Biotechnology: Our Biological Understanding Of A Sustainable Future

Biotechnology is the implementation of living organisms or biological processes which is done to accommodate certain purposes. The methods of biotechnology largely rely on the understanding of DNA replication, translation and transcription. For 10 000 years, humans have used these methods to create products, which have now constructed the fundamental change of society, from ‘hunting and gathering to farming and raising livestock’. Through the production of biotechnology, the establishment of genetic improvement technologies have started to rise. Ameliorating agriculture, the environment, medicine and industrial biotechnology, catering the human population becomes essential. Expanding our knowledge, to improve the quality of human life.

The industrial application of biotechnology produces products using microorganisms and enzymes. In the 1920s the processes of biotechnology started the production of useful chemicals through biological processes. When Chaim Weizmann used Clostridium acetbutylicum, for the conversion of starch to acetone and butanol. Later, supplying industries, for the replacement for petrochemicals. Goods such as chemicals, textiles, biofuels, food ingredients, paper, and pharmaceuticals are bio-based products that are produced as they are more profitable and environmentally friendly. The metabolic process within a single cell breaks down and convert nutrients into a new product. The enzymes control and coordinate reaction to form the product. Shown in figure 4. Even if the enzyme reacts, the process parameter is still altered due to the inadequacies of the enzymes, like instabilities, inhibitions, low yield or selectivity. This opened more studies on how we can use such organisms for sustainable acts, enhancing our understanding of basic forms of cellular organisms.

Agricultural biotechnology or agritech is the use of techniques and scientific equipment to alter living organisms. Biotechnology is used to help feed the world, it produces higher crop yields with fewer inputs, and reduces the volume of chemicals required by crops. Plants are one of the most crucial sources of food for humans. By manipulating the DNA of plants, the plant population would receive more desirable traits. Before the modern investments, traditional crop breeders, would practise ‘plant tissue culture’ and enforce mutations. Manual cross-pollination and conventional plant breeding toolbox are traditional techniques used to develop hybrid varieties, by crossing two parental strains to produce a new combination. In 1875, the first hybrid cereal grain was created, by crossing rye and wheat. Doing so it improved the grain’s physical characteristics, increased vigour, allowing a lower seed rate. By introducing biotechnology into agriculture, the production of genetically modified plants was inevitable. Genetically modified plants or transgenic plants is a much more precise way of only transferring desired genes into the plant. It is required to use either two methods for transgene insertion, the first method is the gene gun. This method utilises a microscopic pellet to be shot at high velocity into the plant’s tissue or cells. Shown in figure 2. The second is Agrobacterium tumefacient, which requires a biological vector to be transferred by the DNA transfer mechanism. Shown in figure 3.

The invention of biotechnology in the field of medicine has created a new practice in which can manipulate and fix mutant genes, overall providing an ulterior method to treat diseases. In 1990,

the first gene therapy clinical research took place, on a four-year-old with severe immune system deficiency. The testing was a success, partially restoring the child’s immune system, temporarily, this was the first step in completing the permeant DNA alter (has been announced in 2019). Gene therapy is one of the methods which involve the introduction of a non-mutated gene in the genome. The gene would be able to cure diseases by replacing a protein, which may not be present due to a genetic mutation. It is mainly practised to cure heritable diseases, by incorporating functioning genes into an individual with non-functioning genes. As shown in figure 1. It works by preventing proteins from doing harmful acts, it restores normal function to the protein, by giving it new functions or enhancing its existing functions. Before the treatment, people were mercilessly convicted against genetic diseases, but through biotechnology, gene therapy gave society a chance to fight against diseases.

Environmental biotechnology basically is known as ‘the optimal use of nature. It is defined as the utilisation of biological systems for the restitution of polluted environments. Integrating a cycle of profit, where the waste of a process becomes the life source of another. Not until the late 19th century, it become possible to treat sewage with the biological decomposition of organic components through microorganisms. In the early 1890s, Christopher Hamlin came up with a philosophy that 'sewage purification as the prevention of decomposition with one that tried to facilitate the biological process that destroys sewage naturally.' Microbes are microscopic organisms that break down chemicals in the environment. Biotechnology has enhanced the abilities of the microbes by situating them into sewage treatment plants, to clean up wastewater before it returns to other bodies of water. The contact beds used in this process, maximised the surface area of the tank, for the microbial growth to break down the sewage. The sewage was then held until it was fully decomposed, then filtered out into the ground.

In conclusion, biotechnology has improved the quality of life. It provided a natural process that could accommodate human needs. It enhanced our biological understanding of a sustainable future. Inventing white technology, genetically modified plants, gene therapy and natural sewage purification. For 10 000-year humans had utilised biotechnology without knowing, and since then we’ve only expanded our understanding of it. Before then, the human’s life quality was poor, people died from simple infections, struggled to produce food, and never truly understood the human body. Developing all those factors we’ve started to realise the potential of biotechnology and its capabilities, providing a basis for all biological discoveries.