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Three Volkswagen Foundation Momentum grants go to the University of Tübingen

New generation professors Rosa Lozano-Durán, Marcus Scheele and Nadine Ziemert each receive more than 900,000 euros for cutting-edge academic development

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The University of Tübingen has this year achieved a triple success in acquiring Momentum funding from the Volkswagen Foundation for the newly appointed professors Rosa Lozano-Durán from the Center for Plant Molecular Biology, Marcus Scheele from the Institute of Physical Chemistry, and Nadine Ziemert from the Interfaculty Institute of Microbiology and Infection Medicine.

The Volkswagen Foundation supports professors in the first years of their appointment with its Momentum funding program for recently tenured professors. The grant gives them scope to further develop their research long term, or to tackle new topics. The highly endowed grants run for four years. They may be extended for a further two years. The Volkswagen Foundation approved just eleven Momentum grants across Germany this year.

“It is a mark of success that three researchers have received the Volkswagen Foundation’s prestigious and highly endowed Momentum funding for their first professorship at the University of Tübingen,” says University president, Professor Dr. Dr. h.c. (Dōshisha) Karla Pollmann. “This approval of applications from a wide range of disciplines shows once again that the University is strongly positioned across a wide range of topics.”

Insight into the infection process: How viruses reorganize the cell nucleus

Rosa Lozano-Durán
Photo: Friedhelm Albrecht/ University of Tübingen

Rosa Lozano-Durán will use her Momentum grant to take a very close look inside infected cells in the "NEWCLEAR – Understanding the viral subversion of the nucleus" project. She will receive funding of more than 920,000 euros.

In a viral infection, the virus takes control of cells so that it can use them to multiply and spread. Lozano-Durán's research group is investigating these processes in geminiviruses which infect plants. These viruses can cause devastation in crops worldwide. Lozano-Durán recently confirmed previous observations that these viruses cause a profound remodeling of the nucleus in the infected cells. The DNA of the plant is pushed to the edge of the nucleus, and a potential factory for viral replication is built in the central space. Plant and virus proteins are selectively recruited to this structure. Similar observations on the remodeling of the cell nucleus have been made for viruses that infect animal cells. So far, however, little is known about how this factory is formed and what it entails.

In her Momentum project, Lozano-Durán will seek to understand the processes that lead to the formation of this different nuclear structure, as well as the consequences this has for the biology of both the viruses and the plant or animal hosts. In order to tackle this project, she has to do two things first: She will expand her model viruses to include not only plant-infecting, but also human-infecting viruses that are known to induce similar nucleus remodeling. Then Lozano-Durán needs to procure a special microscope for laser microdissection, which will enable tissue sections and cells to be dissected in a microscopic procedure using a focused laser beam. This will make it possible to isolate the nuclei of infected cells at various stages of the virus-induced remodelling. In this way, the newly discovered processes can be recorded at a molecular level. Lozano-Durán is also thinking of new strategies to fight viral infections that could be applied to a wide variety of living organisms.

Learning from proteins: Improving quantum dot light sources

Marcus Scheele
Photo: Friedhelm Albrecht/ University of Tübingen

Marcus Scheele is seeking ways to generate highly ordered supercrystals of colloidal quantum dots that can be used as light sources. His Momentum project is entitled "Advancing Quantum Dot Lightsources by Learning from Proteins" (QuantumLeaP). Scheele's project will receive some 930,000 euros

Colloidal quantum dots (QDs) are tiny semiconductor crystals whose size is in the nanometer range. They are often referred to as "artificial atoms" as they share many of the traits of real atoms, including their ability to self-assemble into crystalline structures. Sometimes called supercrystals, they can be customized to have certain properties. However, currently accessible QD supercrystals are still of low crystalline quality; this means that they do not have the sufficiently regular and unflawed internal structure ideally needed. This is due to the particular difficulties involved in crystallizing macromolecular building blocks such as QDs. The state of development of QD supercrystals today is comparable to the beginnings of the crystallization of proteins, which over many decades of continuous development has produced special techniques that take into account the special requirements of crystallizing macromolecules.

Marcus Scheele's main goal in the Momentum project is to adapt and modify those techniques for the production of QD supercrystals with unprecedented crystalline quality. To this end, he plans to collaborate with leading research groups in the field of protein crystallization to identify those techniques with the greatest potential for the growth of QD supercrystals. The new QD supercrystals obtained in this way will be used as light sources and in displays that are significantly more energy-efficient and consume less power than conventional technologies.

A pipeline for predicting and synthesizing new antibiotics

Nadine Ziemert
Photo: UKT

How can new antibiotics be discovered more quickly? This is the question at the heart of Nadine Ziemert's Momentum project. With the project “A machine learning-driven pipeline for the prediction and production of new antibiotics”, she aims to systematically and efficiently accelerate the search for urgently needed bioactive compounds against pathogenic bacteria. The project will receive around 940,000 euros.

Bacteria naturally produce a variety of chemical compounds, called secondary metabolites or natural products. These compounds are used by bacteria to sense and respond to their environment. From a human perspective, they represent an important reservoir for the development of new therapeutics – especially in light of the growing resistance of many pathogens to existing antibiotics. Although advances in genomics and improved sequencing technologies have enabled researchers to identify some promising compounds, many others remain undiscovered because they are either not produced under standard laboratory conditions or originate from unculturable microorganisms.

Nadine Ziemert uses the latest methods in microbiology and bioinformatics to further develop genome mining approaches. The aim is to correlate genetically encoded biosynthetic pathways with potential target molecules in pathogens in order to predict and produce new natural products. To do this, she combines machine learning algorithms with methods from the fields of synthetic biology and molecular biology.

Momentum grants

The Volkswagen Foundation's Momentum funding line is aimed at academics in all disciplines in the first three to five years after taking up their first tenured professorship. The highly endowed funding is intended to open up potential for new thinking in research and teaching at universities. The funding goes to projects aimed at further developing the respective professorship both strategically and in content. The Volkswagen Foundation chose the term “momentum” because it means a decisive instant as well as the magnitude and direction of an impulse.

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