David Charles Baulcombe

Regius Professor of Botany, Royal Society Research Professor; Head of the Department of Plant Sciences at the University of Cambridge

2012 Balzan Prize for Epigenetics

For his fundamental contribution to the understanding of epigenetics and its role in cell and tissue development under normal and stressful conditions.

Institution Administering Research Funds: University of Cambridge

Adviser for the Balzan General Prize Committee: Marc van Montagu

Further Investigation of Epigenetics in Hybrids and Evolution

The project is designed to address fundamental questions in biology using a genetic and molecular approach. The link with biology – in this instance evolutionary biology – is an essential component of this project. Molecular biologists are sometimes overly preoccupied with the naming of parts – scientific stamp collecting – rather than the biology of the systems. The project 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 my 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 we have observed already, to be initiated in hybrids between the tomato – *Solanum lycopersicum* – and a wild relative – *S. pennellii*. When completed, the conclusions will give us a baseline for the analysis of other loci that will be identified in the second stage. This second stage will involve genome-wide characterisation of genetic and epigenetic changes in the *lycopersicum* x *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. It is to ask whether algae that are defective in soft inheritance are compromised in the ability to adapt to an altered environment. The first stage will be to characterise mutant and knock down lines of *C. reinhardtii* for epigenetics and RNA silencing. In parallel with this molecular biology preparation we will set up a series of long term culture experiments in which cultures are subject to mild stress herbicides and high CO2. The detailed experimental regime will be designed in collaboration with Sinead Collins in the Edinburgh Institute of Evolutionary Biology, with whom we are collaborating already, and will take account of previous studies in which *C. reinhardtii* cultures were adapted to these stresses.

Part I will be carried out by a postdoctoral scientist and Part II will be allocated to a four year PhD student.