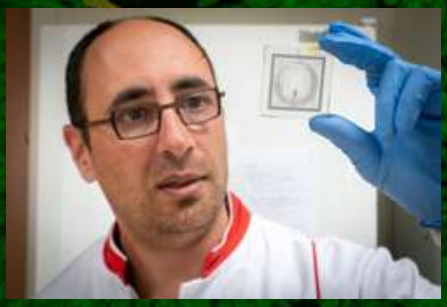
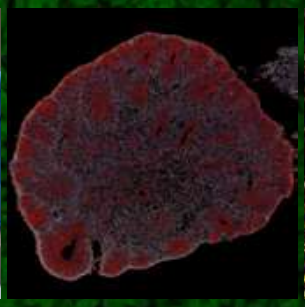
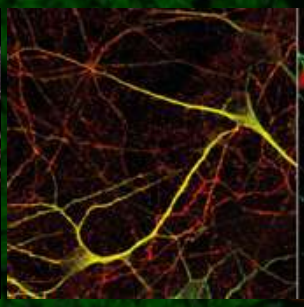
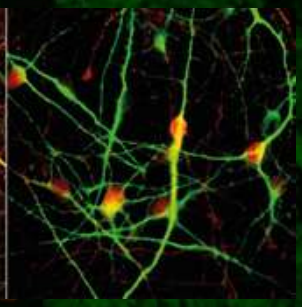
Personal healthcare through braincells on a chip

It's alive! Professor Nael Nadif Kasri has found a way to turn skin or blood cells into brain cells. "Twenty years ago, we thought that what we are doing right now, was absolutely impossible."

Nael is a professor of Medical Neuroscience at the Radboud University in Nijmegen. He researches the electrical activity from braincells, to understand neuronal communication and unravel its underlying mechanisms. With his research group in Nijmegen, he took huge steps in the further development and application of a technology to grow brain cells, on a chip! First, he takes skin cells and turns them into stem cells. With those stem cells he can then make any kind of body cell he wants. The advantage of this brain-on-a-chip technique? Nael: "The cultured brain cells contain exactly the same DNA as that of the patient. In such a culture dish we can see exactly what goes wrong in that individual patient. It is even possible to test a certain drug with these brain cells to see if they work against the condition of the individual patient. This allows us to provide better, faster and more efficient healthcare."

Human-on-a-chip

In recent years, the technology has undergone explosive growth. Heart, liver, muscle, intestines, cancer, eyes, blood vessels; they are all already being cultured on a chip. Not only in a Petri dish but also in miniature organs that are artificially grown. Nael: "Thanks to new techniques, individual chips can now also be linked together, making increasingly complex networks possible, such as gut-brain-on-a-chip or eye-brain-on-a-chip. We are already on our way from organ-on-a-chip to human-on-a-chip."

WE ARE ALREADY ON OUR WAY FROM ORGAN-ON-A-CHIP TO HUMAN-ON-A-CHIP

Healthcare of the future

In the Netherlands almost all research groups work together in the Institute for human Organ and Disease Model Technologies (hDMT), where Nael himself coordinates all brain-related initiatives. In one of the projects, he is investigating Dravet syndrome, a severe form of epilepsy that occurs in young children and is difficult to treat. Often, finding the right drug is a matter of trial and error, which means that a lot of time is lost before the right drug is found. "By culturing brain cells, we can test the twenty or so available drugs at once", says Nael, "So we can find the optimal drug much faster."

Finding the right combination

The initial results look good, but Nael also points out an important issue. "Is what we find in our cultures also reliably translatable to the patient? Human brains are made up of about 100 billion cells, some of which are quite different from each other. Neurons, astrocytes, microglia, for example, are brain cells that not only look different, but also function differently. So, in the culture for Dravet syndrome, we have to grow the right combination of brain cells that are involved in the disease in the patient. Otherwise, we will not get useful data. Luckily, we have mastered the cultivation of a brain-on-a-chip that contains many different brain cells and the results are becoming more and more reliable."