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Structural features of synthetic elastin surfaces

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Elastin is a key extracellular matrix protein found within skin, lungs, bladder, elastic cartilage and arteries. It is principally synthesised during the development or growth of tissues, with tropoelastin expression occuring during mid- to late fetal or embryonic periods. Elastin is remarkably stable in healthy tissue, with an estimated half-life of 70 years, making it the most persistent protein in the human body. Elastin plays an essential role in tissue biomechanics, providing a combination of strength and flexibility, as well as modulating a variety of cellular and protein interactions.
The importance of the major properties of elastin to the field of tissue engineering has been illustrated by recent biomaterial designs. Significantly, despite its notable characteristics elastin is currently critically lacking from tissue-engineered grafts. Major challenges to the use of native elastin result from its substrantial insolubility. These are compounded by its highly crosslinked nature and contamination with tightly associated proteins.
We have recently demonstrated that synthetic elastin sheets can be produced from the same building blocks as native elastin; a protein called tropoelastin. Although a common material in the human body, very little is known about the structure of tropoelastin at the molecular level. To date, no crystal structure studies have been reported. Using a number of techniques we have assembled molecular films of tropoelastin on a variety of solid surfaces and studied their structures using AFM, X-ray, and neutron reflectometry. By modifying surface characteristics of our substrate materials we have gained a deeper understanding of the structure of tropoelastin as well as gaining some insight into the mechanism of cross-linking to form synthetic elastin biopolymer.