Engineering Shape of Polymeric Micro and Nanoparticles for Drug Delivery

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Polymeric micro- and nanoparticles are routinely used for applications in drug delivery. Encapsulation of drugs in polymeric carriers protects them from enzymatic degradation and provides sustained release over prolonged periods. Further, encapsulation also allows drug targeting via cell and tissue-specific ligands. The performance characteristics of polymeric particles in the body, for example circulation times, macrophage clearance, targeting and drug release rates, depend on several particle parameters including size, shape, surface chemistry, and mechanical strength. Our research aims at developing quantitative laws describing the relationships between particle design and performance. We particularly focus on engineering particle shape, a design parameter that has received little attention in the past. We have devised methods to generate particles of several distinct shapes and studied their impact on key processes in drug delivery, in particular phagocytosis, the clearance of particles by macrophages. Our results show that particle shape makes a profound impact on phagocytosis, more so than particle size. Based on this understanding, we have designed novel polymeric particles possessing complex shapes that are highly resistant to phagocytosis. These studies reveal that particle shape provides a new dimension in engineering of polymeric carriers and opens up new opportunities in drug delivery.

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Refreshments will be served before the seminar.