Strengthening Tissue Structure with Amino Sugars

By Dr. A.F. Burton

The amino sugar NAG, (N-acetyl glucosamine) formed in animal tissues from glucose, is the starting point for the synthesis of many important components of our tissues. NAG, and the amino sugars derived from it, can form chains of various lengths and can attach to proteins, fats (lipids) or other sugars to make giant molecules of glycoproteins, glycolipids and glycosaminoglycans (mucopolysaccharides), respectively. With proteins such as collagen, they can form cartilage, ligaments and tendons.

Tough, thin sheets form membranes which surround blood vessels, enclosing bundles of cells, holding them together, directing their growth and movements, and determining what passes in the way of nutrients and wastes. The space between cells is occupied by tough fibres of collagen enmeshed in a gel-like matrix of glycosaminoglycans. This gel is the "glue" that holds us together. But it is more than that: it is also a filter and a barrier, for example, to the spread of bacteria.

The mucus membranes which line our digestive, respiratory and urinary tracts are covered with a microscopically thin coat of glycoprotein which protects the underlying cells. The mucus, a protective fluid which flows over their surface, is a solution of glycoproteins.

Each molecule of NAG and the other amino sugars derived from it remain in place in some particular tissue component for only a few days. Even in cartilage there is a turnover of constituents. Some of these constituents are recycled; some are lost in the shuffle and must be made. Although our diet does contain some NAG – even mother's milk does – the diet is normally not an important source because NAG is made from glucose by all the cells of the body. In skin, for example about one fifth of the glucose goes to make NAG.

What happens if the amount of NAG made is not enough to meet the demands of the tissues? Anything for which NAG is required will be in short supply, especially the substances outside of cells such as the "glue" and the membranes. When tissues are in injured or diseased, they may have greater demands to repair and replenish these structures.

Many diseases afflicting humans are thought to be the result of antibodies formed to one's own tissue components, which attack them and cause damage. More likely the original offending substances come from outside, absorbed through the respiratory and especially the digestive system. Were this not so, it would be difficult to understand the profound effects that the diet can have on these conditions. The present-day treatment of these conditions is to impair the body's immune system in order to reduce the formation of antibodies in general – ironical in this age of AIDS!

Persons who suffer from sensitivities to the diet have been shown to absorb substances not normally allowed to pass through the wall of the intestine. This is attributed to defects in the protective coat and the "glue" made from NAG. Another way that NAG might affect the troublesome substances is by sticking to these molecules and thereby altering their effects in tissues.

Many people suffer from erosion and ulceration of the bowel with inflammation, diarrhea, pain and discomfort. These distressing conditions are lifelong and sometimes life-threatening. The formation of NAG from glucose has been found to be much lower than normal in the intestinal tissue of such persons, which also can lead to severe defects in the protective coat of the intestine. Cells in the intestine have a short life, being replaced every few days by new cells. The intestines, with a large area for absorption, can affect tissues throughout the body, by determining what is absorbed. The integrity of the protective coat is therefore of the utmost importance.

The skin is another tissue where cells are continually being shed and replaced. Whenever tissue is injured and forced to repair and replenish at a greater rate, there is the possibility that the supply of NAG might not keep pace with the demand. Decreased formation of NAG as a result of drug treatments can be overcome by supplying more amino sugar to cells which make cartilage. The effects of drugs on the formation of essential substances made from NAG can be considerable. This is especially so in the case of long-term treatment with such drugs as corticosteroids. Although life-saving in many situations, their long-term use slows down the renewal of the supporting structures in skin and cartilage and around blood vessels. NAG supplementation can correct the deficiencies by providing directly what is needed to make the required components.

In Alzheimer's disease, it is now thought that the very first thing that goes wrong is a deficiency in the formation of the glycosaminoglycans which surround and guide the nerve cells and their fibres. These fibres grow into a tangled mass which fails to function normally. In Schizophrenia, cells in the region of the brain most involved, instead of lying in an orderly fashion, lie in disarray with nerves making abnormal connections, again due apparently to similar deficiency in the materials surrounding nerve cells.

Tissue components made from NAG tend to be dispersed throughout tissues and to be durable, that is not easily degraded to release the amino sugars of which they are composed. For this reason, free NAG is not readily found in nature in any quantity, and until recently, has never been produced on a large scale. It has been around for a long time however, and it is known that it is entirely without any undesirable effects on the body. Being a normal, important body substance, this is not surprising; it can be taken up and used by the tissues in the various synthetic pathways into which it enters.

NAG is soluble and tasteless and is readily absorbed from the digestive tract. It circulates in the blood for about half a day until it is used up. For this reason it is recommended to take a dietary supplement of NAG in divided dose, morning and evening to ensure a continual blood supply of NAG throughout the whole day. NAG is not used for energy like other sugars such as glucose and very little is excreted. Unlike vitamins, the deficiency of which would be felt in all tissues, a deficiency of NAG could be confined to one or a few tissues. People suffering from certain inflammatory bowel diseases such as Crohn's disease, however, are often more liable to have, for example, arthritis or psoriasis. The other tissues involved are those rich in components derived from NAG. So although normally each tissue makes its own NAG, if the supply is short in any place, a suitable dietary supplement can provide what is needed.

Dietary NAG, however, is easily broken down into its constituent components in the acid environment of the stomach so that it is no longer biologically active. Enteric coating or special delayed release capsules are necessary to deliver NAG to the small intestine where it can readily be absorbed.

NAG is not a drug or even something from the food chain; it is a normal body constituent, whose formation might sometimes be inadequate. NAG is now available as a dietary supplement and is a new and natural way of promoting vital body processes essential to health. Because it is relatively new, the full scope of its benefits is not known. Certainly, the digestive tract is of special importance and is especially vulnerable. However, every tissue in the body needs NAG; the possibilities for its contribution to good health appear to be significant.