Dankesrede

von

Prof. Emmanuelle Charpentier

anlässlich der Verleihung

des Paul Ehrlich- und Ludwig Darmstaedter- Preises

2016

in der Paulskirche Frankfurt am Main

14. März 2016

Es gilt das gesprochene Wort

Honorable Members of the Paul Ehrlich and Ludwig Darmstaedter Prize Committee,

Honorable Members of the Board of Trustees and of the Foundation Board,

Dear Colleagues,

Ladies and Gentlemen,

This is a great honor for me to receive the 2016 Paul Ehrlich and Ludwig Darmstaedter Prize in recognition of seminal work published in Nature 2011 and in Science 2012, highlighting the discovery of tracrRNA, the delineation of its key role in the targeting and editing of DNA by CRISPR-Cas9 together with the harnessing of the system into a powerful programmable technology for genome editing and engineering. This work is a wonderful example of the importance of basic research, demonstrating its relevance for translational science and relevant medical applications. I am very grateful to the distinguished members of the committee for having selected the CRISPR-Cas9 discovery.

I would like to share this award with my former and present team members and collaborators. The prize recognizes today the hard work and dedication of a team of young researchers with whom I have been working over the past decade in a very cheerful, enjoyable and dynamic environment. I would like to address my special thanks to those youngest researchers who have contributed specifically to the deciphering of the key aspects of the CRISPR-Cas9 pathway, specifically Elitza Deltcheva and Krzysztof Chylinski.

I would also like to share this award with my former mentors (Patrice Courvalin, Pamela Cowin, Richard Novick and Elaine Tuomanen), my numerous colleagues in France (notably at the Pasteur Institute), in the US (notably at the Rockefeller University, New York University Medical Center and Skirball Institute), in Austria (notably at the Vienna Biocenter), in Sweden (notably at Umea University) and in Germany (notably at Helmholtz, the Medical School of Hannover and Max Planck). I thank my family, my friends (particularly Rodger Novak) and all the passionate researchers who have strongly impacted my work and career over the years. This work would not have been possible without the support of universities and institutions as well as funding agencies in Austria, Sweden and now Germany. My special thanks to my colleagues at the MIMS and Umeå University who have provided me with the right support and scientific environment at the right time of my career to allow me to develop the CRISPR-Cas9 discovery.

I am also very delighted that the award recognizes the field of fundamental microbiology, biochemistry and genetics, which I have personally defended over the years through my personal international journey. Science should be more celebrated for all the discoveries that many scientists make every day around the world. Scientific findings have been critical to improve our lives and society. As recent history has shown, modern medicine has benefited from numerous discoveries

that have been achieved through aiming at understanding the mechanisms of life, how our genes and cells function and how diseases develop.

This is exactly the case for the research being recognized today, CRISPR-Cas9. Originally, CRISPR-Cas9 is a defense system in bacteria, the development of which is now a transformative technology for biology, biotechnology and medicine. Bacteria can also get the flu and be infected by viruses or mobile genetic elements such as plasmids or transposons. These elements can be detrimental and kill the bacterial cells but they can also be beneficial and bring new genes and features to improve or modulate the fitness of the bacteria. Bacteria have evolved various strategies to defend themselves against these genome attacks, one of which is CRISPR-Cas, an accessory adaptive immune system. A large variety of CRISPR-Cas mechanisms exist and CRISPR-Cas9 belongs to the most minimal systems. The system is composed of an RNA component, the CRISPR RNA that contains memorized past infections of mobile genetic elements and a protein component. CRISPR-Cas9 is unique as it consists of one enzyme, Cas9, programmed by a duplex of two RNA molecules, tracrRNA and the CRISPR RNA. The system functions like a pair of scissors that recognize and cleave sequence-specifically the DNA of the invading genome using the RNA component as a guide for recognition. We took advantage of the natural mechanism of CRISPR-Cas9 to harness it as an RNA programmable tool that can recognize and cleave DNA and enable precise modification of genes, correction of mutations or modulation of gene expression of any genome in any cell and organism. CRISPR-Cas9 is easy-to-use, cheap and versatile and has already proven to be an efficient tool for the manipulation of the coding information of genomes in various cells and organisms in the lab all over the world. CRISPR-Cas9 is expected to greatly improve our understanding of the genetic background and molecular mechanisms responsible for diseases. I made early on the specific wish that CRISPR-Cas could one day be successfully harnessed to treat severe human genetic disorders. I personally do hope that the technology beyond its already proven potential in the labs for research and development purposes will demonstrate its transformative potential as therapeutics in medicine. In reference to the prize awarded today, I am thinking that Paul Ehrlich would have most likely given to CRISPR-Cas9 the definition of “the magic bullet of genome engineering”.

Science is a very inspirational discipline. And I hope that the Paul Ehrlich and Ludwig Darmstaedter Prize awarded to CRISPR-Cas9 provides a positive message to the young generation and motivate them to pursue the path of fundamental science.

For the funding agencies and governmental institutions, I wish to convey the important message that it is even more essential in our days to support fundamental science and to allow blue-sky research projects to develop. CRISPR-Cas9 is a perfect illustration of this request. This research initiated from my deep interest in understanding how bacterial pathogens interact with their environment including the human host and in deciphering the mechanisms of regulation controlling these interactions. The ultimate goal was to identify and decipher pathways that could potentially be exploited for the development of novel anti-infective interventions or gene technologies. The mechanism that we ended-up to unravel – CRISPR-Cas9 – has resulted in many broader applications not only in medicine but also beyond, impacting globally biotechnology and biological research.

Once again, I express my warm thanks to the distinguished members of the committee of the Paul Ehrlich and Ludwig Darmstaedter Prize, founders and members of the foundation for this prestigious award.