A Novel Model to Efficiently Embody Platelet Morphological Change

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Platelets, also known as thrombocytes, are one of the three blood cells of the human body that play a major role in the physiological process of hemostasis. Platelets, unlike erythrocytes, have a tendency for morphological shape change, by growing long and adhesive pseudopod projections that allow for platelet accumulation and motility. Each thrombocyte is unique, because they vary in cell body morphology and in the quantity, dimension, and location of each pseudopod present. Understanding the behaviors and properties of platelets is central in the elucidation of diagnosis and pharmaceutical treatment methods for medical predicaments, and explanations for natural phenomena. A mathematical model of platelets was developed that accounts for their tendency for morphological transformation, and can be utilized in hemodynamic simulations. A system of equations utilizing spatial, temporal, and shear stress accumulation parameters was derived to model thrombocyte morphology accurately, and also to produce platelet images in a timely manner. The images generated using this formula in the open-source program GNU Octave were then meshed to save the points in the periphery of the platelet, and serve as an outline for the simulated images. The equation was verified by comparing model-generated images with actual SEM images of platelets. To demonstrate versatility, the three equations were manipulated to showcase their ability to produce a variety of unique platelet shapes. The model has widespread applicability that could potentially serve as a platform for the discovery of a variety of preemptive diagnosis and treatment algorithms through computational medical simulations.