

## **Unravelling the function of the unusual antioxidant ergothioneine in plants and photosynthetic protists**

### **Supervisory team:**

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### **Project description:**

Plants and algae need antioxidants to protect them reactive oxygen derived from photosynthesis. We have recently discovered that many plants and algae accumulate significant quantities of the metabolite EGT, a potential novel antioxidant, but its role in these organisms is not understood. Ergothioneine (EGT) is a thione/thiol compound derived from the amino acid histidine. It is produced by fungi and some bacteria, including cyanobacteria, and has proposed health benefits in the human diet (indeed, humans have a specific EGT transporter that allows accumulation to high concentration in some tissues). As a potential antioxidant, reacting with various reactive oxygen species, it could be important in protection against environmental stresses. EGT is also more effective at binding potentially toxic metals such as Cu, Ni and Co than its precursor histidine suggesting additional cytoprotective roles. Despite this background, we know rather little about which organisms synthesise EGT and its physiological functions remain elusive.

The overall aims of this project are to investigate the occurrence of EGT in plants, algae and photosynthetic protists, identify the genes and enzymes involved in its synthesis and, using selected model organisms, produce mutants with altered EGT to investigate its functions. The project will use a combination of approaches: phylogenetic analysis of gene sequences; expression of candidate genes in *E. coli*; knockouts in model organisms using CRISPR-Cas/amiRNA; biochemical and physiological characterisation of EGT deficient mutants and in vitro investigation on EGT protective effects on macromolecules. There is scope for the student to follow routes most suited to their interests.