



# research

The Bayer Scientific Magazine

EDITION 26 | July 2014

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AWARD-WINNING JUNIOR RESEARCHER: PLANT SPECIALIST DR. STEVEN SPOEL

# Decoding the immune system

*The Bayer Science & Education Foundation promotes top research and junior talents. Molecular biologist Dr. Steven Spoel won the 2013 Early Excellence in Science Award for his research into the genetic regulation of the plant immune system. His work on plants may even be transferable to cancer research.*



Understanding plants – healing people: biologist Dr. Steven Spoel studies how the immune system functions on a cellular level and how it can be influenced.

Many important discoveries in the life sciences are first made on plants and later applied to humans, which may also be the case with the work of Dr. Steven Spoel. The 34-year-old Dutchman is currently a Royal Society University Research Fellow at the University of Edinburgh's Institute of Molecular Plant Sciences. Spoel has specialized in the immune system of plants or, more accurately, one puzzle piece of it, because the plant defense system is a complex structure of regulator genes. "I'm interested in how plant cells detect and respond to environmental changes," Spoel says. His work centers on plant responses to pathogen infestation. Whether a plant grows and survives depends on numerous factors. In addition to nat-

ural enemies, such as insects and bacteria, growth is influenced by the nutrient and water supply, and by high and low temperatures.

Researchers are rapidly learning more about the interplay between the environment and the plant immune system, and in the process expanding their options for arming plants against adverse conditions. "This is a very critical goal if we want to feed the growing global population. Furthermore, the importance of utilizing plants as a source of energy or as drug producers is likewise on the rise," Spoel explains. In addition to making plants more resistant and crop yields more stable, Spoel hopes his research will have another effect: "On a cellular

## Early Excellence in Science Award

First established in 2009, the international Bayer Early Excellence in Science Award recognizes talented young scientists in the early stages of their academic careers. An independent expert jury selects three prizewinners in the categories Biology, Chemistry and Materials. Criteria include the originality of the research, as well as the quality and significance of the results. The awards are worth EUR 10,000 each. The other awards in 2013 went to the chemist Dr. Abigail Doyle of Princeton University and Dr. Javier Fernandez of Harvard University in Boston. Doyle developed a method for the low-impact and efficient incorporation of fluorine in organic molecules. In the future, this will make it possible to synthesize substances with unique, previously unknown properties. Fernandez discovered a new material called "shrilk." It displays strength and toughness similar to that of aluminum, but weighs only half as much, is biodegradable, suitable for complex molding processes and can be produced at low cost. The material has potential for use in numerous applications, including packaging and medicine.

level, there are several similarities between the plant and human immune systems. Our research may also uncover possibilities for new cancer treatments." In recognition of his work, Spoel won the 2013 Early Excellence in Science Award, funded by the Bayer Science & Education Foundation. The puzzle piece he concentrates on in his research is salicylic acid. This starting component for acetylsalicylic acid, the active ingredient in Aspirin™, is part of a plant's system of defense against harmful organisms.

### Help against pathogens: salicylic acid induces gene expression and activates the immune system

"We know that the plant immune system can switch on specific gene groups to fight pathogens," Spoel explains. Salicylic acid helps it correctly transcribe information in the DNA and switch on the genes required for defense. "Many of these molecular mechanisms in which salicylic acid alters genes exist in the cells of both man and animals," he continues. Errors in this sensitive network have an impact on the metabolism of the entire organism, potentially leading to faulty immune system reactions and the development of disease. "We need to understand in greater detail what effect salicylic acid and other factors have on the finely balanced regulation system, and how we can influence these effects," Spoel says.

Spoel became fascinated with the immune system activator while working on his dissertation at Duke University in North Carolina, USA. He had previously completed his undergraduate studies at Utrecht University in the Netherlands. Spoel knew at a young age that he wanted to dedicate his career to plants. His parents gave him and his siblings a corner of the yard to plant seeds and to water, fertilize and observe the growing plants. "Within a short time, I had taken over my siblings' plots," Spoel remembers. To compensate for all the hard work, the biologist likes to practice judo, a sport he has been involved in since he was five. Spoel also participates every year in the Glasgow half marathon. This stamina and perseverance could very well reward him with a promising career – and new discoveries in cancer research as well.

## Veterinarian in Namibia

The 25-year-old veterinarian Marion Leiberich is a fan of Africa. While in college, she used her Carl Duisberg scholarship from the Bayer Foundation to fund an internship at the Windhoek Veterinary Clinic in Namibia.



Practical experience: Marion Leiberich in the operating room

### What draws you time and time again to Africa?

Ever since we took a family vacation there, I have been fascinated by the landscape and animal world of Africa. Between high school graduation and college, I spent nine months working for a chimpanzee protection project, observing lions for a research project and volunteering for whale and dolphin research. I also spent all my semester breaks in Africa.

### How did you benefit from the internship?

I examined and x-rayed animals, and assisted with ultrasound examinations. I was even allowed to operate. If I can add to this experience by working with wild animals, then hopefully I can be accepted into the Wild Animal Health program in London.