Bacteria in your pad – Translation from an article in « Le Temps » Newspaper

Technology : Students from Lausanne are working on a new type of touchscreen integrating organic elements.

They will present their project at the end of october at a competition organized by the prestigious MIT in Boston.

[Fabien Goubet]

No respite for smartphones and other pads. As soon as they invaded our pockets and our living rooms, some already think about the next step. Sakura Nussbaum and her thirteen teammates, students in Bachelor of Life Sciences at EPFL, are some of them. « We are working on the design and the fabrication of a « BioPad », a touchpad working with the help of biological compounds, in this case bacteria that emit light when a pressure is applied on the screen », summarizes the young student. Their project is only at its beginning, but is no less encouraging.

When we put bacteria under mechanical pressure, they don't stay inert but react to limit the consequences. It is the case for Escherichia coli, a very common intestinal bacteria.

A pressure on its envelope makes it produce protective proteins that rigidify its structure to limit this stress. The mechanism by which it happens is still uncertain, but Sakura Nussbaum and her teammates have studied it closer. They noticed that it involves a protein named CpxR, which role is to stimulate the production of these protective proteins. In the absence of pressure, CpxR is divided in two distinct and inactive parts. These parts reassemble in case of pressure on the bacterial envelope and constitute the CpxR protein itself, active this time. The team of students based the concept of their project on this mechanism. « We have genetically modified Escherichia coli, so that it emits light when it is subjected to pressure », details Sakura Nussbaum. The luminescence is ensured by a protein coming from glow worm, the luciferase. This protein is « grafted » on the CpxR protein and emits light only when the two parts are assembled.

Thus, the students have bacteria that emit light when we touch them. To take advantage of this, they used a microfluidic chip. This is a small plate of a few centimeters long, composed of PDMS, a carbon and silicium polymere which structure is slightly malleable. The chip is made of 768 tiny cavities of a few micrometers in diameter in which are placed bacteria with a little culture medium. « Each chamber constitutes in a way one pixel », indicates Axel De Tonnac, the microfluidics specialist of the crew. The students are currently verifying that their bacteria really emit light when pressure is applied on it. Here is where their work is. Of course, they are still far away from a hypothetical « BioPad », but the project only started this summer. « We are still at the stage of proof of concept, admits Axel De Tonnac, But our objective now is to make sure that everything works as expected, and to present our work at the iGEM competition. »

The whole team is going to fly to Boston, where the competition international Genetically Engineered Machine (iGEM) will take place. Starting on the 30th of octobre and organized by the Massachusetts Institute of Technology (MIT), this competition reassembles 220 teams of students, from different specialities. It brings synthetic biology at honour, a discipline in which biologists work as engineers and build standardized biological compounds, « biobricks », which can be useful in the future for other researchers wanting to give particular function to living organisms.

Naturally, the obstacles to the realisation of a screen are numerous. How to renew the culture medium once it is used ? How to control the multiplication of the bacteria without compromising the performance of electric circuits ?

Bent Stumpe, retired from CERN and inventor of the first touchscreen in 1972, heard about the project. For him, they should not be impressed by this kind of inconvenients. « They absolutely must persevere in their work. I am convinced that the screens of the future will combine electronics and biology », assures the researcher.