Finding reliable funding in the course of a scientific career is difficult, even for the best scientists, says Emmanuelle Charpentier, head of regulation and infection biology at the Max-Planck-Institut in Berlin, Germany. Better known for her work on developing the CRISPR/Cas9 gene editing technique, she calls for an informed debate on the implications of her work and wishes to avoid giving into the media buzz without more in-depth reflection. In this first of a two-part series, Charpentiers shares her perspective on these issues.

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Emmanuelle Charpentier: the strings attached to CRISPR/Cas9 success

Charpentier's achievements stem from her ability to navigate the convoluted funding landscape

Emmanuelle Charpentier is one of the most famous living scientists. She is one of the co-discoverer of the ground-breaking gene editing technique CRISPR/Cas9, designed to precisely insert DNA sequences into a genome. She is currently head of regulation and infection biology at the Max-Planck-Institute in Berlin, Germany, and visiting professor at Umeå University in Sweden. *Euroscientist* Editor Sabine Louët met the French scientist in Manchester at ESOF2016. They discussed her research, its ethical implications and the hurdles young scientists face on the path to securing funding and establishing their career.

How it all started

Charpentier explains her research in simple words: "We try to understand the mechanism used by bacteria to cause diseases [and] to adapt and survive in their human host." Together with her team they are mainly focussing on regulatory mechanisms acting on DNA, RNA and proteins. Their goal is to find new drug targets and, perhaps, new techniques for gene silencing and gene targeting. This resulted in the development of new methods like CRISPR/Cas9. "We are basic scientists, happy to understand the mechanisms of life," she points out.

Charpentier together with Jennifer Doudna and their colleagues discovered CRISP/Cas9 by studying the adaptive immune system of a type of bacteria. These can very smartly recognise foreign DNA and cut it out via the mediation of special proteins. This discovery, and its potential consequences, turned Charpentier into the object of unstoppable media attention.

The media curiosity has been fuelled further by the ongoing legal battle on the patent related to the new methods, estimated to be worth million of dollars. It opposes the University of California, Berkley, USA--where Charpentier and Doudna worked when they published their first seminal paper in 2012--to the Broad Institute, Cambdridge, Massachusetts,USA, where the main contender Feng Zhang works.

Funding struggle

Before becoming one of the Director at the Max-Planck-Institute, Charpentier has to go through many difficult times in her research career, peppered by multiple attempts to secure enough funding to keep her research going. "When I was a PI in Austria," she says, "I had to look all the time for funding. I started in a very humble way, collecting different funding from small organisations."

Competition was fierce. She thinks competition is good, however. That way, "only the most competitive science is funded," she says. But the percentage for success for grants is way too low now, she believes, both at ERC – a type of funding that did not exist at the beginning of her career – and for other funding entities. "It was not easy to not have even one euro of stability," she says.

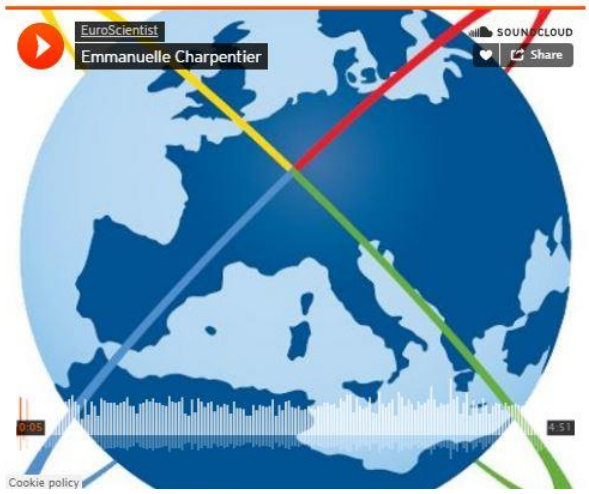
She confesses that she got to the point of having to write 10-12 grants per year to make sure her budget woud be garanteed. She also believes that the timeframe covered by a grant – typically, three years, is too short: "five years would be more confortable," she points out. "You end up having a lot of ideas, but little time to carry them on because you have to make sure your research is funded."

And she adds: "It cannot be a good setting when you write grants and you do not have time to do and follow the research and guide properly the scientists in your lab."

Bureaucracy

Another difficulty in her career has been bureaucracy, she notes, "especially if you have to change country." Not only on a personal level – for logistics, tax issues, etc – but also because "it takes some time to enter in a new funding system and get integrated. People need to get to know you and trust you." She estimates that this process normally takes two or three years.

"Systems are not always adapted to fast integration", she concludes. However, she notes, as an exception, "Germany was very different, and they were very generous for me from the beginning, and I did not have to fight for money." She also shares the difficulties she has encountered as an early career scientist in a separate Q&A interview.



Ethics

Charpentier's research raised a number of ethical concerns. In the associated podcast, she explains that these issues mainly arose once other scientists acknowledged that the CRISPR/Cas9 technique worked well in different types of cells or organisms. "That's when it came the concern: where will we go with this?" she said.

One aspect of the ethical concerns is the safety issues. Indeed, she believes, applying the gene editing method to human pathogens requires a careful approach to avoid creating superbugs, that could become resistant to antibiotics and escape the lab. Such careful handling is key to ward off the potential threat of bioterrorism. "Within the walls of a lab, scientists know what they are doing and know what kind of regulatory paperwork they need to complete and fill out." A very "logical" procedure, she thinks.

Another aspect of the ethics debate is the necessary discussion about other types of research that "we would not be doing spontaneously," she says. For example, the manipulation of embryos and of human germ lines. Also gene drive, the technique designed to transmit a certain gene to virtually all of the offsprings, raises concerns, she explains. This approach could also be used in a way that is beneficial for humain health as it raises the possibility of making sterile mosquitoes; one of the recently suggested application of the CRIPS/Cas9 technique to prevent malaria.

The French scientist declares, however, that "for the manipulation of germ lines, the technique is not ready yet," and she adds: "even if it were the case, I would be restrictive with regard to this application. Gene drive has to be considered with caution," she concludes. Regulations are enforced within labs, but "we have a need for regulations also outside the lab."

Science and media

Her work has generated media interest, making them part of her daily life. This made her consider the role of the media in a particular light. They work "on buzz and on the drama," she says. Last year research carried out in China generated a "storm" after it became known that scientists were working on genetic germ lines; even though the method was not working properly. Some scientists in the US reacted and asked for a moratorium. It led to a statement that is even more open than [those] in place in Europe, she says dismissively.

In her view, part of her job is "to convince journalists that the technique is good, useful and reliable" and that maybe "some dogmas in biology will be revised." She is confident that the "media got it" and hopes that "the message is still that the technique is transformative and really helpful". Perhaps, she concludes, this can lead the public--without having an understanding the details of genetics--to "ask themselves questions" about the outcome of such scientific research.

Interview Sabine Louët.

Text and podcast editing Luca Tancredi Barone.

Photo Credit: Sabine Louët. Photo taken at ESOF 2016.