הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע״ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

Thursday, March 20th, 2025 at 13:30

Room 6

Understanding the Influence of Surfaces on Initiating Fibrin Fiber Formation in the Absence of Thrombin

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Special Seminar

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We have shown that the introduction of fibrinogen on hydrophobic surfaces leads to fibrillogenesis in the absence of thrombin. Furthermore, immunohistochemical labeling of the fibers shows that γ-chain platelet binding domains, the αC domains, as well as the fibrinopeptide A and B domains are all exposed on the fibers. High resolution imaging of the surfaces beneath the fibers indicates the adsorption of fibrinogen monomers, where the αC domains appear untethered and the tri-nodular structure is clearly visible. Exposure of these surfaces to platelet rich plasma also shows the formation of fibers, with platelet adhesion occurring only on the fibers. In contrast, adsorption of fibrinogen to hydrophilic surfaces does not result in fiber formation, and immunohistochemical staining indicates that the αC domains are bound to the surface and unavailable.

To understand the nature of these fibers and how they are initiated by the surface properties, we performed serial imaging as a function of fibrinogen concentration and time, where we first observed single monomers, followed by formation of protofibrils, and subsequently increasingly larger fibers. Initial treatment of the monomers with anti-Aα529-539 monoclonal antibody is seen to block protofibril formation, indicating that this initial phase is driven by the αC domains. Larger spherical structures are also observed on the surface, which were absent when cryoprecipitate fibrinogen was used, allowing us to identify these structures as soluble fibrin. In the absence of soluble fibrin, fibrillogenesis does not continue, with the surface simply covered by the self-assembled sheet of monomers. Immunofluorescence staining reveals the mixed fibrin/fibrinogen nature of the larger fibers and the purely fibrinogen composition of the surface adsorbed layer. Addition of thrombin after the fibers are formed does not change their morphology, rather it just increases their modulus, as the knob/hole interactions are secured when the fibrinopeptides are cleaved. This understanding will enable us to engineer a non-thrombogenic surface.

Refreshments will be served at 13:15.