

AWARD-WINNING RESEARCHER: CHEMIST PROFESSOR ABIGAIL DOYLE

# When molecules go new ways

*Molecules containing fluorine are put to a wide range of uses but they are often difficult to produce. Now, new methods developed by a working group led by Professor Abigail Doyle from Princeton University in New Jersey, USA, enable fast, efficient synthesis with fluorine. In recognition of her research work, Professor Doyle received the Bayer Early Excellence in Science Award in June 2014.*



New approaches in chemistry: Professor Abigail Doyle has tamed the element fluorine. The methods developed by her team enable completely new chemical reactions.

As a core component of many active ingredients used in areas from crop protection to medicine, fluorine is highly prized by chemists. "Molecules containing fluorine play an important role in almost all areas of the chemical industry. The element is present in agrochemicals, anesthetics, pharmaceuticals and contrast media, but also in materials such as Teflon," says Professor Abigail Doyle. However,

fluorine doesn't bond easily, particularly not with carbon. "Fluorine is the element with the highest electronegativity. In other words, it resists sharing its electrons within a compound," she explains. She and her colleagues are therefore working on developing new strategies that will make it easier to combine fluorine and carbon – and it's paying off. "We have developed a new raw material for fluorination reactions which overcomes some of the issues we experienced previously," explains Doyle.

## A passion for chemistry and humanities

Her working group also studies catalysts – materials that work alone or in combination with other substances to initiate difficult reactions more easily. For this, the researchers used transition metals such as cobalt and nickel. "They tame the stubborn fluorine and make it a more willing reaction partner," says Doyle. For example, she and her colleagues have developed a new method for producing contrast media using the radioactive fluorine isotope  $^{18}\text{F}$ , which are used in cancer diagnostics, among other things. "We changed the reaction in such a way that it now also works for the industrial production of contrast media," continues Doyle. This method could also help to develop entirely new contrast media.

Chemistry that wasn't always Doyle's first love. "At high school I was more interested in the humanities and music," she says. It was only during an introductory course in organic chemistry at Harvard University that she discovered her passion for laboratory work. "I discovered that chemistry gave me the oppor-

tunity to combine my love of the logical nature of science with the creativity you find in the humanities and when playing a musical instrument," she explains.

Doyle's success proves she made the right choice. At 34, her CV covers seven closely-typed pages and numerous awards, such as the Thieme Chemistry Journal Award. A very special honor was added to this list in June 2014, when Doyle received the Bayer Early Excellence in Science Award for her work on chemical synthesis. "This award was exceptionally important to me. The Bayer award has recognized my program early on, and that has drawn international attention to the research work done by my group," says Doyle. With the prize money, she is also able to pursue new paths of research.

## Catalyst combinations open up new reactions

Her research group studies cross-coupling reactions, a process used to combine two different organic molecules. Working with researchers led by her colleague David MacMillan, her team recently managed to combine two types of catalyst – a photoredox catalyst and a nickel catalyst. This opens the door for reactions that were virtually impossible previously. For example, carboxylic acids can now be combined with complex cyclic molecules that serve as the basis of new active pharmaceutical ingredients.

Despite her heavy workload, Abigail Doyle feels it is extremely important to leave enough time for her family. When she's not in her lab coat, she spends most of her time with her husband and son, "preferably out enjoying nature, hiking or diving."

## Open your mind and think bigger

*The Bayer Foundation gives 20 young scientists the chance to attend the Lindau Nobel Laureate Meeting.*

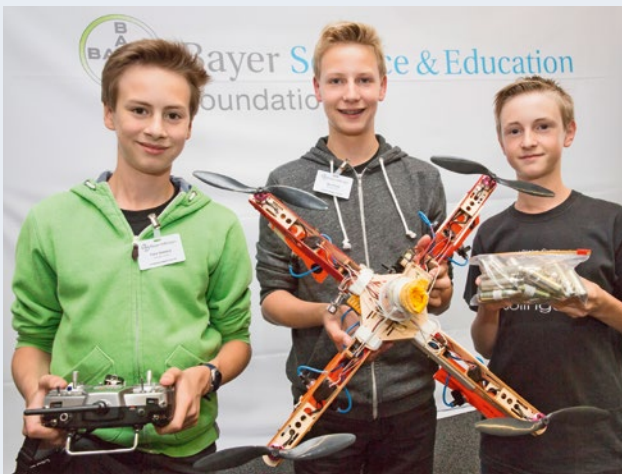
"Open your mind and think bigger." That was the message that Liangliang Hao from Northwestern University in Illinois in the United States took away from the 2014 Lindau Nobel Laureate Meeting. She was one of the 20 Bayer Lindau Fellows, talented young scientists from 18 countries, whose visit was sponsored by the Bayer Foundation. This year the conference, which has been bringing together Nobel Prize winners with young researchers over the course of a week for 63 years now, was firmly focused on medicine. Other participants were equally impressed by the inspirational atmosphere. "I met lots of interesting people who were filled with the spirit of invention," says Dr. Christian Herzmann from Borstel Research Center, winner of the 2014 Aspirin Social Award. Like Hao, he had been invited to the event by the Bayer Foundation. Selected guests were also able to take part in a special highlight – the Bayer Lindau Foundation Dialog, an evening event devoted to scientific dialog. As part of this, they had the opportunity to use posters to present their research work and engage in discussions with Bayer scientists and Nobel Prize winners such as Professor Harald zur Hausen (Medicine). Liangliang Hao was awarded the prize for the best poster, winning a week at the Bayer research centers in Berlin and Wuppertal.



Scientific dialog: biomedicine technician Cheryl H. Cui (left) from Canada was one of 20 Bayer Lindau Fellows. She swapped notes with Bayer's Management Board member responsible for Innovation Kemal Malik (right), the host of the Bayer Dialog evening.

## School teams and Bayer experts develop prototypes for multicopters

*The winners of the schools technology competition developed crash protection for a remote-controlled aircraft.*



Safety for miniature aircraft: the winners of the Bayer schools technology competition panel's award Felix Wieland, Ben Preuss and Benedikt Schmitz (left to right) proudly present their multicopter. They devised a sophisticated system that protects the aircraft in the event of a crash.

Eleven school teams from all over Germany had the opportunity to explore for themselves how ideas become prototypes. In June 2014, the finalists in Bayer's schools technology competition presented their ideas to a panel of experts. The ideas included a rapid test for heart attacks and a garbage can for biodegradable waste that can stand up to winter weather. After that, the students had three months to put their ideas into practice. Each group received support from a Bayer expert. The engineers helped the students deal with tricky technical problems. This year's winners were three 9th graders from the August Dicke High School in Solingen. Along with their teacher, they were presented with the panel's award and prize money of EUR 5,000 in the BayArena soccer stadium in Leverkusen. The three students had developed crash protection for multicopters, i.e. remote-controlled aircraft. The panel of judges said that the device could well be translated into practical applications. A parachute and type of airbag ensure that the aircraft can land undamaged in an emergency. "The students impressed us with their quality, professionalism and problem-solving abilities," said Thimo V. Schmitt-Lord, Managing Director of the Bayer Foundations, at the award ceremony.

## New approaches in a global social mission

*Employees from Bayer Business Consulting are working in social foundation projects in countries such as Kenya and the Philippines.*

Employee development paired with social work – that is the aim of the “Bayer People Care for Society” program. In this new initiative launched by Bayer Business Consulting and the Bayer Cares Foundation, consultants lend their support to the Foundation’s international social and healthcare projects. “In addition to the fact that we are actively supporting Bayer’s social commitment, we also regard these activities as a new aspect of employee development, as our consultants are deployed to social projects that are far away from their usual office environments,” explains Alexander Meyer auf der Heyde, Head of Business Consulting.

Yuchen Li, for example, is supporting a health education project run by the Deutsche Stiftung Weltbevölkerung (DSW) in Kenya. She talked to research about her experiences.

### What appeals to you about a project in Kenya?

I’ve been volunteering in social projects for a long time now. Health education in Kenya actually fits in very well with my professional background. It’s a once-in-a-lifetime opportunity for me to make a positive contribution to society and I can also develop my own professional skills so that I can become a more versatile manager.

### How do you help on the ground?

The DSW supports 400 youth clubs in East Africa. They teach young people about contraception, family planning and protection against

sexually transmitted diseases. I analyze the influence and effectiveness of this network and try to implement improvements. My knowledge of project management, market research, data analysis and marketing stands me in very good stead.



Yuchen Li, shown here at a youth club, works as a management consultant at Bayer Business Consulting in Morristown, the Bayer Group’s global center of management consulting expertise.

## Better patient care via smartphone

*“Explain TB” – the name says it all. This smartphone app provides multilingual information about tuberculosis and is therefore a valuable instrument in the treatment of TB patients who do not understand German. In 2014, the project took first place in the Aspirin Social Award, which recognizes charitable projects in the healthcare sector. research spoke with the man behind “Explain TB”: Dr. Christian Herzmann, a respiratory medicine specialist at Borstel Research Center.*



First place: Bayer Management Board member Michael König (right) congratulates Cordula Ehlers and Dr. Christian Herzmann (left to right) on “Explain TB.” The app can be downloaded free of charge.

### How did you come up with the idea for “Explain TB”?

Because of my day-to-day work. It’s often difficult because many tuberculosis (TB) patients don’t speak German. As a doctor, that makes it tricky to give them information about the need to screen contact persons like relatives and friends for TB.

### How does the app work?

It contains information about all the key issues relating to tuberculosis in a total of 37 languages. There is also information in audio format for illiterate users. For example, if a doctor has to explain that a patient needs to take an HIV test, she can play the relevant audio section on the app.

### How will the Aspirin Social Award help you?

We’ll use the EUR 15,000 prize money to develop the app further. For instance, we could develop tests that patients can carry out themselves to check the side effects of certain drugs. The app could also automatically translate patient data into a different language.