Competition-funded NERC PhD project

Probing the intersection of environmental chemistry and health: degradation of tear films by atmospheric pollutants

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Background

This studentship seeks to investigate the interaction between atmospheric pollutants and the degradation of the thin films that protect mammalian eyes. Eyes are one of the most exposed interfaces on mammals and oxidation of the film may result in dry eye disease. In this PhD you will undertaken novel research to understand how the morphology of eye film becomes altered in the presence of the atmospheric oxidant ozone in both indoor and outdoor settings. You will be based at Royal Holloway University of London but will frequently travel to use the enviable neutron facilities at ISIS(Oxfordshire) and the ILL(France).

Methodology

You will make artificial tear films and will extract organic material from real tears with ophthalmic experts from the Manchester School of Ophthalmology and Pharmacy. You will then study the chemical and morphological alteration of these materials on exposure to air. Neutron reflection studies will determine the morphology and thickness of the organic material, allowing an assessment of its biological lifetime and resistance to degradation. There will be an opportunity to develop coding and modelling skills to help interpret your data.

Training

You will train in advanced techniques to study the interface between tears and atmospheric pollutants. You will be trained in soft matter chemistry, physics of neutron reflection, chemical extraction of biological materials, atmospheric sampling and atmospheric modelling. You will achieve a PhD with modelling, health and laboratory components. The Rutherford-Appleton Laboratory will allow you to interact with many world leading scientists and you will be embedded in the Royal Holloway Centre of Climate, Ocean and Atmosphere.

Person specification

Candidates with numerical degrees in Chemistry, Biology, Biochemistry, Physics, Engineering or Earth Science are encouraged to apply.

References

1) Rosalie H. Shepherd, Martin D. King, Adrian R. Rennie, Andrew D. Ward, Markus M. Frey, Neil Brough, Joshua Eveson, Sabino Del Vento, Adam Milsom, Christian Pfrang, Maximilian W. A. Skoda, Rebecca J.L. Welbourn. “Measurement of gas-phase OH radical oxidation and film thickness of organic films at the air–water interface using material extracted from urban, remote and wood smoke aerosol” Environmental Science: Atmospheres, 2022, 2, 574 - 590.
2) Katherine C. Thompson, Stephanie H. Jones, Adrian R. Rennie, Martin D. King, Andrew D. Ward, Brian R. Hughes, Claire O.M. Lucas, Richard A. Campbell, and Arwel V. Hughes, “Degradation and

Rearrangement of a Lung Surfactant Lipid at the Air−Water Interface during Exposure to the Pollutant Gas Ozone" Langmuir, doi: 10.1021/la304312y, 2013.
3) S.H.Jones, M.D.King, and A.D. Ward, "Atmospherically relevant core-shell aerosol studied using optical trapping and Mie scattering", Chemical Communications, 51, p. 4914-4917 doi: 10.1039/C4CC09835H.
4) Martin D. King, Stephanie H. Jones, Claire O.M. Lucas, Katherine C. Thompson, Adrian R. Rennie, Andrew D. Ward, Amelia A. Marks, Fleur N. Fisher, Christian Pfrang, Arwel V. Hughes, and Richard A. Campbell. The reaction of oleic acid monolayers with gas-phase ozone at the air water interface: the effect of sub-phase viscosity, and inert secondary components. 2020 Phys. Chem. Chem. Phys. 22, 28032-28044.
5) K.C.Thompson, A.R. Rennie, M.D. King, S.J.O. Hardman, C.O.M.Lucas, C. Pfrang, B.R. Hughes and A.V. Hughes "Reaction of a Phospholipid monolayer with gas-phase ozone at the air-water interface: Measurement of surface excess and surface pressure in real time." 2010, Langmuir, 26(22), 17295-17303 (doi:10.102/la1022714).

Key Information

- This project has been shortlisted for funding by the ARIES NERC DTP and will start on 1st October 2024. The closing date for applications is 23:59 on 10th January 2024.
- Successful candidates who meet UKRI's eligibility criteria will be awarded a NERC studentship, which covers fees, stipend (£18,622 p.a. plus London Weighting for 2023–24) and research funding. International applicants are eligible for fully-funded ARIES studentships including fees. Please note however that ARIES funding does not cover additional costs associated with relocation to, and living in, the UK. We expect to award between 4 and 6 studentships to international candidates in 2024.
- ARIES students benefit from bespoke graduate training and ARIES provides £2,500 to every student for access to external training, travel and conferences, on top of all Research Costs associated with the project. Excellent applicants from quantitative disciplines with limited experience in environmental sciences may be considered for an additional 3-month stipend to take advanced-level courses.
- ARIES is committed to equality, diversity, widening participation and inclusion in all areas of its operation. We encourage enquiries and applications from all sections of the community regardless of gender, ethnicity, disability, age, sexual orientation and transgender status. Academic qualifications are considered alongside non-academic experience, and our recruitment process considers potential with the same weighting as past experience.
- All ARIES studentships may be undertaken on a part-time or full-time basis, visa requirements notwithstanding.
- For further information, please contact the supervisor. To apply for this Studentship follow the instructions at the bottom of the page or click the 'apply now' link.
- ARIES is required by our funders to collect Equality and Diversity Information from all of our applicants. The information you provide will be used solely for monitoring and statistical purposes; it will remain confidential and will be stored on the UEA sharepoint server. Data will not be shared with those involved in making decisions on the award of Studentships, and will have no influence on the success of your application. It will only be shared outside

of this group in an anonymised and aggregated form. You will be ask to complete the form by the University to which you apply.

- ARIES funding is subject to UKRI terms and conditions. Postgraduate Researchers are expected to live within reasonable distance of their host organisation for the duration of their studentship. See https://www.ukri.org/publications/terms-and-conditions-for-training-funding/ for more information.