Targeted Project / AY 2026 -2027

Discovery and engineering of terpenoid biosynthesis in plants

Project Reference: TRG-PLA-NP26

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Department/Institute: Plant Sciences

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Main BBSRC strategic theme: Bioscience for renewable resources and clean growth

Secondary BBSRC strategic theme: Understanding the rules of life; Transformative technologies

Project outline:

Plants produce numerous specialised metabolites that are important for surviving stress, and for mediating interactions with bacteria, insects, fungi and other plants. This richness of bioactive molecules also provides a wealth of potential pharmaceuticals, insecticides, flavours and fragrances. However, these compounds are often only present in tiny quantities or in rare and difficult-to-cultivate species. Chemical synthesis has provided easy and cheap access to some natural products but remains challenging or uneconomical for most molecules. In the past decade, aided by advances in genomics and synthetic biology, pathways for high-value natural products have been elucidated enabling scalable production in heterologous species.

This project will investigate sesquiterpene lactones (STLs), a sub-class of terpenoids predominantly found in the Asteraceae (sunflower) family. It will elucidate the genetic basis of a rare and useful STL with high potential in biomedicine and industry, aiming to enable heterologous biosynthesis. In addition, it will explore the diversification of STLs in the Asteraceae, with the aim of understanding their evolution and identifying novel bioactive compounds.

In the Patron Lab, the student will gain expertise in comparative gene expression analysis, homology modelling, and phylogenomics to identify candidate genes. They will also characterise candidate genes and employ synthetic biology approaches to pathway reconstruction. At the Royal Botanic Gardens Kew, they will build on recent work to obtain metabolomic and genomic profiles of a large number of closely related Asteraceae species to investigate the distribution and diversification of STLs, through access to Kew's extensive and diverse plant collections (including preserved specimens from Kew's Herbarium and specimens from the Living Collection).

This project will provide training in a range of transferable technical skills including bioinformatics (transcriptomics, comparative genomics, molecular evolution, structural modelling); biochemical techniques (metabolomics, mass spectrometry), genome size evaluation (flow cytometry), and synthetic biology (design, build, and test of synthetic constructs, gene editing, protein design). We also mentor students to acquire the skills, independence, and confidence they need to reach their career goals, with a focus on the development of writing, critical thinking, time management, collaboration, and presentation skills.