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Platelet – Inspired Biomedical Technologies

Platelets are megakaryocyte-derived nucleated vesicles found in the blood. Their most well known function is to render hemostasis or clotting to prevent bleeding complications. Decreased platelet numbers or deficiencies in platelet's clotting function can lead to various acute or chronic bleeding disorders and hemorrhage. On the other hand, dysregulated and hyperactive clotting processes can lead to thrombosis and vascular occlusion, which is responsible for morbidities and mortalities in many vascular pathologies like ischemia, stroke and myocardial infarction. Beyond their well-established involvement in hemostasis and thrombosis, platelets also play crucial mechanistic roles in other disease scenarios such as inflammation, immune response and cancer metastasis via mediating multiple cell – cell and cell – matrix interactions, as well as secreting several soluble factors in the microenvironment. Building on such rationale, platelets provide an interesting paradigm in developing unique therapeutic and diagnostic technologies customized for targeted treatment of multiple disease conditions. To this end, our research is focused on mimicking platelet's cell – cell and cell – matrix interactions on synthetic particle platforms and thereby developing platelet – inspired technologies such as synthetic hemostats, thrombus - targeted drug delivery systems, metastasis – targeted therapeutic platforms and transplant – targeted immunomodulatory formulations. The talk will describe how platelets' disease – relevant mechanisms are being utilized to engineer several targeted therapeutic systems.