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Nobel adjacency

Check for updates

It's time once more for the announcement of the winners of the Nobel Prizes, which again fail to include any researchers who work on plants. However, that does not mean to say that the prizes have no relevance to plant biologists.

The 2022 Nobel Prize in Physics was awarded to Alain Aspect, John F. Clauser and Anton Zeilinger "for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science". Quantum effects are used by plants primarily during photosynthesis, but as of yet no botanical examples of quantum entanglement, or 'spooky action at a distance' as Albert Einstein rather dismissively called it, have been uncovered.

Thankfully, the Chemistry Nobel Prize was awarded for a topic with more practical application for plant researchers, indeed for a branch of chemistry with a wide range of practical applications: click chemistry. This prize was shared between three researchers. Barry Sharpless and Morten Meldal were honoured for synthesising complex molecules by assembling smaller building blocks with functionalised groups, thus laying the foundations of the technique. Carolyn Bertozzi, the third awardee, took those principles and adapted them for use within and on the surface of cells, without disrupting the cells' normal activity. These bioorthogonal reactions have been used to tag and track all sorts of biological molecules and organelles; meanwhile Bertozzi has used them to develop precisely targeted cancer therapeutics.

The versatility of click chemistry and bioorthoganal reactions has made it a popular research tool, including in plant biology. As long ago as 2016, *Nature Plants* published a paper in which click chemistry was used to cross link a pattern recognition receptor to its cognate pathogen molecule, thus identifying the process by which tomatoes recognised flagellin through its flgII-28 epitope[1]. Furthermore, in the month since the Nobel Prize was announced, we have published two papers employing click chemistry. In the first[2], researchers from the Chinese Academy of Sciences and Beijing Institute of Lifeomics elucidated the role played by the thiol peroxidase, PRXIIB, in sensing hydrogen peroxide to trigger defence responses in stomata against *Pseudomonas syringae* attack, in part by using click chemistry to identify sulphenylated proteins in the plant's cells.

A second paper[3], published in this issue, looks at the growth of root hairs in *Arabidopsis*. The expansion of root hairs was thought to be entirely by growth at the tip, however Jozef Mravec and colleagues demonstrate that at least some of the increase in length results from expansion of the cell wall at the shank of the hair. They used a 'click-enabled' galactose analogue to cross link to components of the cell wall, a bioorthogonal reaction that could be repeated multiple times without affecting the normal growth of the root hair. Thus, pulse chase experiments with fluorescently-labelled clickable galactose showed a region of the shaft, a little back from the tip, where xyloglucan was being incorporated into the root hair wall.

The 2022 Nobel Prize for Physiology or Medicine was unusual in being awarded to a single researcher, Svante Pääbo, for his work on human evolution through sequencing the genome of extinct hominins from archaeological samples. The technical challenges of sequencing DNA from ancient samples took decades to surmount, but Pääbo was eventually able to sequence mitochondrial DNA and then genomic DNA from Neanderthal remains, demonstrating that not only had they coexisted with ancient *Homo sapiens*, but that a substantial amount of interbreeding occurred. He also discovered a whole new race of extinct hominins, the Denisovans, through the sequencing of DNA from a finger bone found in a cave in the Altai mountains of Russia. So far, most of the hominin sequences have come from material less than 50,000 years old, although Pääbo has managed to obtain nuclear sequences from remains dated from 430,000 years ago.

Hominins are not the only creatures whose archaeological remains are amenable to sequencing. Seeds make excellent sources of genomic material, however their preservation at dateable sites tends to extend back little further than the beginnings of agriculture around 10,000 years ago. Nevertheless, *Nature Plants* has had its fair share of archaeological sequencing papers. In our very first issue in 2015, da Fonseca et al. charted the spread of maize through the Americas by sequencing kernels from archaeological sites across the southwest of North America[4]. Since then, we have published papers sequencing grapes from Iron Age Europe[5], emmer wheat from the New Kingdom of ancient Egypt[6], beans from the Andes[7] and even cereals from the Altai Mountains[8] (although some 35,000 years after Pääbo's Denisovans lived in the area).

The Nobel committee may not have chosen to celebrate any of the world-changing discoveries that have been made in plants again this year. However, we can feel more than justified in calling ourselves 'Nobel adjacent'.

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