Embargo notice: This press release is under embargo until 29October 2009, 2:00 pm U.S. Eastern Time / 6:00 pm London time (GMT).

Scientists crack the code that bacteria use to manipulate agricultural crops

Sebastian Schornack, a scientist at The Sainsbury Laboratory, is interested in plant-pathogen interactions, in particular how pathogen-derived proteins known as effectors can modify the gene expression of plants to overcome resistance mechanisms. In 2008 Sebastian was granted a Fellowship from the German Research Foundation to study the molecular interplay between *Phytopthora infestans*, the causal agent of potato late blight, and its host species, in Prof Sophien Kamoun's group at TSL. A key motivator to his joining TSL was the opportunity to train in one of the world's top laboratories for plant-pathogen interactions, and the recent publication of the genome sequence of *P. infestans*, involving TSL work, is proving a valuable resource for the study of effector proteins.

Prior to joining Sophien Kamoun's group, Sebastian was at Martin-Luther-University, in Halle, Germany, studying another plant pathogen, *Xanthomonas*. He co-discovered the way pathogen-derived effector proteins bind to DNA, manipulating the plant's own gene expression to make it more susceptible to infection. This finding, recently published by the journal *Science*, could have important applications in biotechnology.

Xanthomonas bacteria have led to the loss of many crops in Asia, America and other hot and humid areas. The pathogen attacks important cultivated plants such as rice, peppers, tomatoes and citrus fruits by manipulating the genes of these plants. Biologists at the Martin Luther University Halle-Wittenberg (MLU) have now worked out how the pathogen does this. In this week's Science Express, the advance online version of the renowned *Science* magazine, they reveal the secret behind a special code that *Xanthomonas* uses to manipulate genes. Knowing this code is imperative when it comes to breeding resistant plants.

This seminal discovery has potentially important applications, particularly for biotechnology. "With the help of this study, factors could be developed for the first time that specifically regulate any type of plant gene," says Dr. Jens Boch, main author of the *Science* magazine's article. "We still have to see whether this principle works only with plants, or whether it can also be transferred to animals and people," Boch adds.

The scientists from the Institute of Biology at MLU discovered a new, unique pattern after they bound proteins from the causative agent to the DNA of the plant. "It works a bit like a zipper. In the right combination, these proteins target the DNA within the nucleus of the plant's cells," explains Prof. Ulla Bonas, director of the Department of Plant Genetics.

In the paper in *Science*, the Halle researchers prove that with the help of this previously undiscovered pattern, proteins can now be manufactured which target specific areas of the DNA.

Xanthomonas uses a sophisticated strategy to colonize the plant. It injects proteins directly into the nucleus of the cells in order to manipulate the plant's gene activity. A large and important group of these proteins are Transcriptional Activator-Like (TAL) effectors. Just how the TAL effectors were able to recognize the target gene of the plant they affected had been a puzzle. To their astonishment, Dr. Jens Boch and Dr. Sebastian Schornack at MLU stumbled upon a direct correlation between individual modules in the effectors and the DNA building blocks.

"The principle is extremely simple and therefore very elegant. A series of modules in the TAL proteins exactly matches the corresponding DNA building block sequence," Boch explains.

Unlocking this code now allows predictions to be made as to how *Xanthomonas* triggers diseases in plants and through this, enables the breeding of disease resistant plants. The unique modular structure also enables proteins that bond with any type of DNA to be manufactured in a laboratory.

The Department of Plant Genetics at the MLU's Institute for Biology, headed by Prof. Ulla Bonas, has been researching into the interaction between *Xanthomonas* and pepper and tomato plants for some years now. In 2007 Bonas and her colleagues revealed in two "Science" publications that the protein AvrBs3 binds to DNA. The scientists at MLU have been funded by the German Research Foundation as part of the SPP 1212 program and the 648 collaborative research center.

The paper will be published online by the journal Science, at the Science Express web site, on Thursday, 29 October, 2009. See http://www.sciencexpress.org.

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Notes for Editors:
About The Sainsbury Laboratory http://www.tsl.ac.uk/
The Sainsbury Laboratory (TSL) is a world-leading research centre focusing on making fundamental discoveries about plants and how they interact with microbes. TSL is evolving its scientific mission so that it not only provides fundamental biological insights into plant-pathogen interactions, but also delivers novel, genomics-based, solutions which will significantly reduce losses from major diseases of food crops, especially in developing countries.