



**The Chinese University of Hong Kong**  
**Non-confidential Abstract of Technology Disclosure**

---

**Title:**

**Production of Biologically Active Human Recombinant Insulin-like Growth Factor-I and Human Insulin-like Binding Protein-3 in Transgenic Rice for the Management of Diabetes, Obesity, Cancer and their Related Diseases**

**CUHK Ref. No.:**

06/SCI/237

**Inventor(s):**

Professor Samuel SUN, Department of Biology

**Patent Status:**

- ◆ US Patent Pending

**Non-confidential abstract:**

Diabetes mellitus is a common chronic disease affecting more than 10% of our population and will lead to devastating complications. Abnormal growth hormone/ insulin-like growth factor-I regulation contributes to the deterioration in glycaemic control in patients with insulin deficiency. Treatment with recombinant human insulin-like growth factor I (rhIGF-I) has been shown to reduce plasma glucose and insulin doses in both type 1 and type 2 diabetic patients. Recently, it has been demonstrated that co-administration of rhIGF-I with recombinant IGF Binding Protein 3 (rhIGFBP-3) can reduce the side effects without affecting the therapeutic efficacy. In addition to its high-binding activity to IGFs, IGFBP-3 has been found to negatively regulate cell proliferation and induce apoptosis in an IGF-independent manner. This may be an attractive feature in the potential development of IGFBP-3 as an anticancer agent.

The lack of sufficient quantity of recombinant proteins has hindered further research on the potential use of rhIGF-I and rhIGFBP-3 in diabetes. It has been demonstrated that plants such as tobacco can be used as bioreactors to produce animal proteins at low costs. We have established an efficient bioreactor platform for mass production of rhIGF-I and rhIGFBP-3 in transgenic rice. Two groups of constructs were designed and introduced into the tobacco plants by Agrobacterium-mediated transformation. One group of constructs contained glutelin signal peptide (SP) and targeting tetrapeptide sequence (KDEL) while the other contains SP alone. These expression constructs were driven by seed-specific glutelin promoter. Western blot analysis showed that both rhIGF-I and rhIGFBP-3 were successfully produced in transgenic rice. In the biological activity assay, results demonstrated that the crude protein extracted from transformants containing IGF-I could induce membrane ruffling of skeletal muscle cells. The ruffling effect was significantly reduced by crude protein from IGFBP-3 transformants. Besides,



**The Chinese University of Hong Kong**  
**Non-confidential Abstract of Technology Disclosure**

---

**Title: Production of Biologically Active Human Recombinant Insulin-like Growth Factor-I and Human Insulin-like Binding Protein-3 in Transgenic Rice for the Management of Diabetes, Obesity, Cancer and their Related Diseases**

rhIGFBP-3 inhibited proliferation of MCF- cancer cells. Our results showed that transgenic plants can be developed as bioreactor for the synthesis of hIGF-I and hIGFBP-3 and the plant-produced recombinant proteins were biologically active.

The results will advance our understanding on the synthesis of human proteins in transgenic plant. The rice system will give further insights into the usage of plant bioreactor to produce high-value proteins in large quantity at low cost. The availability of rhIGF-1 and rhIGFBP-3 will stimulate more research effort on the potential use of these agents in the management of diabetes and other different diseases.

---

**For further queries, please contact:**

Mr Billy Lam  
Technology Licensing Coordinator  
*Tel:* (852) 2609 8882  
*Fax:* (852) 2603 5451  
*Email:* [billylam@cuhk.edu.hk](mailto:billylam@cuhk.edu.hk)

*Address:*  
Technology Licensing Office  
The Chinese University of Hong Kong  
Room 226, Pi Ch'iu Bldg, Shatin, New Territories  
Hong Kong SAR