

## **The Chondroprotective and Skin Therapy Properties of the Glycosaminoglycans**

### **Introduction:**

The glycosaminoglycans are a group of carbohydrates of great importance in higher animals and widely distributed in nature in connective tissue, intercellular fluids and skeletal structures. As a group they are also known as mucopolysaccharides and are sugars with repeating molecules in excess of eight repeating units.

Interest in the therapeutic properties of the glycosaminoglycans has been stimulated in recent years by the beneficial effects they have had in relieving painful joint conditions and also their influence on skin condition when used cosmetically. In their role of relieving joint pain they are acting as chondroprotective agents where their gelatinous nature causes them to fill joint spaces thus providing a buffering or shock absorbing function.

In their role as a therapeutic cosmetic (cosmeceutical) it is their affinity for water molecules which tensions the skin thus removing wrinkles and sagging skin pouches.

Although very little research data on the use of the glycosaminoglycans as therapeutic cosmetics is available there has been a significant amount of publicised anecdotal confirmation of the benefits conferred on ageing skin by the use of these carbohydrates in both oral and topical forms.

The pharmacology of their role as chondroprotective agents and in the structure of connective tissue is well documented in medical textbooks. The saccharides (both oligosaccharides and polysaccharides) are also involved in the structure of proteoglycans which, in addition to several other important physiological functions are associated with lubrication in joints.

The brief discussion which follows explains the mechanisms involved in the role of the glycosaminoglycans as chondroprotective, lubricating and cosmeceutical agents.

### **The Glycosaminoglycans as Chondroprotective and Lubricating Agents.**

The basic structure of the glycosaminoglycans, in particular, hyaluronic acid and the chondroitin sulphates is such that they are very easily hydrated, ie they combine with water molecules naturally present to form highly viscous fluids. In the joints the high viscosity of these fluids allows them to act as shock absorbers thus protecting the bone surfaces from jarring together under impact. This is particularly important for athletes whose joints are continually being shocked and jarred. It is also helpful for easing the pain created by eroded bone surfaces rubbing together in cases of osteo arthritis.

Hyaluronic acid is also an important component of synovial fluid which is a viscous packing material providing the lubricating material in joints.

Another important function of the glycosaminoglycans is their inclusion in the structure of proteoglycans. The proteoglycans are essential components of connective tissue and one form of

connective tissue is cartilage. In joints, cartilage forms the solid, but flexible, padding to protect the bones. The combination of cartilage and high viscosity synovial fluid provides a well filled and lubricated joint cavity. Unfortunately, ageing causes a decrease in the proteoglycan content of cartilage and, without supplementation of component materials, the cartilage can be reduced to a stage where its joint protection is minimal or non-existent.

Chondroprotection using suitable raw materials with which the body can regenerate cartilage and enhance the viscosity of the synovial fluids is therefore a means of minimising the deleterious effects of ageing on mobility and freedom of movement.

### **The Glycosaminoglycans in Skin Therapy.**

Skin is another form of connective tissue in which the cells, in this case fibroblasts, manufacture the proteoglycans (and also fibres) for use in the matrix. The interaction of the proteoglycans with fibres creates healthy and resilient connective tissue. In young people this is normally evident in the texture and elasticity of their skin.

Ageing causes a reduction in the elasticity and resilience of the skin and is evidenced by wrinkles and, in extreme cases, pouches or folds of loose skin.

Supplying, in the diet, the ingredients needed by the body for the natural biosynthesis of new connective tissue and the regeneration of proteoglycans can prolong the healthy and resilient texture of the skin.

There are two principle mechanisms by which this rejuvenating appearance is achieved when glycosaminoglycans are included in the diet. One is by the formation of new connective tissue by the combination of the glycosaminoglycans with proteins available in the body to form new proteoglycans.

The other mechanism is that of filling out the interstitial spaces in the skin which are causing the wrinkles thus recreating a smooth skin surface. The way this is achieved by glycosaminoglycans is due to their affinity for water molecules. The glycosaminoglycan molecules bind to endogenous, interstitial water molecules thus forming much larger molecular structures. These larger molecules require more space and thus tension the skin around them taking out creases or wrinkles.

The combined effect of connective tissue regeneration and re-tensioning of the skin by filling out the gaps created by ageing results in a healthy and youthful skin texture.

Note: It will be apparent from the above that the natural biosynthesis by the body of proteoglycans, cartilage and connective tissue requires a variety of components to be available. Although there are some who claim that the diet should include pure glucosamine or chondroitin sulphate as the glycosaminoglycan component, it is the writer's opinion that the natural blend of the glycosaminoglycans as found in marine derived carbohydrate extracts is much superior. The rationale for this statement is that it is not just one of these sugars which provides the essential component for the reactions described but rather a combination of several. Also, the writer believes that the body reacts more favourably to natural blends of substances (as in foods) than it does to hard shots of pure chemicals.

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