Targeted Project / AY 2026 -2027

Defining and transforming the molecular and morphological landscape of developmental phase change in grass crops

Project Reference: TRG-SAI-MB26

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Main BBSRC strategic theme: Bioscience for sustainable agriculture and food

Secondary BBSRC strategic theme: Transformative technologies

Project outline:

Plants transition from juvenile to adult vegetative growth phases, and from vegetative growth to flowering. Each of these phases–juvenile, adult, flowering–is characterized by specific anatomical, morphological, and molecular traits. In agriculture, crops are more sensitive to weeds, independent of available resources, before they have transitioned to flowering. A microRNA (miR156) regulates the juvenile to adult transition in flowering plants, acting through the SPL transcription factor genes. While spl mutants and juvenile vs. adult traits are well-characterized in select lineages, including maize, this is not the case for many key model organisms or weeds. This project will define the morphological, anatomical, and molecular components of phase change, as well as work on developing advanced tools for genome editing in the grasses. This work will generate a multi-scale atlas of developmental phase change, setting the stage for modulating molecular pathways underlying grass crop yield.

This project involves an integrative combination of comparative morphology, development, genetics, and genomics. In addition, the project includes methods development in the field of viral induced gene editing. Students will gain experience with a broad range of computational and wet lab techniques, as well as with quantitative phenotyping and genetic analysis in multiple plant systems.

This comparative framework will allow us to identify precise, robust morphological and molecular traits of phase change, applicable across grass diversity. The morphological markers will be useful for precise experimentation and field diagnostics, while the molecular traits will be useful for identifying potential targets for yield improvement. The genetic reagents and methods we develop have the potential to be broadly applicable and accelerate grass research.