Bilayers at the ILL

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Probing the internal structure of nanoparticles for mRNA delivery

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New therapeutic modalities, such as RNA-based drugs, have shown promising results in treating diseases that are currently difficult to tackle with standard small molecule drugs. One type of RNA therapeutic, mRNA, is especially promising due to its ability to induce protein production in target cells, where it can replace damaged or missing proteins. However, clinical progress is often limited by the mRNA molecule's innate properties: a large size, hundreds of negative charges and a propensity for rapid degradation in serum. Hence, successful application usually requires an advanced delivery system. Lipid nanoparticles (LNPs) are among the most advanced delivery vehicles for mRNA. Physico-chemical characterization of mRNA-containing LNPs reveal a structured core enveloped by a defined outer shell. By varying LNP size and surface composition we demonstrated that both size and structure have significant influence on intracellular protein production. To design better LNPs for improved therapies, we seek to understand how specific components affect the structure of these nanoparticles as well as their function.

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