Binding of Water-Soluble, Globular Proteins to Anionic Model Membranes

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The role of electrostatics in the adsorption process of proteins to preformed negatively-charged (phosphatidylcholine/phosphatidylglycerol, PC/PG) and neutral (PC) small unilamellar vesicles (SUVs) is studied [1]. The interaction is monitored, at low ionic strength, for a set of model proteins as a function of p*H* [2] The adsorption behaviour of lysozyme, myoglobin and bovine serum albumin (BSA) with p*I*s = 10.7, 6.9 and 5.5, respectively, with preformed SUVs is investigated, along with changes in the fluorescence emission spectrum of charged proteins, *via* the adsorption on SUVs [3]. Significant adsorption of the proteins to negatively-charged SUVs is only found at p*H* values, where the number of positive charge moieties exceeds the number of negative charge moieties on the protein by at least 3 e.u. Negligible adsorption to SUVs composed of zwitterionic lipids is observed in the tested p*H* range (4–9), except for formally dianionic cardiolipin (CL). The fluorescence emission of positively-charged proteins increases after adsorption on negatively-charged SUVs. With increasing protein to phospholipid ratio, the increase in the fluorescence emission levels off and reaches a plateau; protein adsorption profiles show a similar shape. Analysis of the data demonstrates that neutralization of the SUV charge, due to the adsorption of the positively-charged proteins, is the controlling factor in their adsorption. The reached plateau level depends on the type of protein and the p*H* of the incubation medium. This p*H* dependency can be ascribed to the mean positive charge of the protein. The effective charge of lysozyme, myoglobin and BSA (defined as the number of phosphatidylglycerol groups neutralized by one adsorbed protein molecule) is calculated from the charge differences between empty and protein-coated SUVs, using the Gouy–Chapman theory.

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