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Abstracts

Exploring the interaction among the main macromolecules of the extracellular matrix

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The extracellular matrix (ECM) has multiple functions in tissues: it provides structural support for cells, defines rigidity and elasticity, acts as a reservoir of growth factors, and provides an environment for remodeling in response to developmental, physiological and pathological challenges. The ECM in various tissues exhibits tissue-specific composition. The multiple functions and the complex composition of the ECM make it difficult to mimic its properties.

The ECM of different tissues contains similar macromolecular constituents. However, the organization of these components is significantly different depending on the architectural, mechanical and biological functions of the tissue. For example, in cartilage large aggrecan-hyaluronic acid complexes are enmeshed in a collagen matrix providing mechanical resistance to the tissue under external load. In the ECM of brain collagen is also present but in a much smaller quantity.

Better understanding of the role of ECM components makes it necessary to quantify the interactions among them. This knowledge is also essential for creating scaffolds in tissue engineering to mimic the functions of the ECM. We made systematic studies on model systems containing the main macromolecular components of the ECM: aggrecan, hyaluronic acid and collagen. We determined the thermodynamic interactions among the constituents by osmotic pressure measurements. We employed an array of scattering techniques (small angle neutron scattering, small angle x-ray scattering, static and dynamic light scattering) to probe the structure and dynamic properties over a broad range of length and time scales. Atomic Force Microscopy was used to visualize the structures at high resolution.