

# Engineering Plants for Farming and Pharming

Nicola J Patron

Engineering Biology, Earlham Institute, Norwich Science Park, Norfolk, NR4 7UZ  
nicola.patron@earlham.ac.uk

## Abstract

Although unable to flee predators or sub-optimal growth conditions, plants have the incredible ability to continue normal life after losing whole organs. They can also alter the expression-levels of thousands of genes, remodelling growth and metabolism and deploying an extensive molecular armoury in response to threats. These abilities provide us with food but also present a potential platform for the rapid production of complex molecules from water and light. Until recently, however, we lacked the tools and data necessary for complex engineering of plant systems. The application of engineering principles to plant biology has enabled us to establish platforms for high-throughput, automated, experimentation at nanoscales. We are combining these approaches with genome editing technologies and comparative genomics to investigate how regulatory functions are encoded in plant DNA and to engineer plants with new traits and functions. In recent work, we have shown that genome editing can be used to make plants with different carbohydrate structures, paving the way for the production of more nutritious crops. Currently, we are learning where to make precise changes to regulatory regions in order to rewire the control networks that coordinate large-scale responses to environmental signals. Beyond foods, we are developing plants as photosynthetic platforms for biomanufacturing. We are interested not just in making human therapies but also in manufacturing a greater range of products to improve the sustainability of agriculture.