**Gene-for-gene interactions in plant-microbe interactions**

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**Summary of the practical:**

The aim of this practical session is to familiarise you with the use of model organisms to investigate the plant immune system. The bacterium *Pseudomonas syringae* pv. *tomato* DC3000 (*Pst* DC3000) infects *Arabidopsis thaliana* and causes disease. To promote virulence, DC3000 maintains a large repertoire of effector proteins that are injected into plant cells via the type III secretion system (T3SS). Another important virulence factor utilized by *Pst* DC3000 is the polyketide phytotoxin coronatine, which mimics the plant hormone jasmonate to antagonize salicylic acid immune signaling. Plant pathologists can manipulate this pathosystem to understand key components of the plant immune system and bacterial pathogen virulence.

Studying the function of individual effectors on the plant immune system in *Pst* DC3000, because the large repertoire of effectors can obfuscate the influence of a single effector. The Pf0-1 strain of the soil bacterium *Pseudomonas fluorescens* does not cause disease on *Arabidopsis*; it lacks aT3SS and effectors. Researchers have exploited this characteristic by engineering a T3SS into Pf0-1 to create the Effector-to-Host-Analyzer (EtHAn) strain (Thomas et al. 2009 Plant J 60(5):919). Plasmids encoding individual or multiple effectors can be transformed into EtHAn, which will deliver the encoded effectors into plant cells.

**Part I: Overview of the use of *Pseudomonas* – *Arabidopsis* pathosystems to study plant immunity.**

We will present several ways we can use *Pst* DC3000 and *Pf0-1* (EtHAn) to study the role of pathogen secreted effectors in virulence, and the role of the plant immune system in suppressing pathogen growth. You will learn the advantages of different techniques and will be challenged to consider the use of the *Pseudomonas* – *Arabidopsis* pathosystem in your own research.

**Part II: Practical.**

A crucial component of the plant immune system is the repertoire of NLR (Nucleotide binding domain and Leucine-rich Repeat containing) intracellular immune receptors encoded by *Resistance* genes. NLRs confer recognition of effector proteins in a gene-for-gene relationship: the presence of an NLR gene in the host confers recognition to a specific effector gene in the pathogen. In this part, we will showcase this gene-for-gene relationship in the *Pseudomonas* – *Arabidopsis* pathosystem. We will infiltrate Pf0-1 (EtHAn) carrying different effectors into different *Arabidopsis thaliana* accessions or mutants. The following day, a hypersensitive cell death response will be observed where a gene-for-gene relationship exists.