# Chemically-Fuelled Non-Equilibrium Self-Assembly

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Nature extensively exploits transient self-assembly structures with high energy that are able to perform work through a dissipative process. Often, self-assembly relies on the use of molecules as fuel which is consumed to drive thermodynamically unfavourable reactions away from equilibrium.[1] Implementing this kind of non-equilibrium self-assembly processes in synthetic systems is bound to profoundly impact the fields of chemistry, materials science and synthetic biology leading towards innovative dissipative structures able to convert and store chemical energy.
Here, I will present recent contributions by our group that show how ATP can be used as a chemical fuel for the transient self-assembly of vesicles.[2-5] These vesicles act as nanoreactors for chemical reactions, which are transiently upregulated when ATP is added. We will also show that a hydrogel containing catalytic nanoparticles can be maintained in a stationary non-equilibrium state upon local UV-irradiation causing an enhanced catalytic activity as a result of persistent concentration gradients in the gel.[6]

## REFERENCES

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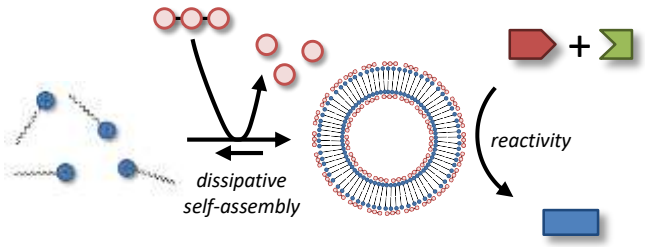


**Figure 1:** ATP-fueled transient self-assembly of vesicular nanoreactors [3]