ActiMatrix™ M: Mushroom Derived Peptides Exhibiting Firming Capabilities

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Abstract

Using the tools of biotechnology, specifically DNA microarrays, our research has identified Actimatrix™ M a protease-derived, peptide based mushroom extract that helps to reduce the signs of chronological and environmental ageing. As discussed in greater detail below, Actimatrix™ M has been shown *in vitro* to increase the expression of collagen 1 and decrease the expression of MMP1. It has also been shown to upregulate the expression of PLOD, consequently increasing the enzymatic post-translational bundling of collagen fibres. Additionally, Actimatrix™ M has been shown *in vitro* to increase the expression of intermediate attachment proteins. *In vivo* clinical results show great promise for topical application in cosmetic formulation.

Introduction

Youthful skin is characterized by firm, elastic, resilient skin and the underlying, supportive tissue, called the connective tissue. Physiologically, this is attributable to a well-maintained equilibrium between synthesis and degradation of the underlying extracellular structure or matrix [of the connective tissue]. More particularly, strong, "mature" collagen fibres are produced in sufficient amounts to impart tensile strength to skin and connective tissue. As we age, however, physiological changes due, in part, to environmental factors (such as sun damage caused by exposure to ultra-violet rays, referred as photodamage or photoageing) alter this delicate balance.

Procollagen, the precursor to collagen, must undergo chemical modification after it is synthesized (post-translational modification) in order to form its three-dimensional structure, then be secreted into the extracellular matrix in order to undergo self-assembly to form chemically (covalently) crosslinked, mature collagen fibres. The post-translational modification is influenced by many enzymes, one of the most important of which is called Procollagen-lysine 2-oxoglutarate 5-dioxygenase (PLOD). In addition, strong tensile strength requires that the mature collagen fibres be anchored to the matrix. This anchoring is facilitated by small intermediate proteins, notably fibronectin and vimentin.

The Physiology of Collagen in Youthful Skin

For the most part, youthful skin is resilient and, to the extent it suffers from environmental or internal insults, can repair itself. Two of the major reasons why youthful skin is thought to maintain its elastic, firm appearance are the ability to produce copious amounts of procollagen 1 (the chief component of skin (dermal) collagen) as well as the ability to prevent/control elevation of another enzyme called Matrix Metalloprotease 1 (MMP1). Through PLOD, MMP 1, and other enzymes, youthful skin regulates post-translational modification of procollagen 1. This allows for the formation of collagen bundles, which then self-associate and covalently crosslink to form mature collagen fibres, thereby increasing tensile strength. Additionally, youthful skin is characterized by an increase (upregulation) of expression of genes that code for small intermediate proteins involved in anchoring collagen fibres to the extracellular matrix (such as fibronectin and vimentin). Together, these processes generate a tissue with sufficient tensile strength to produce and maintain a youthful appearance and decrease the signs of chronological and photoageing.

The Physiology of Collagen in Aged Skin

In contrast, aged skin has diminished levels of mature collagen. Environmental insults (exposure to ultraviolet