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**Title of Poster:** Elastic and osmotic properties of articular cartilage

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**Abstract:**

The pathophysiology of osteoarthritis involves cellular and biochemical processes linked to mechanical stress. A better understanding of the mechanism of these processes and how they cause changes in the composition, macro- and micro-structure, and mechanical properties of cartilage is necessary for developing effective preventative and treatment strategies. In this study, elastic and osmotic swelling properties of tissue-engineered cartilage were explored using atomic force microscopy (AFM) and a tissue osmometer. AFM was also used to image the surface of the specimens while chemical composition was determined by biochemical analysis. Estimation of the Young's moduli of the tissue from AFM force-indentation data was performed using an optimization approach to fit appropriate models to the data. Force-indentation data were acquired both with sharp, pyramidal and with microspherical probes. The procedure has been validated by making measurements on model gel systems of known elastic properties. This approach is presented as a robust method of optimally extracting Young's moduli of soft, crosslinked materials from AFM data. Gross inhomogeneities at different scales in the cartilage tissue are manifested in the high degree of variance in local Young's moduli values obtained from both AFM and osmotic swelling data. These findings suggest that the mechanical properties of cartilage are affected by the local macromolecular composition.