The Project

Lipids are key building blocks of cells that form bilayer membranes with many important roles. Thousands of different lipids are produced by cells but their functions are largely unknown. The goal of this project is to understand how lipids, and especially their side-chains, modulate the structure, dynamics and function of bilayers. This interdisciplinary project will pioneer DNA-based molecular rulers to answer the fundamental question of how lipid length alters the localized bilayer thickness within live cells. As there is no other comparable experimental route, our approach is expected to provide a step-change in understanding of how lipid side-chain diversity shapes bilayers. The Research Associate will work with Prof. Stefan Howorka in the Department of Chemistry at University College London and with Prof. Ulrike Eggert, King’s College London. The postholder will perform research in both laboratories.

Stochastic sensing with nanopores is a versatile technology for the detection of a wide range of analytes. Protein nanopores are advantageous because they can be engineered with atomic precision. Until now, narrow protein pores have been used and stochastic sensing has been confined to analytes of low mass or, for DNA sequencing, extended polymer chains. Here, we propose to make a new class of functional membrane-spanning DNA nanopores. The architecture of the pores will be of much simpler architecture than DNA-Protein hybrid nanopores, from DNA scaffolds with attached peptide chains/current DNA pores. The approach will be the first to produce large diameter (5-30 nm) pores that are monodisperse: no broken pores and each pore with an identical number of subunits. The hybrid new nanopores will extend the scope of stochastic sensing, e.g. to the analysis of folded proteins. Our industrial partner, Oxford Nanopore, will test our hybrid nanopores in their hand-held sensing devices.

Relevant publications of Stefan Howorka.


Relevant publication of Ulrike Eggert:


Main Purpose

The postholder will be required to biophysically characterize molecular rulers composed of DNA strands and study their interaction with lipid bilayers of synthetic or biological origin. The DNA rulers will be used to measure biophysical properties of the bilayers such as membrane thickness using biophysical techniques including fluorescence microscopy, with the goal of application to live cells.

The postholder will be required to carry out research into the fabrication of DNA-protein nanopores in collaboration with a second PDRA appointed in the group of Prof. Bayley, Oxford University which span the bilayers and are capable of recognizing analytes. In these hybrid nanostructures, DNA will be used as a nanoscale scaffold for the assembly of peptide-based transmembrane domains. The PDRA in the Howorka group at UCL will be responsible for the design and assembly of DNA scaffolds, and in conjunction with the Oxford PDRA for the attachment of the peptides to the scaffold and their interactions. The UCL PDRA will also be primarily responsible for the structural characterization of the hybrid pores with biophysical techniques, and collaboration on the crystallization and X-ray diffraction with a structural biologist. The PDRA will also be responsible for the attachment of lipid anchors for membrane insertion of the pores as well as of ligands within the hybrid pores to specifically recognize act as receptors for protein analytes. The PDRA’s in UCL and Oxford will be in frequent communication to conduct the research project.

Duties and Responsibilities

- To contribute to biophysically characterize molecular rulers composed of DNA strands and study their interaction with lipid bilayers of synthetic or biological origin. The design and implementation of membrane-spanning DNA-protein hybrid nanopores. To record, analyse and write up the results of these calculations.

- To contribute to the drafting and submitting of papers to peer reviewed journals.

- To prepare progress reports on research for funding bodies as required.

- To contribute to the preparation and drafting of research bids and proposals.

- To contribute to the overall activities of the research team and department as required.

- To undertake a limited amount of teaching in relation to subject area.

- To contribute to the induction and direction of other research staff and students as requested.

- Responsible for ensuring that equipment is safe and maintained in working order.

- The job description reflects the present requirements of the post, and as duties and responsibilities change/develop, the job description will be reviewed and be subject to amendment in consultation with the post-holder.

- The postholder will carry out any other duties as are within the scope, spirit and purpose of the job as requested by the line manager.

- The postholder will actively follow UCL policies including Equal Opportunities and be expected to give consideration within their role as to how they can actively advance equality of opportunity and good relations between people who share a relevant protected characteristic and people who do not share it.

Last updated 16/3/2015
The postholder will maintain an awareness and observation of Fire and Health & Safety Regulations.

To be aware of and act upon:
- Disciplinary procedure and Disciplinary rules
- Grievance procedure
- Section 7 and 8 of the Health and Safety at Work Act

UNIVERSITY COLLEGE LONDON
Department of Chemistry

Person Specification for the Post of Research Associate

Knowledge – including Qualifications
PhD in relevant subject area Biophysics, Chemical Biology, Biological Chemistry, Cell or Molecular Biology, Organic Chemistry, Chemical Biology, Biological Chemistry, ESSENTIAL.

Knowledge of research techniques: fluorescence microscopy, lipid bilayer biophysics including formation of synthetic membranes, fundamental molecular biology, gel electrophoresis, HPLC, NMR, mass spectrometry, size-exclusions chromatography, ESSENTIAL

GSCE English Grade C or above (or equivalent, e.g. IELTS), ESSENTIAL

Skills
- Proven research skills, ESSENTIAL
- Ability to analyse and write up data, ESSENTIAL
- Ability to present complex information effectively to a range of audiences, ESSENTIAL
- Effective written and verbal communication skills in English, ESSENTIAL

Experience
- Experience of working in a research environment, ESSENTIAL
- Experience of multi-disciplinary working, ESSENTIAL

Experience with one or more of the following: fluorescence microscopy, lipid bilayer biophysics including formation of synthetic membranes, fundamental cell/molecular biology, nucleic acids chemistry, biologically relevant chemistry and DNA nanotechnology, ESSENTIAL

Experience in the DNA nanotechnology and nucleic acids chemistry or cell biology/biophysical characterisation of nucleic acids and nanopore analysis, ESSENTIAL, DESIRABLE

Personal Qualities
- Commitment to high quality research, ESSENTIAL
- Ability to work collaboratively and as part of a team, ESSENTIAL

General Information
Terms & Conditions of Employment
The post is a UCL grade 7 post, the salary for which ranges from £34,635 to £41,864, per annum (excluding London Allowance of £3,031 p.a.). Progression through the salary scale is incremental. Cost of living pay awards are negotiated nationally and are normally effective from 1st August each year. UCL’s non-clinical pay and grading structure is at http://www.ucl.ac.uk/hr/salary_scales/final_grades.php.
UCL’s terms & conditions for research staff are at http://www.ucl.ac.uk/hr/salary_scales/Support_Research_tcs.php

The full range of benefits is at http://www.ucl.ac.uk/hr/benefits/employee_benefits.php

Equal Opportunities
UCL recognises that in our society, individuals and groups are discriminated against both directly and indirectly on the grounds of: age, colour, disability, ethnic origin, gender, HIV status, marital, social or economic status, nationality, race, religious beliefs, responsibility for dependants, sexual orientation, trades union membership or unrelated criminal convictions.

To counteract discrimination, UCL is committed to actively opposing all forms of discrimination, raising awareness and tackling the causes and consequences. It is committed to providing a learning and working environment in which the rights and dignity of all its members are respected and which is free from discrimination, prejudice, intimidation and all forms of harassment including bullying; to making staff and students feel valued, motivated and enabled to do their best work and to creating a safe, welcoming working environment accessible to all.

The Department has been awarded a Bronze Athena Swan Award and we support the Athena beliefs that:

- The advancement of science, engineering and technology (SET) is fundamental to quality of life across the globe.
- It is vitally important that women are adequately represented in what has traditionally been, and is still, a male-dominated area.
- Science cannot reach its full potential unless it can benefit from the talents of the whole population, and until women and men can benefit equally from the opportunities it affords.

Further information on Athena Swan is at http://www.athenaswan.org.uk/

TO APPLY

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You will need to register to use the system if you have not used it before and are able to do this after you have clicked on the 'Apply now' button at the bottom of the page.

Thank you for your interest in this post and the Department of Chemistry at UCL