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Human erythropoietin production in mammalian cells

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Erythropoietin (EPO) is an important glycoprotein hormone, which is produced and secreted by the kidney in mammals. It has been well established in many studies that providing exogenous EPO in humans has a therapeutic effect in improving anaemia. As such, the production of human EPO has become significant, especially for treating anaemic conditions resulting from chronic kidney disease, cancer and other cases. For this purpose, recombinant therapeutic proteins are expressed in a suitable host cell for high-yield production in the biopharmaceutical industry. Many studies have established a wide range of approved approaches in terms of producing such therapeutic glycoproteins in different host cell systems. Among these host cells, mammalian cells have been demonstrated to be the most suitable for producing such proteins for clinical applications in humans. Mammalian cells provide an advantageous platform for producing the most compatible proteins for human use. Some of the popular cell lines used in this regard include Chinese hamster ovary (CHO), baby hamster kidney (BHK), human fibrosarcoma (HT1080) and human embryonic kidney 293 (HEK-293). CHO cell line is the most commonly used cell line for producing human EPO. However, some recent studies suggest that the human EPO produced in CHO cells contains some foreign components. Therefore, these products are associated with the risk of causing an unwanted immune response when introduced in the human body. A suitable alternative for producing human EPO and other glycoproteins could be the use of a human-based cell line. The HEK-293 cell line has shown the most potential in this regard. Current studies are attempting to establish certain genetically augmented HEK-293 cell lines for this purpose. Using gene modification techniques, such as zinc-finger nucleases, RNA interference and CRISPR/Cas9, a gene could be essentially turned off so that it is not expressed in the host cell. This genetic modification leads to developing improved cell selection systems for high-yield therapeutic EPO and other glycoproteins. One key challenge is to develop a time and cost-effective approach for producing a large amount of EPO in human-based host cells. As human cell-based expression systems are very expensive and time-consuming, present studies are attempting to optimise time and cost-effectiveness while maintaining a higher yield of EPO production.

Keywords: Mammalian cells, Glycoprotein, Erythropoietin, Biopharmaceutical industry, Therapeutic protein

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