advancements in the field of science, techniques such as genetic engineering, nanotechnology and synthetic biology are being used to design new devices or artificially engineer cells to relieve the symptoms associated with the disease. While the old conventional ways of taking medications or managing glycaemic levels using insulin syringes are more common, new-age treatments like insulin patches, synthetic cells, and synthetic receptors will likely gain popularity in the coming years.

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maintain the glycaemic levels[4]. Type-1 diabetes is an autoimmune disorder when the immune system mistakenly attacks and destroys the insulin-producing β-cells in the pancreas. This form of diabetes is often diagnosed in childhood or adolescence, but it can occur at any age. Diabetes can also result from reduced sensitivity of cells to insulin in combination with pancreatic β-cell dysfunction; this is known as Type-2 diabetes. Both types of diabetes take a toll on an individual's health and lead to a range of complications such as heart disease, stroke, kidney failure and blindness[5,6].

Current diabetic treatments range from medications to specialized glucose monitoring machines. However, with the advent of engineering in the field of healthcare and medicine, many new prospective treatments have come into the limelight. A new area of research has gained popularity, which is referred to as 'synthetic biology'. This fast-growing, multidisciplinary area seeks to design new biological systems or redesign current biological systems for practical applications such as biofortification[7], drug development[8,9], increasing drug efficacy[10] and other advancements in therapeutics. Synthetic cells or designer cells are a product of synthetic biology. These are artificial cells with simpler genomes designed in laboratories to mimic the function of biological cells. Currently, synthetic biology is still in its early stages in the field of diagnostic treatments. However, it is a promising area of research with potential applica-