Further Investigation of Epigenetics in Hybrids and Evolution

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David Charles Baulcombe is Regius Professor of Botany, Royal Society Research Professor and Head of the Department of Plant Sciences at the University of Cambridge. His two-part project is designed to address fundamental questions in biology using a genetic and molecular approach. It is also intended to introduce young scientists to the statistics and computational aspects of handling large datasets related to genome-wide profiling of epigenetic modification, gene expression and genome sequence. The advent of high throughput sequencing technology has been transformational in biology, and their ability to use the resulting datasets is essential for their career progression as research scientists.

Part I is based on recent discoveries from Baulcombe's laboratory determining that epigenetic marks affecting gene expression are initiated in the genomes of hybrid organisms. It will have two stages. The first stage will involve dissection of an epigenetic change that has already been observed, to be initiated in hybrids between the tomato – *Solanum lycopersicum* – and a wild relative – *S. pennellii*. When completed, the conclusions will give a baseline for the analysis of other loci that will be identified in the second stage, which will involve genome-wide characterisation of genetic and epigenetic changes in the *lycopersicum pennellii* hybrids. This research will indicate the extent to which induced epigenetic changes might affect the phenotype of the hybrid plants.

Part II exploits the unicellular green alga – *Chlamydomonas reinhardtii* – to investigate the role of epigenetic mechanisms in adaptation. The aim of the experiments is to test

a hypothesis related to soft inheritance, asking whether algae that are defective in soft inheritance are compromised in the ability to adapt to an altered environment. The first stage will characterise mutant and knock down lines of *C. reinhardtii* for epigenetics and RNA silencing. In parallel with this molecular biology preparation, a series of long-term culture experiments will be set up in which cultures are subject to mild stress herbicides and high CO_2. The detailed experimental regime will be designed in collaboration with Sinead Collins (Edinburgh Institute of Evolutionary Biology), and will take account of previous studies in which *C. reinhardtii* cultures were adapted to these stresses.