DESCRIPTION FOR THE GENERAL PUBLIC

Tendon is a multiscale biocomposite which biomechanical properties are still poorly understood. Tendons consist of collagen fibers and bundles surrounded by a interfascicular matrix (IFM). The IFM is composed of collagen, elastin and proteoglycans (PG) surrounded by electrolytes. The negatively charged PG's interacting with collagen and elastin, linking with cations (e.g. sodium, potassium, calcium) are responsible for the viscoelastic behavior of the IFM, that controls biomechanics of tendons and therefore the process of failure of these connective tissues.

THE SCIENTIFIC GOAL of this project is to analyze the influence of electro-chemo-mechanical factors on the biomechanics of tendon failure. In this project we plan to investigate the influence of simulated body fluid solutions on the strength and biochemical properties of the tendon. These solutions initiates calcification process of the tissue thereby influencing its' viscoelastic and strength properties. During the project a series of biochemical, structural, and mechanical tests in the micro and macroscopic scales will be carried out, that finally will lead to the development of a multiscale model of the IFM and the whole tendon. Created model will be used to analyze the influence of calcium and phosphate ion concentrations in the body, on mechanics of tendon injuries.

Calcium and phosphate ions in the body, in our opinion affects the mechanics of tendon injuries, through interaction with proteoglycans and calcific deposits in interfascicular matrix. The presence of calcific deposits may aggravate the clinical course of tendinopathy, increase tendon rupture rate, increase the time needed for postoperative recovery, and increase the frequency of postoperative complications such as wound infection. Understanding of the initial mechanism of calcific tendinopathy will constitute a milestone in the prevention of the tendon injuries. It will also open up new areas of research concerning the relationship between the electro-chemo-mechanics of tissues and their pathological states.