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研究论文

相互作用对纳米颗粒跨生物膜输运的影响

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摘要：

纳米颗粒与生物膜之间的相互作用，对于纳米颗粒在细胞成像、生物传感器设计、药物输送及疾病诊断和治疗等方面的应用有着重要的影响。本文采用自洽场理论，考察了不同相互作用条件下，纳米颗粒跨膜输运过程中生物膜的形变情况，以及系统自由能的变化情况。结果表明，在纳米颗粒跨膜输运的过程中，随着纳米颗粒与生物膜之间相互作用的改变，生物膜的形状呈现出不同的形变；进一步，通过对系统自由能变化的分析，发现纳米颗粒与生物膜之间的相互作用能显著影响颗粒跨膜输运的难易程度。这些结果将为纳米颗粒在生物领域的相关应用提供一些理论参考。

关键词： 生物膜 纳米颗粒 跨膜输运 自洽场理论

Influence of Interactions on the Translocation of Nanoparticles Across Biomembranes

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Abstract:

The interactions between nanoparticles and biomembrane have important influences on nanoparticle applications in cell imaging, biosensor design, drug delivery, disease diagnoses and therapy. Here, the morphological deformation of the biomembranes and the change of the free energy of the system during the translocation of a rodlike nanoparticle across the biomembranes under the conditions of different interactions is investigated with the self-consistent field theory. The results show that, during the translocation of nanoparticles across the biomembrane, the morphology of the biomembranes is deformed differently with varying the interactions between the nanoparticles and the biomembranes; furthermore, through analyzing the change of the free energy of the system, it is found that the interactions between nanoparticles and biomembranes can obviously influence the translocation of the nanoparticles across the biomembranes. These results may yield some theoretical insights into the relevant biological applications of nanoparticles.

Keywords: Biomembranes Nanoparticles Translocation across biomembranes Self-consistent field theory

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