DC7: Oligomeric nucleic acid coacervate system

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The Laboratory of Biochemistry (LBC) is a multidisciplinary laboratory spanning physics, chemistry, and biology. The unifying theme of their research is the use of microfluidic systems, and in particular droplet microfluidic systems, to answer questions in the field of biology and for the development of biotechnology applications. Three main areas of fundamental research can be distinguished: (1) the emergence of Darwinian chemical systems (origin of life), (2) Darwinian system dynamics and directed evolution, and (3) single-cell analysis and screening. There is great synergy between fundamental research and applied projects, and this has resulted in the creation of several start-ups.

Project description: The aim is to develop autocatalytic systems based on coupling nucleic acid growth by non-enzymatic ligation to growth and division of coacervate droplets and determine whether the system can display rudimentary evolution by natural selection. Specifically, DC7 will: (1) Create coacervate droplets with different initial compositions, alter the strength of the base-pairing interactions through changing the environment (salt concentration or temperature), and subject these systems to multiple cycles of coacervate droplet growth and division using the microfluidic system developed by DC3. (2) Aided by theoretical modelling, explore induction of heritable variation in droplet growth rates, aiming to induce local switching between attractors by locally changing temperature or salt concentration, or oligonucleotide composition. (3) Explore experimentally how evolution might be rendered more efficient by improving heredity and evolvability. As states are controlled by base-pairing interactions this may constitute a steppingstone towards heredity based on replication of nucleic acid sequences with a very high level of evolvability.

Secondments: This project is carried out in strong collaboration with the following groups, and visits to their laboratories are expected during the project. A willingness to travel and spend time abroad is therefore essential:

- Host: ELVESYS (ELV) | Length: 1 month | Purpose: Explore new technological developments in microfluidics systems.
- Host: Parmenides Foundation (PARM) | Length: 2 months | Purpose: Develop theoretical model to explore induction of heritable variation in droplet growth rates.

Eligibility conditions:

- Relevant MSc degree or equivalent (e.g., chemistry, biochemistry, physics)

Required Skills:

- The candidate should have expertise in nucleic acid chemistry. They should have a strong command of written and spoken English.

Monthly allowances:

- Living allowance: €3400*
- Mobility allowance: €600
- Family allowance, if applicable: €660

Estimated gross salary: ~43,000 €/year

** The living allowance is adjusted by a country correction coefficient, depending on the country where the host institution is located. The exact net salary is dependent on local tax and social and health insurance regulations and will be confirmed upon appointment.*

Enquiries

For general information about the DarChemDN visit the project website or send an email to info@darchem-dn.eu.

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How to apply

To complete your online application, visit the DarChemDN recruitment web page.

Required documents:

- Cover Letter
- Curriculum Vitae (including contact information of two referees)
- Copy of Transcripts
- Copy of Diplomas (if available at the time of application – otherwise please provide a confirmation with the expected graduation date)

Only shortlisted applicants will be contacted. Interviews are expected to be online in November/December 2023.

Application deadline: To receive full consideration, applications must be submitted before **31 October 2023**.

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