Integrating Mechanically Interlocked Molecules and Molecular Machines with Biomacromolecules

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Molecular machines are used by Nature in almost every biological task. These protein-based assemblies utilize nanoscale molecular movement to recognize, construct and transport other biomolecules in extremely precise fashion. We want to use artificial molecular machines – synthetic nanosized assemblies that undergo controlled mechanical motion – to solve outstanding problems in biomedicine. By harnessing the same design concepts as biology itself, we aim to create novel biosensors and therapeutics that are directly interfaced with molecular machines.

In our group at KTH, we are working on the interface of *supramolecular chemistry*, *nanomedicine* and *biomaterials*, using the toolbox of *synthetic organic chemistry* to engineer new nanotechnology for improving biomedical diagnostics and therapeutics. Artificial molecular machines have huge potential in modern biomedicine, for example as adaptive biosensors and smart drug delivery vehicles. In our group, we make molecular machines based on mechanically interlocked molecules such as rotaxanes and catenanes and use these molecules to address challenges in modern therapeutics and diagnostics. In particular, we are interested in new systems for small-molecule drug delivery and regenerative medicine.

Our *modus operandi* thus far has been to integrate natural biopolymers – in particular polysaccharides but also polypeptides – with synthetic molecular assemblies such as rotaxanes to endow new properties to inherently biocompatible macromolecules. Equipping traditional biomaterials with stimuli-responsive features can hopefully open pathways to a new brand of regenerative medicine with unprecedented precision and efficiency.