METHODS FOR PRODUCING GLYCOPROTEINS IN PLANTS

TECHNOLOGY OVERVIEW

The technology is a method to improve the protein yield of plants by engineering post-translational modification and secretion signals. To achieve high yields of proteins in plants, all stages of gene expression must be optimized, from transcription to protein stability. Gene expression is a process that involves the translation of the information encoded in a gene into protein or RNA. Transcription is the first stage of this process. For high-level transcription, the two most important elements are the promoter and the polyadenylation site. Promoters allow the expression of a transgene in a particular environmental, developmental or tissue specific manner. One of the most important factors governing the yield of recombined proteins is targeting at the sub-cellular level. This affects the interlinked processes of folding, assembly and post-translational modification. Experiments have shown that the secretory pathway is a most suitable environment for folding and assembly, leading to higher yields. By including a glycosylation site and a secretion signal peptide in the recombinant protein, protein yields increase significantly in comparison to the expression of the same protein without the glycosylation site and signal sequence.

POTENTIAL FIELDS OF USE

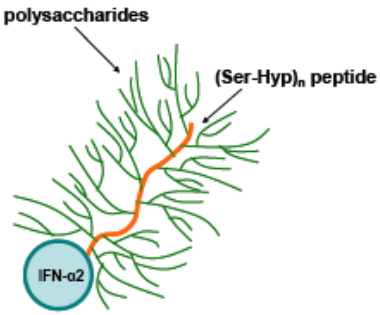
The most beneficial application of the technology is in the field of plant biotechnology. The market for post-translationally modified proteins depends in large part on the specific use the protein. For example, 2005 sales of Pegasys® and PEG-Intron® (PEGylated versions of interferon alpha 2a and 2b) were over $2 billion. 2006 sales of Nutropin® (unglycosylated human growth hormone sold by Genentech; hGH has been produced with this technology to demonstrate its value) were $378 million. The worldwide market for therapeutic antibodies is over $15 billion, with Rituxan® alone having sales of over $2 billion in 2006.

BENEFIT ANALYSIS

- Increased yield of 1000-100,000 times higher yield than current plant systems.
- Potentially improved pharmacokinetics (rate of absorption, distribution, metabolism and excretion).
- Opportunity to expand IP lifetime of proteins with expiring patents.
- Increased solubility, bioavailability and stability of the produced protein.
- The process works with existing bioreactor infrastructure.
- Eliminates the possibility of pathogen contamination.

STAGE OF DEVELOPMENT

The technology stands at an advanced stage of development. The results of the concept have been proven with the concept with the Human Growth Hormone (hGH) and human interferon α2b. The diagram on the right is a schematic of a fusion glycoprotein. The orange line represents the repetitive $(Ser\text{-}Hyp)_n$ terminal peptide extension.



FUTURE DEVELOPMENT

Further research would contribute to further optimization of the process for commercial applications.

LICENSING OPPORTUNITIES

US and Foreign patents for this technology have been filed. Licensing opportunities are available.

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