Contribution ID: **84** Type: **Flash presentation**

Glycation in collagen macromolecule of diabetic biotissues

Wednesday, 14 September 2022 16:25 (5 minutes)

Glycation is the most important long-term reaction that leads to the structural and functional alterations of collagen macromolecules in diabetic tissues. It is due to a hyperglycemic condition, more than 110mg/dL of sugar in blood, over a long period and consists of the non-enzymatic formation of sugar bridges between sugars and biological macromolecules, leading to loss of physiological and mechanical functions in tissues and organs. As collagen is the main fibrous protein of the extracellular matrix it is widely glycated both in diabetes and when aging. Although the impact of glycation on nano-scale collagen fibrils is well established, less is known about the effects at the molecular level. Furthermore, there is a lack of ex vivo model systems. Ex vivo X-ray scattering (SAXS/WAXS) imaging techniques are here adopted for the characterization of intra- and inter-molecular structural parameters of collagen in decellularized bovine pericardia biotissues soaked with different sugars (D-glucose, D-galactose, D-ribose) at increasing concentrations (0, 2.5, 5, 10, 20 and 40 mg/ml), and incubated at 37℃ for 3, 14, 30 and 90 days. Collagen was found to behave in a similar way when incubated with glucose and galactose, namely glycation processes occur near the arginine and lysine amino acids of the collagen structure, as proved by the Fourier difference synthesis, computed from the SAXS patterns. Regarding ribose, glycation occurred at the same amino acids but a factor 38 faster and abundant than with the other sugars.

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Session Classification: MS

Track Classification: Current Approaches in Structural Biology