A mathematical and molecular approach to the study of plant developmental transitions

Supervisory team:
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Project description:

Nearly all plant-based foods are either derived from a flowering plant or a direct product of its defining trait, the carpel, which is the female reproductive organ of all flowering plants. The carpel is a fascinating structure that encloses the ovules at the centre of the flower and plays a critical role in the life of a plant. During fertilization it helps guide the pollen to the ovules and after fertilization it develops into the fruit which protects, helps disperse, and supports seed development into a new plant. Therefore, the carpel is a structure of key agronomic importance, and understanding its origin as well as the mechanisms that shape its formation and diversity is a key strategic priority.

The beginning of carpel formation is a complex developmental process, as the pool of stem cells that gives rise floral organs terminates a new developmental program begins and gives rise to the carpel primordium. This transition requires both a change in the molecular networks and the generation of new growth patterns. In this project you will use a multidisciplinary approach combining molecular and developmental genetics with mathematical and computational methods to dissect the molecular mechanisms that underlie the developmental transition from meristem to carpel formation.

As the student in this project, you will dissect the gene regulatory networks that regulate the transition from floral meristem to carpel initiation and examine how those genes regulate the growth patterns that shape the carpel. To achieve this, you will work across disciplines to investigate: 1) how genes interact to trigger the developmental transition from floral meristem to carpel initiation, and 2) how genes influence plant tissue growth, including cell expansion and division patterns, during organ formation.

This multidisciplinary work will provide varied training in classic molecular and genetic biology and mathematical and computational approaches through collaborations across the School of Biological Sciences at the University of Bristol and the School of Biosciences at Cardiff University.

This studentship will generate valuable new insights into the molecular processes that underlie plant morphogenesis, which will build fundamental knowledge that can help us better understand and engineer seed and fruit diversity.