Laudatio

von

Prof. Dr. Anthony A. Hyman

anlässlich der Verleihung

des Paul Ehrlich- und Ludwig Darmstaedter-

Nachwuchspreises 2020

an

Dr. Judith Reichmann

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Die Laudatio wurde im kleinen Kreis gehalten, weil der Festakt in der Frankfurter Paulskirche wegen der aktuellen Entwicklungen in der Coronavirus-Pandemie abgesagt worden war. Sie wurde in Abwesenheit des Laudators von Professor Ivan Dikic verlesen.

Anrede

It is a pleasure to introduce Judith Reichmann for the Paul Ehrlich and Ludwig Darmstaedter Young Researcher Prize.

Like all good young scientists, Judith Reichmann has two skills that are essential for discovery. She is intensely curious, and she can identify an important yet unsolved problem. In her case, she has identified perhaps one of the most important and outstanding problems in human biology, which is the successful creation of a mammalian embryo.

Despite the fact that the issue of fertility dominates much of human existence, we know surprisingly little about why oocytes in humans lose fertility after 40 years. Or we can put the problem the other way around. How is it possible for oocytes to stay dormant for so long, but can wake up and get ready to be fertilized even after 40 years? An oocyte is a remarkable cell. While our somatic cells get older, the oocyte stays young. Oocytes can pass on to the next generation without getting old, for as long as our species exists. If we can understand how oocytes stay young, we would understand much about why we age.

Science is also the art of the soluble, and in her young career, Judith focused on one particular aspect of oocyte biology, which is how the chromosomes maintain their correct organization during their dormancy and how the chromosomes of the oocyte and the sperm come together correctly. During fertilization, half of the chromosomes are provided by the mother, and half by the father – and the chromosomes in oocytes and fertilized eggs do a delicate dance to make sure that they only have half of their complement when the sperm arrives bringing the other half. Like any dance, sometimes the chromosomes must hold onto each other and sometimes they must let go. Judith has asked whether chromosomes hold on to each other, and let go of each other at the right time.

Judith started her work on oocytes as a PhD student in Edinburgh with Professor Ian Adams. Her work there would be the envy of any PhD student in the world. In three first authorships, three co-authorships and two reviews, she laid the groundwork for studying this problem. She was able to identify key protein complexes that are required to keep chromosomes linked during long dormancy, and suggested that when these systems fail, oocytes start to mis-segregate their chromosomes. Such mis-segregation is thought to play a key role in human birth defects.

For the next stage of her career, Judith demonstrated another truism in biology, which is that most important advances come from developing new ways of looking. Making discoveries by looking down a microscope stretches back to Antoine van Leeuwenhoek, who was the first person to identify cells using microscopes of his own making. As a postdoctoral scientist at EMBL in Heidelberg, she adapted a new type of microscopy, called light sheet, to look at oocytes during the early stage of development. This work has revolutionized our understanding of how chromosomes segregate and has had important consequences for the definition of life.

After fertilization the chromosomes from the oocyte and the sperm must come together to ensure that they are correctly distributed in future divisions. But chromosomes are often lost at this stage, and this contributes to infertility. Chromosomes are correctly distributed through a structure called a spindle, which is formed from microtubule filaments. Previously it was thought that the fertilized egg forms one spindle, and the mother and father chromosomes segregate on this spindle. Judith was able to show that surprisingly, the mother and father chromosomes form one spindle each. However, in a complex "*pas de deux",* the two spindles must stay aligned next to each other while the chromosomes segregate. If they fail to align, then the fertilized egg ends up with two nuclei rather than one. This was a particularly interesting result for infertility clinics, because in vitro fertilization often erroneously

produces two nuclei, but no one ever new why. Judith's experiments provided a reason. Perhaps more importantly for the general public, the legal definition of life in Germany depends on when the two genomes come together. Judith's work showed that this takes longer than previously thought and was therefore widely covered in the German press. A good example of how careful science can help guide policy.

Judith – it's been a pleasure to read your work and prepare this Laudatio. Science is a wonderful endeavor where we work hard to seek the truth, but it is also nice to be recognized by our colleagues. And as you can see from this award, your work is well recognized by your colleagues. We look forward to reading more of your papers as you unlock the mysteries of oocyte and embryo biology.