About the 'Nitroplast' project

A major challenge of the twenty-first century is to ensure food security for all. For optimal yields, crop plants require fixed nitrogen in the form of fertilizers, which require large fossil fuel inputs and can also result in runoff which contaminates aquifers and estuaries. Some microbes have the capacity to fix atmospheric nitrogen, but plants do not have this ability. The ultimate goal of our research is to engineer a novel synthetic nitrogen fixing organelle, with the long-term aim of conferring efficient nitrogen fixation in non-leguminous crop plants. However, there are significant hurdles before realizing this goal, which include high metabolic energy costs and overcoming the oxygen sensitivity of the process. The goal of this project is to build a novel synthetic, controllable nitrogen-fixing module in a cyanobacterium. Cyanobacteria are relatively simple organisms and are evolutionarily related to plant plastids. Therefore, these engineering goals should be achievable, constituting a technological stepping stone that would lead to the engineering of nitrogen fixation into plastids.

A team of scientific experts from the U.S and the U.K. have been assembled from the fields of biophysics, biochemistry, molecular genetics and synthetic biology. The outcome of this research is expected to benefit basic researchers in academia as well as applied scientists through the development of new tools for cyanobacteria, and through products such as the introduction of nitrogen fixation into plants. This project is a unique opportunity for methodology exchange between U.S and U.K. scientists and for developing tools that will be freely available to the synthetic biology and cyanobacterial research communities. The preparation of the next generation of scientists is a major goal of this interdisciplinary team. If successful, the work will also benefit traditional agricultural research.

MEMBERS OF OUR CURRENT GROUP (SEPTEMBER, 2015, BURNHAM BEECHES, U.K.)