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Features of the interaction of fibrinogen with the lipid surface

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Abstract

Lipid bilayers are of the most important structures in the nature. Besides the protective and transport function, lipid membranes can act as templates providing immobilization, concentration and optimal spatial configuration for ligand-protein interactions. The blood plasma protein, fibrinogen, and the product of its proteolytic cleavage, fibrin, play a key role in hemostasis processes. The rate of thrombus formation, its mechanical properties and permeability are regulated by its interactions with proteins and lipid particles of plasma. The interaction of fibrinogen with lipid bilayers having different composition was investigated by microgravimetric and fluorometric methods. Based on the new method of lipid bilayers precipitation, immobilized membranes with well reproducible properties were obtained, which allowed to give a more reliable characteristics of the fibrinogen adsorption. It is shown that the adsorption and orientation of protein molecules on a lipid surface depends on the nature of the lipid and the protein concentration in the solution. At low concentrations, fibrinogen is adsorbed on the surface of liposomes as a monomolecular layer with the maximum contact area of each protein molecule with the surface, which results in low availability of the fibrinogen reaction centers for thrombin cleavage. At fibrinogen concentrations above 0.2-0.3 μM, thicker and loosely packed layer, possibly a monolayer of molecules perpendicular to the surface, is adsorbed on liposomes from 1,2-dioleoyl-sn-glycero-3-phosphoserine or 1,2-dipalmitoyl-sn-glycero-3-phosphocholine. At the same time, adsorption on the surface of egg phosphatidylcholine proceeds in the form of a monolayer in the whole investigated range of fibrinogen concentrations. Differences in the orientation of macromolecules on lipid particles can determine differences in the availability of fibrinogen for the proteolytic action of thrombin, thereby altering the kinetics of formation and the properties of the fibrin clot.

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