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Increasing Recombinant Protein Synthesis *via* Reducing Oxidative Stress

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Introduction

Overexpression of foreign proteins by cells cultured in stirred tank bioreactors is used in large-scale biopharmaceutical manufacture of biologics. Protein overexpression has been shown to affect host cell metabolism, and variables associated with large-scale culture, such as hydrodynamic forces and in homogeneities inside bioreactors, have been shown to cause cellular stress. Increased energy production and better secretory capacity are two metabolic changes required to sustain high-level expression of recombinant proteins, which can lead to an increase in Reactive Oxygen Species (ROS) created by respiratory metabolism and interactions with media components [1].

The imbalance between the creation of free radicals and the antioxidant reaction within the cells is known as oxidative stress. Through the alteration of cellular components, the accumulation of intracellular ROS can interfere with cellular processes and produce harmful consequences. To promote cell development, productivity, and reduce product micro heterogeneity, techniques to alleviate oxidative stress caused during the culture have been devised. We give a synopsis of the many tactics utilised to reduce oxidative stress in Chinese hamster ovary cells in this review, emphasising medium development and cell engineering as the key mechanisms for keeping ROS levels under control [2].

Description

One of the most commonly used species for recombinant protein synthesis is Escherichia coli. Its popularity as a cell factory is well-known, and it is now the most often used expression platform. As a result, various molecular tools and methods for high-level heterologous protein production are available, including a large catalogue of expression plasmids, a large number of modified strains, and a variety of cultivation methodologies. We examine the many ways for recombinant protein production in E. coli and discuss current advances in this ever-evolving field. Biochemistry has undoubtedly been changed by the creation of recombinant proteins in microbial systems. The days of purification of small amounts of a specific protein requiring kilos of animal and plant tissues or enormous volumes of biological fluids are virtually gone. Every scientist who begins a new project that requires a pure protein instantly considers how to obtain it in recombinant form. The ability to generate and purify a desired recombinant protein in high quantities allows for biochemical characterization, industrial process application, and commercial product development [3].

The processes required to obtain a recombinant protein are theoretically rather basic. You take your gene of interest, clone it in whatever expression vector you have on hand, transform it into the host of your choosing, induce, and then purify and characterise the protein. However, dozens of things can go wrong in practise. Poor host growth, the creation of inclusion bodies (IBs), protein inactivity, and even the inability to acquire any protein are all difficulties that can occur down the pipeline [4].

The impacts of oxidative stress

Oxidative stress has a wide range of impacts that aren't always damaging. Physical activity-induced oxidative stress, for example, may have well, regulating consequences on the body. Exercise promotes the creation of free radicals, which can result in brief oxidative stress in the muscles. Free radicals produced during physical activity, on the other hand, govern tissue growth and drive antioxidant formation. Mild oxidative stress may also help to protect the body against infection and disease. Long-term oxidative stress, on the other hand, harms the body's cells, proteins, and DNA. This can speed up the ageing process and play a role in the development of a variety of diseases [4].

Chronic inflammation

Chronic inflammation can be caused by oxidative stress. Infections and injuries activate the immune system. While fighting off invading bacteria, immune cells called macrophages release free radicals. These free radicals can cause inflammation by damaging healthy cells. In most cases, inflammation subsides once the immune system has cleared the infection or repaired the injured tissue. Oxidative stress, on the other hand, can provoke the inflammatory response, which produces more free radicals, which can lead to further oxidative stress, creating a vicious cycle. Chronic inflammation caused by oxidative stress can lead to diabetes, cardiovascular disease, and arthritis, among other things [5].

Conclusion

Oxidative stress is a condition that arises when the body's cells are overrun with free radicals. During regular metabolic processes, the body produces free radicals. Oxidative stress can harm cells, proteins, and DNA, contributing to the ageing process. It may also play a role in the development of a variety of disorders, including as diabetes, cancer, and neurodegenerative diseases like Alzheimer's. Antioxidants are produced naturally by the body to combat free radicals. Antioxidants can be found in a person's food as well. Certain dietary and lifestyle adjustments may aid in the reduction of oxidative stress. Maintaining a healthy body weight, exercising regularly, and eating a well-balanced, nutritious diet rich in fruits and vegetables are just a few examples.

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