Post-doctoral position in the DesignStarch ERA-CAPS project

Position no longer available. Filled since November 2015

NEW: See a presentation of the project

contact Prof. Oliver Ebenhöh

Summary

In the ERA-CAPS project "**DesignStarch**", three research groups from the ETH Zurich (Sam Zeeman), the John Innes Centre Norwich (Rob Field) and the Heinrich-Heine University Düsseldorf (Oliver Ebenhöh) are collaborating with the goal to **engineer starch production in yeast and in vitro**.

Short post description

The HHU Düsseldorf is coordinating the project and leading the theoretical research activities. For the project, we are looking for a postdoctoral researcher with a strong background in **physics** and/or **biophysics**, in particular with a good understanding of **thermodynamics** and **statistical physics**, and good **programming skills**. The tasks of the researcher will be to develop theoretical concepts and mathematical models to understand and explain the formation of the macroscopic and highly ordered, but still complex, starch granules as a result from the underlying microscopic biochemical and biophysical processes. Eventually, our understanding shall lead to the availability to design starches with desired physico-chemical properties by targeted bio-engineering of yeast or even cell-free systems.

More information – read on if you are interested

Starch is a macroscopic, semi-crystalline, insoluble carbohydrate polymer. The monomers are glucose molecules, which are linked by two types of bonds. One type (-1,4) constitutes mostly unbranched chains of monomers, while the other type (-1,6) forms so-called branch points. The structure of starch is complex, but still highly ordered. Crystalline regions, in which unbranched chains form regular and very compact patterns are alternating with amorphous regions with a high concentration of branch points.

While most enzymes involved in starch synthesis have been discovered and described, it is still a mystery how the macroscopic starch granule with its **unique physico-chemical properties** emerges from the underlying elementary biochemical and biophysical processes. Even less it is understood how the enzymatic properties control the formation and property of starch granules.

Thus, the project aims to bridge the scales by **understanding how macroscopic properties emerge from the microscopic processes**. Statistical thermodynamics exactly links the microscopic and macroscopic world in physical systems. In biological systems, which operate far from equilibrium, this understanding is still largely lacking. However, in order to unravel the mysteries of life and understand what makes and shapes living organisms, the understanding how microscopic processes lead to emergent macroscopic features is essential. Focusing on starch granules, which are complex enough not to be understood intuitively, but still limited regarding the number of enzymes involved, we see this project as an important case study to establish the bridges between the microscopic and macroscopic scales in biology.

Therefore, for the theoretical activities, we seek a person who has a strong background and interest in statistical physics and thermodynamics, good programming skills, who is not scared by intellectual challenges, who likes to work in an interdisciplinary team, who is communicative and open-minded and, most importantly, who is curious about biology and the phenomenon of life and loves to discover new things.