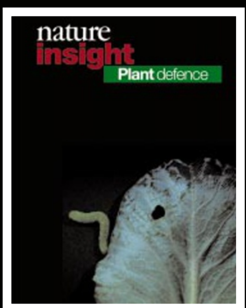
nature insight

Plant defence



Cover illustration courtesy of P. Reymond and E. Farmer.

This is an exciting time to be interested in plant science. The advances in plant molecular biology, of which the sequencing of the *Arabidopsis thaliana* genome is but the most visible manifestation, are providing revelations on a weekly basis, and one of the faster moving fields within plant science is the study of plant defence mechanisms.

Many of the genetic and physiological foundations of the study of plant defence were laid back in the early part of the twentieth century, but it was only seven years ago that the first gene concerned with plant disease resistance was cloned. From a purely academic standpoint this is a ‘road less travelled’. While many immunologists may view the mammalian immune system as a pinnacle of evolution, natural selection has honed the defence strategies of plants over 1.6 billion years without recourse to antibodies, T cells and the like, producing systems no less subtle or effective.

One theme that emerges in this Insight is how molecules and mechanisms involved in plant defence have direct homologues in animals. At least some of the plant resistance genes (*R* genes) considered by Dangl and Jones (pages 826–833) are cousins of the Toll-like receptors whose importance in animals’ innate immunity has recently been recognized. The phenomenon of post-transcriptional gene silencing, which Waterhouse, Wang and Lough (pages 834–842) present as a defence against viruses and transposons, seems practically identical to RNAi discovered nearly simultaneously in *Caenorhabditis elegans*. Programmed cell death, used as a way to isolate and excise diseased plant tissue, is shown by Lam, Kato and Lawton (pages 848–853) to proceed in ways both similar and different to the induction of apoptosis in animals. Even pheromones have their counterparts in the volatile compounds used in inter- and intra-plant communication, and for which Farmer (pages 854–856) coins the term ‘automone’. But despite the similarities, these systems have evolved in directions and to levels of sophistication not seen in animals.

A knowledge of plant defence strategies also has practical applications. The ‘natural’ products of plants’ secondary metabolism have been used for millennia in ‘traditional medicines’, but the function of most of these elaborate chemicals is to protect the plant from attack. Dixon (pages 843–847) surveys the diversity of plants’ chemical warfare on pathogens and considers the potential for metabolic engineering of natural product pathways, while Stuiver and Custers (pages 865–868) explore how our current knowledge of plant defence mechanisms is being, or soon will be, exploited to produce improved disease resistance in crops. But, as Rausher points out (pages 857–864), such things are not new. Evolution has been introducing new defence strategies into plants for millions of years while simultaneously finding ways for pathogens to bypass them. We will need to learn lessons from ecology as well as biochemistry if we are to apply our emerging understanding of plant defence in any meaningful way.

Seven articles is too few to provide anything but a survey of some aspects of this fascinating subject. However, we hope that this Insight will give readers a better idea of the armaments employed for the battle raging in our own backyards.

Christopher Surridge **Senior Editor**

Lesley Anson **Insight Programme Editor**