The Egon Naef Foundation for In Vitro Research awards its 3R Prize to Professor Carole Bourquin of the University of Geneva

Carole Bourquin receives the Egon Naef Foundation 3R Prize in recognition for the development of a new in vitro technique that reduces by 20% the number of mice needed for nanoparticle research in immunotherapy.

Nanoparticles allow drugs to be transported to selected sites in our bodies. By targeting the lymph nodes, it is indeed possible to specifically stimulate the immune system, a promising approach to fight cancer. To choose appropriate nanoparticles, researchers test their behaviour in animals. A team from the University of Geneva (UNIGE) has developed a technique that makes it possible to perform a first *in vitro* screening of the nanoparticles that are being tested. Only the best performers are then tested in animals. This method, which has been awarded the 2019 Egon Naef Foundation Prize for In Vitro Research, reduces the number of mice used in nanoparticle research by 20%.

Immunotherapy research aims to stimulate the immune system to recognize and destroy cancer cells. To this end, nanoparticles can improve treatment effectiveness by delivering the drug in the human body to the exact site where it will trigger the immune response, in the lymph nodes. "It is where immune cells meet, communicate and proliferate to fight cancer cells," explains Carole Bourquin, a professor at the UNIGE Faculties of Medicine and Science.

Strict requirement specifications

The most efficient nanoparticles for transporting and releasing drugs into the lymph nodes have yet to be discovered: they must be captured by immune cells to be transported to the lymph nodes; they must not be toxic to cells; and finally, they must not activate the immune system against themselves. Until now, nanoparticles were systematically tested on mice to ensure that they meet these three criteria. "But we looked for a standardized way to perform a first sorting of nanoparticles, without having to resort immediately to the animal model," says Carole Bourquin.

Her team thus incubated the nanoparticles with immune cells grown in the laboratory (Figure 1). Then, pharmacologists analyzed the cells by passing them through a flow cytometer that measures cell viability and allows observing whether they have captured nanoparticles. At the same time, they determined if the cells were activated. "This test allows us to quickly test the quality of nanoparticles," continues Carole Bourquin. However, to measure transport to the lymph nodes, we do not yet have an alternative method to the mice, which is the only way for us to have access to a complete and functional immune system. "However, the standardization of this sorting of nanoparticles already makes it possible to reduce by 20% the number of mice required for this immunotherapy research! These results caught the attention of the Egon Naef Foundation for In Vitro Research, which awarded its 2019 Prize to the researcher. "Our objective is to stimulate the development of these alternative methods. This is a fundamental work, which is essential to reduce the use of animal experimentation in the long term," says Marcel Naef, President of the Foundation.

A standardized and easily reproducible method

Carole Bourquin's team has been using this *in vitro* selection method for several years, and the research conducted since has demonstrated its effectiveness. "We published this technique and made it accessible as if it were a "cooking recipe", easy to reproduce step by step, so that every scientist could use it," explains the Geneva-based researcher. Thisprize rewards our work and highlights it, which makes us very proud and encourages us to continue along this path. »

Although mice are still needed for immunotherapy research, the research team continues to develop new alternative techniques, including working with human cells isolated from patients' blood. Carole Bourquin is also developing this method to extend it to other uses and cells of the immune system. "In addition to ethical considerations, animal experimentation is expensive and subject to very strict authorisation requests, which is why we are constantly seeking to replace the animal model with alternative methods. But it takes time," concludes Carole Bourquin.

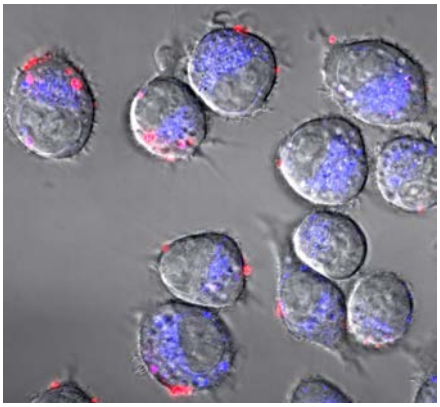

Fig. 1: Cells to help mice: to study nanomedicines, an *in vitro* test developed at the University of Geneva reduces the need for animal experimentation.

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