# TARGETING ATHEROSCLEROSIS USING SUPRAMOLECULAR MICELLAR ASSEMBLIES

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Despite the high level of mortality, the cardiovascular field has not benefited to a similar degree as cancer from recent advances in nanomedicine. Applications of medical nanotechnology toward cancer far out-number those to cardiovascular disease by orders of magnitude. Similarly to cancer applications, nanomedicine can bring numerous powerful advantages, including early detection by amplification of small signals; local, as opposed to systemic, delivery of therapeutics; simultaneous delivery of a battery of agents.

Within cardiovascular disease, atherosclerosis is known to be a leading contributor to morbidity and mortality. Current imaging modalities use techniques that focus on the severity of the blockage within arteries. However, the majority of plaques that rupture and cause a clinical event do not correlate with plaque size. Therefore, early detection is needed, and requires detecting molecular markers that characterize vulnerable plaques. Peptide-based nanomaterials are particularly useful for these applications as the peptide provides a tool to incorporate a biological epitope for specific homing, with inherent biocompatible and biodegradable characteristic. To this end, we have engineered supramolecular, peptide amphiphile micelles (sPAM) that bind to various stages of atherosclerosis and incorporated imaging agents to act as contrast agents for clinically relevant modalities such as magnetic resonance imaging (MRI). Micelles formed from PAs are advantageous because a locally concentrated display of a peptide on the exterior can be used to potentiate specific binding to a disease target of interest, minimizing systemic side effects. Moreover, the nanometer size provides favorable pharmacokinetic properties *in vivo*. And notably, due to the modularity of PAMs and their ability to incorporate multiple components, theranostic micelles can be easily constructed through simple mixing of the various amphiphilic molecules. Such micelles have the potential to be the next generation of nanoparticles with capabilities to bind to specific disease markers of interest, deliver a therapeutic, and monitor the progression and/or regression of the disease in real-time. We present micelles developed for early to late-stage atherosclerosis, and their potential as contrast-enhancing, diagnostic agents *in vivo*.