Postdoctoral Research Associate (3 posts)

**Department:** Biology (2 posts) or Physics (1 post)

**Hours of work:** 37 hours a week / Full time

**Contract type:** Fixed term, up to 36 months (ideally able to start on April 1st 2022 or as soon as possible thereafter)

**Salary:** £33,309 - £40,927 per year / Grade 6
Introduction

The Departments of Biology and Physics are collaborating within the University of York Biological Physical Sciences Interdisciplinary Network (BPSInet) to support a new major interdisciplinary project. The consortium is recruiting three highly motivated, creative, and talented postdoctoral research associates (PDRAs) to perform pivotal roles on a project exploring the liquid-liquid phase separation (LLPS) that underlies efficient CO$_2$ fixation in algae. The UKRI funded Physics of Life project runs for three years with four PDRAs forming a tightly integrated team working across four labs at the University of York. Three positions are available in algal cell and molecular biology (Mackinder Lab), biochemistry of LLPS systems (Plevin Lab) and biophysics of LLPS systems using advanced optical microscopy techniques (Leake Lab). Theoretical soft-matter physics modelling (McLeish Group) will guide wet-lab experiments.

Algae operate highly efficient CO$_2$ uptake and photosynthetic mechanisms, making them responsible for approximately 30% of global carbon fixation and giving them huge potential for providing biotechnological solutions for CO$_2$ capture and boosting crop yields. To "turbocharge" photosynthesis algae condense the primary CO$_2$ fixing enzyme Rubisco into a LLPS organelle called the pyrenoid. This project will work on understanding pyrenoid structure and function in diverse algae to identify the underlying structural principles and physics of the pyrenoid. We envision knowledge will guide synthetic pyrenoid assembly to improve biological CO$_2$ capture and crop photosynthetic performance.

**PDRA1 in cell and molecular biology (Mackinder Lab):** You will use a broad range of cell, molecular and biochemistry techniques to identify and characterise core pyrenoid proteins in diverse algae. Proteins essential for pyrenoid LLPS will be identified biochemically, recombinantly produced and their propensity to drive LLPS characterised in vitro in collaboration with PDRA2 and PDRA3. You will fluorescently tag pyrenoid proteins for localisation and to monitor dynamics using single-molecule approaches (with PDRA3). You will also work with a research technician and PDRA1 to perform higher throughput pairwise phase separation analyses of Rubisco and scaffolds.

**PDRA2 in protein biochemistry and solution biophysics (Plevin Lab):** You will be responsible for performing detailed biochemical and biophysical analyses of target proteins focusing on their structure, dynamics and interactions. You should have strong experience in techniques for measuring thermodynamic and kinetic properties of interactions between proteins in solution (e.g. ITC, SPR, etc); characterising or modelling 3D structures of complexes to reveal critical interface residues (e.g. NMR, Xray crystallography, cryoEM); measuring and/or simulating molecular dynamics or hydrodynamics in solution (e.g. NMR) on different length and time scales with PDRA3. You will also work with a research technician and PDRA1 to perform higher throughput pairwise phase separation analyses of Rubisco and scaffolds.

**PDRA3 in single-molecule biophysics (Leake Lab):** You use innovative biophysics technologies and optical microscopy based in the Physics of Life Group to explore pyrenoid systems, under conditions of assembly, disassembly and equilibrium *in vivo* and *in vitro* (using simplified reconstituted systems of purified components), helping to identify the (dis)assembly-physics of biomolecular sub-structures towards building a minimal mimic. You will be responsible for applying and further developing fluorescence-based super-resolution single-molecule bioimaging approaches including millisecond Slimfield, sptPALM and structured illumination microscopy in addition to molecular force transduction methods including optical tweezers. You will use these tools in close...
collaboration with PDRA1 and PDRA2 to determine the molecular architecture of pyrenoids, how function is linked to composition and physicochemistry, and how these properties depend on internal constituents and the external microenvironment.

**Main purpose of the role**

- To conduct research under the supervision of senior colleagues and to contribute to the production of research
- To assist in the identification and development of potential areas of research and the development of proposals for independent or collaborative research projects

**Key responsibilities**

(Role holders will be required to undertake some or all of the duties below)

- To conduct individual and collaborative research projects, duties to include: analysis and interpretation of research data; use of appropriate research techniques and methods; writing up of research results and dissemination through publications, seminar and conference presentations and public engagement and outreach activities; contributing to the identification of possible new areas of research
- To contribute to the preparation of research proposals and applications to external bodies
- To undertake appropriate organisational and administrative activities connected to the research project, including conference organisation, and the development of promotional or educational material including website maintenance and development
- To develop and initiate collaborative working internally and externally, duties to include: the building of internal contacts and participation in internal networks; collaboration with colleagues on joint projects as required; participation in and identification of external networks in order to share information and identify potential opportunities for collaboration and possible sources of funding; attendance at and contribution to relevant meetings
- To provide guidance to other staff and students, as required, as well as coordinating the work of small research teams
- To assist with undergraduate teaching in own area of expertise.
## Person specification

<table>
<thead>
<tr>
<th>Qualifications</th>
<th>Essential / Desirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>First degree in Biological Sciences, Chemistry, or Physics or equivalent</td>
<td>Essential</td>
</tr>
<tr>
<td>PhD in biology, cell biology, biophysics, biochemistry, or equivalent experience</td>
<td>Essential</td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
<td></td>
</tr>
<tr>
<td>Knowledge in biophysics, biochemistry, molecular biology or cell biology to engage in high quality research</td>
<td>Essential</td>
</tr>
<tr>
<td>Knowledge of a range of research techniques and methodologies</td>
<td>Essential</td>
</tr>
<tr>
<td>Has research expertise in an area that will complement and enhance the department’s research strategy and goals</td>
<td>Essential</td>
</tr>
<tr>
<td>Understanding of experimental biophysical methods (PDRAs 2 and PDRA 3)</td>
<td>Essential</td>
</tr>
<tr>
<td>Understanding of optical methods in biophysics, single-molecule biology methods, and light microscopy</td>
<td>Desirable</td>
</tr>
<tr>
<td>Knowledge of photosynthesis</td>
<td>Desirable</td>
</tr>
<tr>
<td>Knowledge of algal biology</td>
<td>Desirable</td>
</tr>
<tr>
<td><strong>Skills, abilities and competencies</strong></td>
<td></td>
</tr>
<tr>
<td>Highly developed communication skills to engage effectively with a wide ranging audience, both orally and in writing, using a range of media</td>
<td>Essential</td>
</tr>
<tr>
<td>Ability to write up research work for publication in high profile journals and engage in public dissemination</td>
<td>Essential</td>
</tr>
<tr>
<td>Ability to develop research objectives, projects and proposals for own and joint research, with the assistance of a mentor if required</td>
<td>Essential</td>
</tr>
<tr>
<td>Competency to conduct individual and collaborative research projects and to work productively in a team environment</td>
<td>Essential</td>
</tr>
<tr>
<td>Ability to identify sources of funding and contribute to the process of securing funds, with collaborators if required</td>
<td>Essential</td>
</tr>
<tr>
<td>Competency to make presentations at conferences or exhibit work in other appropriate events</td>
<td>Essential</td>
</tr>
<tr>
<td>Excellent skills in molecular biology (PDRA1 only)</td>
<td>Essential</td>
</tr>
<tr>
<td>Excellent skills in protein biochemistry and/or biophysics</td>
<td>Desirable</td>
</tr>
<tr>
<td>Excellent skills in advanced microscopy</td>
<td>Desirable</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Practical knowledge of MATLAB or LabView, or equivalent</td>
<td>Desirable</td>
</tr>
</tbody>
</table>

**Experience**

- Experience of carrying out both independent and collaborative research  
  Essential
- Experience of writing up research work for publication  
  Essential
- Ability to work as part of a team and also to work independently using own initiative  
  Essential
- Practical experience in biophysics, or a related field (PDRA 3 only)  
  Essential
- Practical experience in biochemistry and/or molecular biology  
  Essential
- Practical experience of microbiology and/or cell biology  
  Essential
- Experience in computational/analytical methods applied to biology data  
  Desirable
- Practical experience of interacting with scientists from different disciplines  
  Desirable
- Experience in protein purification  
  Desirable
- Experience with a range of microscopy techniques  
  Desirable
- Experience in bioinformatics  
  Desirable

**Personal attributes**

- Attention to detail and commitment to high quality  
  Essential
- Collaborative ethos and ability to work in a team  
  Essential
- Interest in and enthusiasm for the subject matter of the project(s)  
  Essential
- Positive attitude to colleagues and students  
  Essential
- Willingness to work proactively with colleagues in other work areas/institutions  
  Essential
- Ability to plan and prioritise own work in order to meet deadlines, including using initiative to plan research programmes  
  Essential
- Commitment to personal development and updating of knowledge and skills  
  Essential