The ability of oligomeric lysozyme to modify the molecular organization of the model bilayer membranes composed of phosphatidylcholine (PC) and its mixtures with phosphatidylglycerol (PG) or cholesterol (Chol) was assessed using fluorescent probes 6-propionyl-2-dimethylaminonaphthalene (Prodan), 4-dimethylaminochalcone (DMC), pyrene and 1,6-diphenyl-1,3,5-hexatriene (DPH). The observed changes in the fluorescence characteristics of polarity-sensitive probes Prodan and DMC, located in interfacial bilayer region, were interpreted due to the partial dehydration of the glycerol backbone, which was under the influence of aggregated protein. Cholesterol was found to prevent the perturbations of membrane polar part by lysozyme aggregates. Analysis of the pyrene excimerization data revealed an oligomer-induced reduction in bilayer free volume, presumably caused by an increased packing density of hydrocarbon chains. This effect proved to be virtually independent of membrane composition. It was demonstrated that membranotropic activity of oligomeric lysozyme markedly exceeds that of monomeric protein. The biological significance of the results obtained is twofold, implicating the general membrane-mediated mechanisms of oligomer toxicity and specific pathways of lysozyme fibrillogenesis in vivo associated with familial nonneuropathic systemic amyloidosis.