NJIT New Jersey Institute of Technology

BME

Department of Biomedical Engineering
Graduate Seminar

Date	Location	Time
Wednesday, February 19th	Fenster Hall 698	11:30 AM

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Subject-Quantitative structural biomechanics of contracting blood clots

Abstract: Blood clot contraction plays an important role in prevention of bleeding and in thrombotic disorders. We unveiled and quantified the structural mechanisms of clot contraction at the level of single platelets. We found that activated platelets bend and shorten individual fibrin fibers via their filopodia that undergo sequential extension and retraction, as if pulling hand-over-hand on a rope. Platelets also induce compaction of fibrin fibers into platelet-attached agglomerates. As a result of simultaneous pulling on multiple, closely spaced fibrin fibers, platelets pull themselves closer to each other and form secondary clusters larger than the initial aggregates. Contracting platelets actively remodel the fibrin network by increasing its density followed by enhanced clot stiffness. Kinetic analysis of the time course of structural and mechanical transitions revealed a multiphasic behavior with at least three distinct phases that differ in duration and rate constants. We also showed that the active phase of platelet-induced clot contraction is followed by platelet dysfunction and disintegration. Fragmentation of platelets suggests an underappreciated mechanism of elimination of platelets from circulation once they have performed their function. By combining experimental and modeling approaches, we have studied how fibrin clots resist to applied external loads and embolization. The acquired knowledge provides new insight into the basic mechanisms of platelet-induced clot contraction and its termination as well as describe structural mechanisms underlying the mechanical response of blood clots to pathophysiological stresses. Our findings can also inform the design and engineering of enhanced biomaterials.

Light refreshments will be served.