Title	**Out-of-Equilibrium Self-Assembly driven by Chemical Fuels**
PI	PRINS Leonard
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Project description:

Life is a non-equilibrium phenomenon and the necessity to consume energy is one of its most distinguishing features. On the molecular level, this characteristic is exemplified by energy-driven self-assembly which is extensively exploited by nature for the formation of high-energy materials able to perform work. An example is provided by microtubules, which form a dynamic network of filaments inside the cell that is responsible for controlling shape, movement and mechanical stiffness. Maintenance of the structural integrity of this material requires a constant supply of nutrients in the form of high-energy molecules, such as ATP. This gives the biomaterial the unique property to deform, adapt, and move in response to the availability of energy. Synthetic materials assembled following a similar process are endowed with unique properties that are unattainable for conventional 'static' materials. This enables innovative applications in the fields of materials science, catalysis and life sciences.

The **general objective** of the research in the Prins' group is to develop high-energy synthetic materials capable of converting and storing chemical energy that can adapt to external stimuli in a life-like manner. Materials will be assembled using chemical energy according to the same principles that guide the formation of microtubules. The project specifically aims at demonstrating how chemical energy can be converted and stored in synthetic materials and at studying their unique properties.

Publications

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3. Della Sala, F.; Maiti, S.; Bonanni, A.; Scrimin, P.; Prins, L.J. Fuel-Selective Transient Activation of Nanosystems for Signal Generation. *Angew. Chem. Int. Ed.* **2018**, *57*, 1611-1615.
4. Neri, S.; Martin, S.G.; Pezzato, C.; Prins, L.J. Photoswitchable Catalysis by a Nanozyme Mediated by a Light-Sensitive Cofactor *J.Am.Chem.Soc.* **2017**, *139*, 1794-1797.
5. Maiti, S.; Fortunati, I.; Ferrante, C.; Scrimin, P.; Prins, L.J. Dissipative self-assembly of vesicular nanoreactors, *Nat. Chem.* **2016**, *8*, 725-731.
6. Pezzato, C.; Prins, L.J., Transient Signal Generation in a Self-Assembled Nanosystem fueled by ATP. *Nat. Commun.* **2015**, *6*, 7790.

Collaborations/Network:

Francesco Ricci (Rome Tor Vergata), Camilla Ferrante (DiSC), Alberta Ferrarini (DiSC), Diego Frezzato (DiSC).

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