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SOME CHEMICAL OBSERVATIONS ON JOINT PHYSIOLOGY AND PATHOLOGY

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Chondroitin sulphuric acid, which is a main constituent of cartilage, including joint cartilage, is, in its natural condition, a highly polymerised substance with a chain-shaped molecule. It has a strong affinity for water. These properties enable it to form a gel, which effectively holds together the collagen fibres and also allows the passage of water and molecular substances dissolved in it. Undoubtedly, chondroitin sulphuric acid is important for both the physical properties and the metabolism of cartilage.

Synovial fluid contains a substance closely related to chondroitin sulphuric acid, namely hyaluronic acid, which also has a chain molecule, but which is even longer than that of chondroitin sulphuric acid. The characteristic high viscosity of synovial fluid is due to the hyaluronic acid and depends on the elongated form of the molecule. The viscosity of a fluid which contains chain-shaped molecules increases greatly with increasing length of the chain. Although the concentration of hyaluronic acid in synovial fluid is usually only 0.1-0.2 %, while the concentration of protein substances is about 2-4 %, most of the viscosity of the fluid is due to the hyaluronic acid.

Both a reduced content of hyaluronic acid and a reduced degree of its polymerisation can bring about a decrease in the viscosity of the synovial fluid, with a consequent alteration in its functional state. At the Institute of Medical Chemistry in

Read at the meeting of the *Nordisk Ortopedisk Forening*, June 1947, Stockholm.

Uppsala, Dr. L. Sundblad has carried out a number of estimations of the hyaluronic acid content and viscosity of synovial fluids, and has obtained by these means information on the degree of polymerisation of the acid in synovial fluid. A preliminary result of the investigation has been the demonstration that in traumatic disorders of a joint there is a low content of highly polymerised hyaluronic acid, while in chronic or subacute polyarthritis there is a relatively high content of the acid in a partly depolymerised state. The study is being continued.

SUMMARY

The author discusses the importance of chondroitin sulphuric acid to the joint cartilage. The synovial fluid contains 0.1-0.2 % of the closely related hyaluronic acid and to it the greater part of its viscosity is due. In traumatic disorders of a joint there is a low content of highly polymerised hyaluronic acid, while in chronic or subacute polyarthritis there is a relatively high concentration of the acid in a partly depolymerised state.

RESUME

L'auteur examine l'importance de l'acide chondroïtine-sulfurique pour le cartilage des articulations. La synovie contient 0,1-0,2 % d'acide hyaluronique qui se rapproche beaucoup du premier, auquel elle doit la plus grande partie de sa viscosité. Dans les trouvailles traumatiques de l'articulation, on constate une faible teneur en acide hyaluronique hautement polymérisé, tandis que dans la polyarthrite chronique ou sub-aiguë, il y a une concentration relativement élevée d'acide, en partie dépolymérisé.

ZUSAMMENFASSUNG

Verfasser erörtert die Bedeutung der Chondroitinschwefelsäure für den Gelenkknorpel. Die Synovialflüssigkeit enthält

0,1—0,2 % der nahe verwandten Hyaluronsäure, auf der ihre Viskosität zum grössten Teil beruht. Bei traumatischen Erkrankungen eines Gelenks findet man einen niedrigen Gehalt an hoch polymerisierter Hyaluronsäure, während bei chronischer oder subakuter Polyarthrits eine relativ hohe Konzentration dieser Säure in einem teilweise depolymerisierten Zustande besteht.