

OC10 - MINERVA ERC project: a bioengineered platform for frontier research on microbiota-gut-brain axis

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Background: Brain neurodegeneration is a major challenge for today's research. An intriguing concept referred to as the microbiota-gut-brain axis states that there is a connection between the brain, the gut and the intestinal microbiota. A fascinating hypothesis that is attracting researchers' attention states that microbiota can trigger neurodegeneration through the microbiota-gut-brain axis.

Objective: Using an innovative bioengineered approach, MINERVA's final goal is to develop the first engineered, validated multi-organ platform representing in vitro the connections among all the main players of the microbiota-gut-brain axis.

Methodology: MINERVA platform relies on three compartments, hosting sensorised organ-on-chip miniaturized microfluidic devices that mimic each organ of the axis: the intestinal microbiota, the gut epithelium, the immune system, the blood-brain barrier and the brain. In the "Microbiota-compartment", human microbiota strains will be cultured and produce a mix of molecules named "secretome" that will be transported to the "Gut-compartment", where human gut epithelial cells and cells from the immune system will modify it as occurs in vivo, giving the so-called "metabolised secretome". It will reach the "Brain-compartment", that hosts a complete blood-brain barrier model followed by two 3D human brain cell models, where neurons, astrocytes and microglia, the three main cellular populations of the brain, will be (a) co-cultured to explore microbiota effect on brain cells interconnected as in the real tissue and (b) cultured individually to investigate microbiota impact on each cell type.

Results: MINERVA project will provide the first comprehensive model of the microbiota-gut-brain axis, able to bridge current in vivo model complexity with the in vitro tools' simplicity to investigate neurodegeneration causes shifting from the brain to the body periphery.

Conclusions / Implications for practice: MINERVA project is innovative and breakthrough: thanks to its versatile bioengineered platform, it might help to address microbiota impact and therapeutic potential on brain-centered diseases such as Alzheimer's and Parkinson's disease but also on other severe not-brain centered diseases where microbiota impact might be involved.

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