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Brain organoids are not mini-brains[1]
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The misinterpretation of scientific terminology and works can be a source of confusion and mistrust of science. This is the case for "cerebral organoids". The ability of embryonic or induced pluripotent stem cells (iPSCs), or adult stem cells, to self-organize in three dimensions and to differentiate in vitro is a remarkable discovery in cell biology (1). These cells, in the presence or absence of an artificial or natural extracellular matrix, group together in aggregates called organoids that can reproduce several functions of the tissue concerned. Their study is of considerable interest to understand the cellular and molecular mechanisms involved in cell differentiation, the mode of action and toxicity of drugs, the pathophysiology, to limit animal testing, and to improve the treatment of some diseases.
In neuroscience, the use of organoids extends the field of investigations previously restricted by the difficulty of accessing central nervous system tissues and cells in humans. The possibility of isolating iPSCs by genetic reprogramming of adult cells (blood cells, skin fibroblasts, etc.) obtained by a minimally invasive procedure, and then differentiating them into brain cells, partially overcomes this difficulty. In the laboratory, the production of three-dimensional structures, which are cerebral organoids, allows them to be studied in vitro (2) or after having been grafted into rodents (3). Recent works show that the cells making up the organoid, not only self-organize and communicate with each other, but also differentiate into several cell types with specific markers (e.g., emission of electrical impulses or ability to organize into a network). To study the connectivity between different brain regions, it is also possible to build cerebral "assembloids" combining organoids that simulate different brain regions, thanks to the diversity of the cells that compose them (various types of neurons, astrocytes, microglia, or vessels...) (4,5). To study the development of brain tissue, "embryoids" carrying an elementary brain structure have been created in mice after incubation in an artificial uterus (6).

Nevertheless, the cellular activities observed in these cerebral organoids cannot be assimilated to the cognitive, sensory, or motor processes specific to the human brain. Whether the scientific contribution which attaches to the study of these organoids, is important, the presentation of this research work as part of the development of mini-brains that could be endowed with sensitivity or even

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minimal consciousness, is an abusive and distorting interpretation of its objectives and results (7).

The National Academy of Medicine points out that:

1. Research work aimed at better understanding how the human brain functions leads also to a better understanding of the causes and development of neurological diseases
2. In France, research using human embryonic cells is regulated by law (8);
3. An abusive interpretation of the objectives and results of experimental work on organoids, particularly cerebral ones, risks of fueling an erroneous vision of this research in the public minds and arousing mistrust of science, while progress is expected in the treatment of several neurological diseases.

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8. Law No. 2021-1017 of August 2, 2021 on bioethics.

[1] Press release from the Academy's Rapid Communication Platform.

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