Towards Big Chemistry

Wilhelm Huck -Radboud University, Nijmegen

How do non-living systems become living? Where do emergent properties come from? What are the driving forces in far-from-equilibrium systems? These are some of the most challenging questions in chemistry, and we are only at the beginning of addressing these questions.

In this talk, I will discuss the self-organization of the so-called formose reaction in response to changes in input parameters. This is an important first step to 'chemical evolution' where chemical systems gain complexity by incorporating information from their environment. I will outline how this complex chemical reaction network can be used in physical reservoir computation.

The most advanced 'molecular computation device' is of course a living cell. Living systems constantly process information about their environment via complex signalling pathways. Although we know much about the topology of these networks, we don't understand their dynamics or decision making abilities. We have developed a new method to measure the quantitative changes in phosphorylation state of 100's of proteins in single cells. For the first time, this opens up an experimental route to mapping the dynamic response of cells to external stimuli – and the perturbation of these pathways using drug molecules.

Relevant papers

Nature Chemistry in press (https://doi.org/10.21203/rs.3.rs-775456/v1)
Cell Reports Methods, **2022,** *1* , 100070
Scientific reports **2019,** *9*, 1469
Nature Communications **2018,** *9*, 2384