Stimuli-responsive self-assembled polymer nanoparticles are becoming increasingly more important tools in nanomedicine. In this thesis we studied two large sets of polymer samples designed to be capable of such self-assembly. Polymers in the first set, containing poly(2-methyl-2-oxazoline) or poly[N-(2-hydroxypropyl) methacrylamide] hydrophilic blocks and poly[N-(2,2-difluoroethyl)acrylamide] thermoresponsive block, were designed to act as 19F MRI contrast agents. Polymers in the second set were designed as drug delivery systems and were based on 2-methyl-2-oxazine for hydrophilic parts and 2-propyl-2-oxazoline for thermoresponsive or 2-butyl-2-oxazoline for hydrophobic parts. Both sets of copolymers were prepared with various ratios of monomers in their blocks and the second set was also prepared with gradient chain architecture. Properties of their self-assembled systems were studied in detail and compared with regard to their potential for biomedical applications. The primary used method of analysis was dynamic light scattering supported by a vast array of methods including static light scattering, small angle X-ray and neutron scattering, nuclear magnetic resonance and others. From the investigated copolymers the most promising candidates for biomedical applications were selected and highlighted.