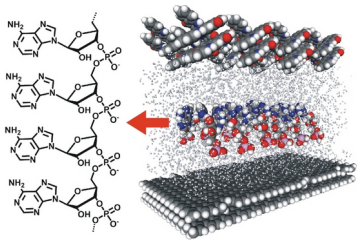
Research group Dr. Frank Trixler
LMU, Department of Earth and Environmental Sciences & Center for NanoScience (CeNS)

Bachelor- /Master Theses

Topic: **Abiotic synthesis of RNA in nanoconfined water within nanogeochemical environments**



Background

Although all life is dependent on water, aqueous environments prevent the synthesis of biopolymers such as nucleic acids and polypeptides for thermodynamic reasons. This long-standing puzzle in the research field of prebiotic chemistry and the question of the origin of life, known as the "water paradox", has so far been attempted to be solved in synthesis approaches by various groups. However, these approaches are not compatible with a principle of evolution: new innovations always build on existing solutions (conservative nature of evolution).

Our group has discovered a synthetic pathway for the abiotic generation of complex RNA that mimics nanogeochemical environments and thereby easily generates nanofluidic effects in water. This pathway produces completely altered properties of water that allow biopolymerisations in water. It utilizes phenomena that occur both in nanogeochemical environments and in the intracellular space of living cells. This approach to chemical evolution is compatible with the conservative nature of evolution and is therefore prebiotically plausible. It thus creates a bridge between geochemistry and biochemistry.

Projects
Several subprojects for the optimization of RNA synthesis are to be awarded. The basis are geomaterials that can be assumed to be plausibly present for the early archean world and, as particle suspensions, enable the production of RNA or further increase the yield. These include material from meteorites (collaboration with the Mineralogical State Collection and a working group from Barcelona), fougerite, a mineral from alkaline vents in the deep sea (collaboration with a working group from Marseille), polycyclic aromatic hydrocarbons as plausible aerosols on the early Earth, and other materials such as primitive lipids at mineral particles. The knowledge gained can also be transferred to technical innovations in the field of sustainable, environmentally friendly syntheses (green chemistry).

The exact project definition and design is agreed with the applicants in order to be able to respond to their personal interests, aptitudes and plans.

Techniques used (training by PhD student)

- Qubit Fluorometry (main technique of the projects! Lab: Theresienstr. 41, LMU)
- Capillary Gelelectrophoresis (Biozentrum LMU)
- Next Generation Sequencing (Sequencing lab of Botanical Garden Munich)

Requirements

- Interest in questions of geobiology and the origin of life on the early Earth
- Ideally: basic knowledge and initial laboratory experience in molecular biology
- you like interdisciplinary research at the boder between geoscience and bioscience

Applications
Just send an email to Frank Trixler: **f.trixler@lmu.de** (nano.geo.uni-muenchen.de)