

Could chloroplast breakthrough unlock key to controlling fruit ripening in crops?

University of Leicester biologists discover plant cell regulation process affects chloroplasts Chloroplast images available from

Biologists may have unearthed the potential to manipulate the functions of chloroplasts, the parts of plant cells responsible for photosynthesis.

Researchers in the University of Leicester's Department of Biology discovered that chloroplasts are affected by the ubiquitin proteasome system (UPS) – a process which causes the breakdown of unwanted proteins in cells, previously thought to only act on central parts of the cell.

As a result, the researchers believe they may be able to use specific proteins to regulate the functions of chloroplasts – such as the conversion of chloroplasts into highly-pigmented chromoplasts during the ripening of fruit.

Their paper, *Chloroplast Biogenesis is Regulated by Direct Action of the Ubiquitin-Proteasome System*, is due to be published in the journal *Science* on Friday, November 2.

The paper identifies a gene (*SP1*) in the nuclei of plant cells that codes for a protein called a ubiquitin E3 ligase which is able to regulate chloroplast development through the UPS process.

The team are already investigating the potential for harnessing the SP1 gene in crop plants, for example to affect the ripening of fruits such as tomatoes, bell peppers and citrus.

The University's Enterprise & Business Development Office has filed a patent application with a view to developing practical applications for the research.

Professor Paul Jarvis, of the University's Department of Biology, has led the project since its inception in 2000.

He said: "Our work shows that the UPS also acts on subcellular compartments in plant cells called chloroplasts, which are responsible for the light-driven reactions of photosynthesis that power almost all life on Earth.

"Identification of this previously-unsuspected link between the UPS and chloroplasts constitutes a major breakthrough in biology, and may enable the manipulation of chloroplast functions in crops.

"It is incredible to get to this point – it has been a long journey. We have known for some time that this was going to be a big breakthrough."

The research has been funded by grants from the Biotechnology and Biological Sciences Research Council (BBSRC).

Professor Douglas Kell, Chief Executive of BBSRC, said: "To ensure that we have enough healthy, sustainable food for a growing population, we need to find a range of novel solutions to challenges such as improving crop yields and reducing food waste. This research highlights one of the many ways in which science can help.

"The ripening process can happen quickly, and it can take just a few days for a fruit or vegetable to be considered inedible. This unavoidable process means big losses to both farmers and consumers. This discovery brings us one step closer to greater control over ripening so that we have greater flexibility for farmers when supplying produces in the best condition."