Hang-Cheol Shin, J Clin Exp Dermatol Res 2018, Volume 9
DOI: 10.4172/2155-9554-C5-080

Development of highly stable growth factors and their applications to wound healing and anti-hair loss

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Growth factors are proteins that act as chemical messengers between cells and play a role in cell proliferation and tissue regeneration. Due to their intrinsic functions, growth factors have important applications in wound healing and hair growth. In diabetic foot ulcer, inflammation and tissue response to wounds are abnormal and the level and activity of endogenous growth factors at the wound site are reduced. In the case of hair growth, there are many reports that growth factors are involved in the hair cycle and stimulate the regeneration of hairs. Despite these therapeutic effects, commercially available growth factors have certain limitations such as short half-life, which indicates lack of stability at room temperature and loss of activity after storing in a variety of formulations. Stabilizing these growth factors can improve their capacity to stimulate wound healing and hair growth, and maintain activity upon delivery to the wound site. To enhance the capacity for wound healing and hair growth, we developed Structurally Stabilized Epidermal Growth Factor (ST-EGF), basic Fibroblast Growth Factor (ST-bFGF) and Fibroblast Growth Factor-9 (ST-FGF9) to overcome limitations of Commercially Available EGF (CA-EGF), bFGF (CA-bFGF) and FGF9 (CA-FGF9), such as short half-life and loss of activity after formulation. None of the ST-growth factors were toxic, and they were more stable at higher temperatures than CA-EGF, CA-bFGF and CA-FGF9. We loaded ST-EGF and ST-bFGF onto a Hyaluronate-Collagen Dressing (HCD) matrix and tested the effectiveness of this system in promoting wound healing in a mouse model of diabetes. Wounds treated with HCD matrix loaded with ST-EGF or ST-bFGF showed a more rapid rate of tissue repair as compared to the control in type-1 and 2 diabetes models. By using ST-bFGF and ST-FGF9, we formulated a growth factor cocktail (Cellcurin®) and found effectiveness for the treatment of androgenetic alopecia.

Biography

Hang-Cheol Shin is currently a Professor at the School of Systems Biomedical Science, Soongsil University and also an Adjunct Member of Korea Institute for Advanced Study, KAIST and Advisor of PnP Biopharm, a biotech venture company. Throughout his career, his research has been focused on understanding the folding-structure-function relationship of proteins and peptides and development of production process for recombinant proteins from microorganism. He deciphered protein folding initiating sites and structural propensity of protein sequence using several model proteins and the role of chaperone protein such as protein disulfide isomerase on the protein folding mechanism *in vivo*. Using structure-function relationship, he designed various analogs of therapeutic proteins, such as hyperactive TNF-α mutants, single-chain insulin analogs and highly stable growth factor mutants. His current research interest is focused on the application of growth factors for the development of anti-wrinkle and anti-hair loss therapeutic and cosmetic formulas.

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