**University of Leicester**

**College of Life Sciences**

**CLS / HPRU Grant studentship**

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**Section 2 – *Project Information***

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| **Project Title** | Transforming aeroallergen monitoring in the UK towards an automated real-time network: Development of a UK specific data processing pipeline for SwisensPoleno Bioaerosol Monitors using empirical sampling and machine learning |
| **Project Summary**  |
| **Project description** *Background* Allergic rhinitis (hayfever) is the most prevalent allergic condition in the UK, affecting 10–15% of children and 26% of adults. Despite being perceived as minor, it can significantly impact quality of life, school and work performance, and drive substantial healthcare costs. Hayfever also increases the risk of allergic asthma, which affects 8% of the UK population. Thunderstorms and high pollen levels can trigger severe, sometimes fatal, asthma attacks. Climate change is expected to worsen this issue by extending pollen seasons and increasing concentrations.  Real-time aeroallergen monitoring and the development of accurate forecasting models are vital for managing symptoms and reducing health burdens. Traditional UK methods using Hirst-style samplers suffer from low resolution and delayed data, limiting integration with weather models that could improve pollen forecasts. Automated systems like the SwisensPoleno Jupiter have the potential to overcome these issues, offering real-time data using holography, fluorescence, and machine learning. While widely adopted in Europe, UK deployment is recent, with instruments now operating at UKHSA Chilton, Leicester, Manchester, and soon Essex. A small network also exists in Ireland.  Use of these instruments in the UK is currently limited by their classification models, which were trained on European data and underperform for UK taxa. This PhD project aims to develop and evaluate improved models using UK-specific data, enabling reliable pollen reporting and forecasting. The project will primarily focus on pollen, as Poleno instruments are currently trained on this and UK datasets are more readily available. However, if time permits, fungal spores, another key aeroallergen, may be explored. These are currently only routinely monitored at Leicester, highlighting a clear gap and opportunity for expansion.  *PhD Objectives* The project’s objectives are outlined below. While the overall aims are defined, the student is encouraged to shape the direction of the work based on their interests, expertise, and findings, with support from supervisors and the advisory board.   Objective 1. Literature Review. Conduct a literature review to build the case for a UK automated pollen counting network. This will provide background on pollen allergy impacts, monitoring methods, and benefits across sectors. Key output: Peer-reviewed discussion paper.  Objective 2. Training Placement at UoL. Undertake pollen identification and counting training in Year 1 to establish foundational knowledge of pollens in the UK. Key output: Define target species for classifier development in Objective 3.   Objective 3: Model Assessment. Statistically compare manual Hirst, and Poleno pollen counts using UK datasets. Assess model accuracy, regional variation, and identify pollen taxa needing improved classification. Additional analysis may explore weather and pollution impacts. Key output: Data analysis expertise; model refinement recommendations; peer-reviewed assessment paper.  Objective 4: UK Pollen Dataset Development.Learn pollen collection and data processing techniques, contributing to a robust UK-specific dataset. Additional analysis may explore regional, subregional and temporal variability in pollen traits. Key output: High-quality UK-specific pollen training dataset.  Objective 5. Pipeline Development. Based on earlier findings, the student will identify areas for improvement and explore options such as further training ML models, optimising pre- or post-processing, or investigating other techniques to improve model performance. Key output: Expertise in Python-based ML workflows; selection of refinement areas, updated Poleno data-processing pipeline specifically for the UK; potential peer-reviewed publication.   Objective 6: Pipeline Evaluation. The student will assess performance of the UK-specific enhancements in data processing pipelines compared to current versions, with the opportunity to explore future applications in collaboration with the Met Office.   *Strategic Relevance* This project supports ongoing work within Theme 2, specifically projects 2-4. The use of the Poleno device for real-time pollen monitoring has also been selected as a case study in the UKHSA’s new AI strategy, offering visibility and strategic relevance across the organisation. The project also holds significant value for the UK and Ireland Poleno User Group, who will serve as an advisory board. Their involvement will ensure the research remains community-focused and impactful, while providing the student with access to a broad network of expertise and collaboration.  Ultimately, this PhD will support development of a UK-wide automated real-time pollen monitoring network, with broader benefits for public health, agriculture, and environmental research.   |