MUTATIONS IN CYTOCHROME C OXIDASE AND ITS BIOLOGICAL IMPACT

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ABSTRACT

Bioinformatics is a process of applying informatics through various methods in order to find the information related to biology understanding. This process is very crucial because it enhances predictions, and also to analyse something that cannot be done experimentally. Cytochrome C Oxidase is a membrane protein or enzyme, which plays an important role in aerobic life, due to its specific ability to deactivate oxygen which involved in respiratory chain. The main objective of this work is to compare the healthy structure of the Cytochrome C Oxidase with the given mutant Cytochrome C Oxidase nucleotide sequence. We have performed Basic Local Alignment (BLAST). Therefore, the determination of original sequence is obtained which is Homo sapiens cytochrome c oxidase subunit Vb (COX5B) gene with accession number of U41284.1 and 5624 base pairs available in NCBI database. Next, we need to determine whether the mutation occurred may affect the protein structure of Cytochrome C Oxidase, and visualize the structure of given protein sequence of Cytochrome C Oxidase by using suitable software such as Cn3D, Rasmol. From the findings, we can conclude that the deletion mutation of the base pairs does not affect the COX5B structure after conducting DNA sequence translation into the protein sequence. And finally, we need to investigate the mutations involved in given nucleotide sequence of Homo Sapiens Cytochrome C Oxidase, and its biological impact. The biological impacts include production of Reactive Oxygen Species (ROS), disfunction of mitochondria, Spinobulbar Muscular Artrophy (SBMA), and overexpression of Bcl-2 in cancer cells.

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND STUDY

Bioinformatics is the process of conceptualising biology by applying 'informatics techniques from various methods in order to search all of the information related to biology field. This process utilizes computational tools and systems which are synergistically complement with the problems in biology (Fulekar, 2009). It has many advantages and applications in order for us to find what we need. Examples of some applications that applied bioinformatics are research in biology, medicine such as cancer, and pharmaceutical research like mechanism of drug action.

The study of bioinformatics is very crucial because it can enhance the accuracy of predictions, and assign a degree of confidence to each prediction. From there, scientists can construct hypotheses for their studies and researches. This process is highly interdisciplinary, which requires implementation of mathematical, biological, computer science and many more (Ramsden, 2015).

It is a common knowledge for us as chemical engineering students to know that oxygen is an unstable molecule, and can react in many process reactions, especially oxidation. There are many microorganisms that utilize this occurrence to power the processes of life. This includes the enzyme of Cytochrome C Oxidase, in which it utilizes oxygen that is essential in aerobic respiration. This protein is a membrane protein which consists of mainly carbon and sulphur atoms. The atoms are located inside a membrane, which is covered by charged oxygen and nitrogen atoms.

This arrangement is perfect for this enzyme to function properly, by the process of conversion of oxygen to water. This process will synthesize energy as ATP which is stored through transfer from one membrane to another. The ATP is synthesized in several ways which are by process of redox reaction consist of formation of water, and also through the transport of protons in mitochondria. Therefore, it is important to note that this enzyme is really important in aerobic life due to its specific capability to deactivate oxygen to form water, which occur in the