

New target found in search for new, more effective herbicide

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Scientists at the John Innes Centre have discovered a new target in plants for the development of new herbicides for use by farmers and gardeners.

Professor Tony Maxwell leads a research team at the John Innes Centre studying an enzyme in [plants](#) called DNA gyrase. In plants, DNA gyrase plays an essential role in the formation of chloroplasts, which are the parts of the plant that give it its green colour and help it to transform sunlight into energy. Without DNA gyrase, the plant is not able to photosynthesise and will die.

DNA gyrase performs an equally important role in bacteria - without this enzyme bacteria will also die. It is known that DNA gyrase in bacteria is an important target for an antibiotic called ciprofloxacin. When bacteria are treated with ciprofloxacin, the DNA gyrase in their cells doesn't work and the bacteria dies.

Scientists also knew that ciprofloxacin kills plants but they didn't know how it does this. Professor Maxwell's team set to work investigating whether the antibiotic had the same effect on the DNA gyrase in plants as it does in bacteria.

They mutated 400,000 *Arabidopsis thaliana* seeds and grew them into plants. They then treated them with ciprofloxacin and found one plant which had increased resistance to the antibiotic. From analysis of its genome, the team found that the plant had a mutation in a very specific gene known to encode the enzyme DNA gyrase. This demonstrated that

the plant version of DNA gyrase is a target for ciprofloxacin but most importantly it shows that DNA gyrase can be used as a target for herbicides because it is essential for plant growth.

This research in no way recommends the use of antibiotics as herbicides. Professor Maxwell said:

"The next step is to find new compounds that can target DNA gyrase in a different way to avoid the potential for developing resistance to medically used antibiotics. These compounds could then be developed and tested as future herbicides."

This research, which is published in the *Journal of Biological Chemistry*, also highlights another important benefit for using DNA gyrase as a target for the development of new herbicides. DNA gyrase is only present in plants and [bacteria](#), and does not exist in animals. Therefore any new [herbicides](#) that target this DNA gyrase in plants are very unlikely to be any danger to humans.

More information: Katherine M. Evans-Roberts et al. DNA Gyrase is the Target for the Quinolone Drug Ciprofloxacin in *Arabidopsis thaliana*, *Journal of Biological Chemistry* (2015). [DOI: 10.1074/jbc.M115.689554](#)

Provided by John Innes Centre

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