Passive Translocation of Hydrophobic Nanoparticles through a Phospholipid Bilayer

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Hydrophobic nanoparticles introduced into living systems may lead to increased toxicity, can activate immune cells or can be used as nano-carriers for drug and gene delivery. The interaction of nanoparticles with bilayers is essential of an in depth understanding of these processes. It is known that small hydrophobic nanoparticles can insert into a lipid bilayer and accumulate in the bilayer core, representing a potential well. Therefore it is generally accepted that escaping the bilayer is unlikely for these nanoparticles. In contrast to this assumption, we demonstrate theoretically how large hydrophobic nanoparticles can cross lipid bilayers with almost no energy barrier, while small hydrophobic nanoparticles stay trapped in the core of the bilayer. This size-dependent translocation was confirmed experimentally using a microfluidic device. Moreover, the kinetic pathway of a single passive translocation event was directly measured and analyzed.

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