Exploring the immune system: the role of hydrophobicity

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Nanotechnology has provided new possibilities in the field of medicine with applications such as drug delivery vehicles and vaccine nano-adjuvants. However, predicting the interactions of these materials with the immune system remains a challenge. Thus, understanding how the immune system responds to specific molecular moieties is crucial for designing biologically compatible nanomaterials.

Surface hydrophobicity is theorized to be involved in innate immune activation through recognition of damage-associated molecular patterns (DAMPs). The systematic study of this relationship is complicated by the fact that changes in hydrophobicity usually cause other important structural variations in most macromolecular systems (e.g. lipids, proteins). To overcome this, we developed a series of gold nanoparticles (AuNPs) with varying degrees of hydrophobicity to explore the structure-activity relationships at biological interfaces.

By employing the unique strengths of nanoparticle surface chemistry, we demonstrated in a direct and quantitative way the close relationship between hydrophobicity and immune response in vitro and in vivo. These results provide insight into the role of hydrophobicity in physiological responses, an important consideration for fundamental and applied studies of nanomedicine and nanoimmunology.