PhD Researcher Position in the Walther Lab, University of Mainz (Germany), embedded within the Collaborative Research Center 1552

ATP-Driven Life-Like DNA Systems

Key words: DNA Nanoscience, Dissipative Self-Assemblies, Chemical Reaction Networks, Systems Chemistry, Machine Learning

Background and Scope of the Position. Non-equilibrium dissipative self-assemblies with autonomous behavior as inspired from living systems are emerging in synthetic system to create life-like matter. The Walther Lab has pioneered ATP-driven DNA-based dissipative systems, including multicomponent systems, light-activated networks, and the formation of transient coacervates and nanostructures.

In this project, we want to take the next critical step and *quantitatively understand ATP-driven dissipative DNA systems* to arrive at a predictive behavior. The scope of the project is to develop kinetic models of the reaction networks and work together with experts from machine learning to interpolate and extrapolate behavior. This will bridge from molecular scale to the colloidal coacervate scale.

The project is part of the **Collaborative Research Center 1552** "Defects and Defect Engineering in Soft Matter" and you will be part of a structured research and training program spanning ca. 15 research groups. You will in particular collaborate with a researcher recruited by Prof. Susanne Gerber (Machine Learning). You will be hired according to the German Salary Scheme with full benefits.

Team. Join our team to do cutting-edge research of highest international visibility. We provide you with an inspiring and collaborative team atmosphere in a multinational and multidisciplinary environment, and ample opportunities to develop. Brand new, cutting-edge synthetic and analytical infrastructure and facilities are available due to generous support by the University of Mainz and the Gutenberg Research College. Prof. Walther (h-index 67, age 42) is a Gutenberg Research Professor, a Max Planck Fellow and a 2 x ERC Awardee.

More information on the group can be found here: www.walther-group.com

Expected Candidate Profile. As an ideal candidate you are creative, highly self-motivated, ambitious, and communicative to excel in scientific challenges. You hold a M.Sc. in Chemistry, Physics or Chemical Engineering, and have a background in physical chemistry, chemical kinetics, or DNA nanoscience. Additional qualifications in coding in Python is a plus. The willingness to learn Python is a must. We are willing to train you in this as well as in complementary skills.

Selected references:

1. **Review:** "ATP-Responsive and ATP-Fueled Self-Assembling Systems and Materials" *Adv. Mater.* 32, 2002629 (**2020**).
2. **Review:** "Materials Learning from Life: Concepts for Active, Adaptive and Autonomous Molecular Systems" *Chem. Soc. Rev*. 46, 5588 **(2017)**.
3. **Viewpoint:** "From Responsive to Adaptive and Interactive Materials and Materials Systems: A Roadmap" *Adv. Mater.* 1905111 **(2020)**
4. „Self-Regulating Colloidal Co-Assemblies That Accelerate Their Own Destruction via Chemo-Structural Feedback" *Angew. Chem. Int. Ed.* **2022,** *61*, e202201573 **(2022)**.
5. "Autonomous DNA nanostructures instructed by hierarchically concatenated chemical reaction networks" Nat. Commun. 14, 5132 (**2021**).
6. "ATP-Powered Molecular Recognition to Engineer Transient Multivalency and Self-Sorting 4D Hierarchical Systems" *Nat. Commun.* 11, 3658 (**2020**).
7. "Pathway Complexity in Fuel-Driven DNA Nanostructures with Autonomous Reconfiguration of Multiple Dynamic Steady States" *J. Am. Chem. Soc.* 142, 685, **(2020)**.
8. "Multiple Light Control Mechanisms in ATP-fueled Non-Equilibrium DNA Systems" *Angew. Chem. Int. Ed.* 59, 12084 **(2020)**.

9. “Programmable ATP-Fueled DNA Coacervates by Transient Liquid-Liquid Phase Separation”, *Chem* 6, 3329 (**2020**).
10. “Programmable Dynamic Steady States in ATP-Driven Non-Equilibrium DNA Systems“ *Sci. Adv.,* 5, eaaw0590, **(2019)**.

The position is fully funded and available from October 2023 and has a duration of 3 years.

Application Deadline is September 1st 2023.

Please send your full application as a **single** PDF file containing

- letter of motivation including a summary of your past research experience, in particular a meaningful summary of your master thesis; transcript of records of your Master and B.Sc. program.
- Detail in your letter why you believe you are the right person and what you expect from us
- curriculum vitae and list of publications (if applicable)
- Two contacts for reference letters

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