Understanding the basis of stomatal adaptation to increased atmospheric CO_2

Supervisory team:
Main supervisor: Prof Alistair Hetherington (University of Bristol)
Second supervisor: Prof Keith Edwards (University of Bristol)

Collaborators: Dr Jaap Velthuis (University of Bristol), Dr Matthew Reynolds (CIMMYT, Mexico)

Host institution: University of Bristol

Project description:

Research over the previous 30 years, primarily in Arabidopsis, means that we know much about the short-term response of Arabidopsis stomata to atmospheric carbon dioxide (e[CO_2]). In contrast we know little about the molecular and physiological basis of long-term stomatal adaptation to growth at e[CO_2] in cereals. This is clearly important in the context of environment change where e[CO2] is predicted to increase in the next 30 years and especially in breeding resilient crops capable of maintaining and improving yields while being grown sustainably. To understand the basis of medium and long term stomatal adaptation to growth at e[CO2] we shall exploit a unique resource developed by the Edwards lab. This is an EMS-mutagenised population of the rapid cycling dwarf wheat variety known as Apogee. Three generations of this variety can be grown per year and, as it is a dwarf, it can be grown in controlled environment chambers. We will carry out a thermal imaging-based genetic screen using this population to identify individuals that fail to show adapted stomatal behaviour in response to e[CO_2]. The result of this screen will be a collection of mutants that will be analysed both genetically and phenotypically. The traits and genes identified will feed in to the physiological breeding programmes run by Dr Reynolds at CIMMYT. The second strand of the work will follow up our recent demonstration, in Arabidopsis, that stomatal CO2 (and relative humidity) responses are dependent on the plant hormone abscisic acid (Chater et al (2015) Elevated CO_2-induced responses in stomata require ABA and ABA signalling. *Current Biology* **25**, 2709-2716.). We will investigate whether this is also true in wheat and barley using mutants and chemical intervention.