BIOREACTOR FOR STUDYING THE EFFECTS OF IMPOSED STIMULI ON CELLULAR ACTIVITY

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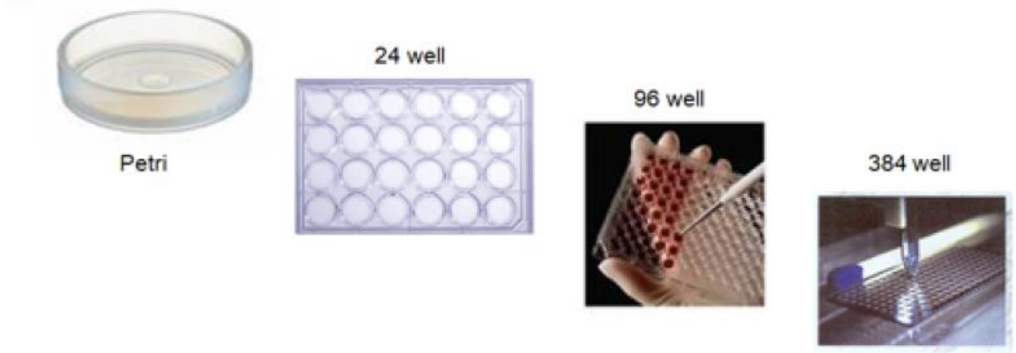
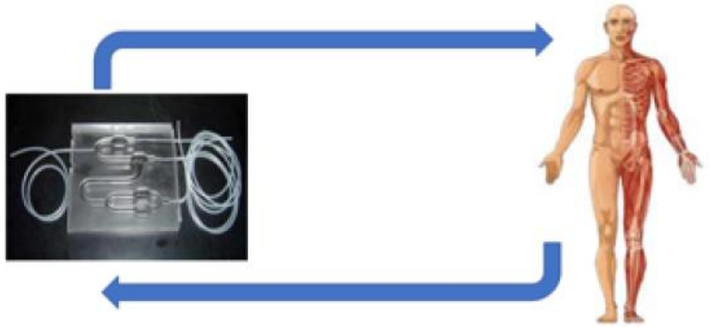
Invention

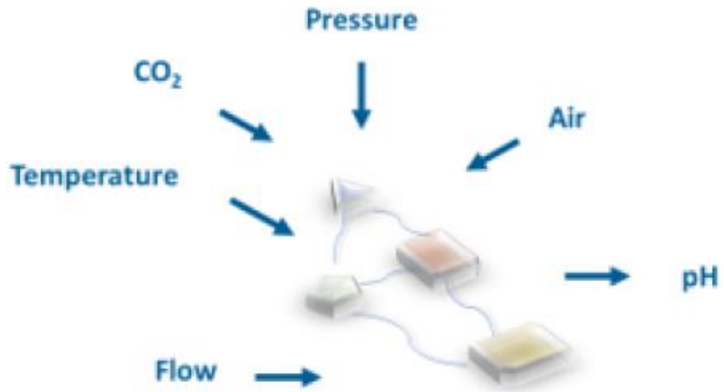
The present invention consists of a **self-contained bioreactor** that allows monitoring of cell activities exposed to v**arious physical, chemical, and mechanical stimuli, both under isobaric conditions and in the presence of controlled flows**. Unlike commercially available products, it does not require an incubator and allows dynamic control of physiological parameters and real-time monitoring of the experiment.

The bioreactor consists of a cell made of silicon, which can be molded according to the purposes. It allows the **inclusion of different force transducers** from time to time, in order to study how different **physicochemical stimuli act on cellular activities**. It can be mounted under a microscope so as to allow real-time analysis of what is happening inside the cell without the use of an incubator in which to allocate it. The system allows to controll all physiological variables of the cells (pH, temperature, nutrient flow, pressure). Pressure is controlled dynamically within the culture cell with a system of flow regulators. Gases such as O_2 and CO_2 can be controlled and cells can be monitored with sensors or by taking medium for metabolite analysis.

Drawings
& pictures







Industrial applications

The invention has wide use in **Bioengineering** for the development of biological constructs for tissue engineering experiments. They can be used as innovative *in-vitro* technologies, to test drugs or allergenic substances in cosmetics.

The advantages in using a *BIOREACTOR FOR THE STUDY OF THE EFFECTS OF IMPOSED STIMULES ON CELL ACTIVITIES* are represented by the characteristics of the prototype realized:

- the cell is modelable;
- autonomous system: there is no need for an incubator;
- real-time analysis;
- possibility of correcting physiological variables in real time;
- dynamic pressure control;
- saving of culture medium, nutrients and growth factors used.

Possible developments

To date, the technology has been developed and implemented as a prototype and tested in several laboratories. The system has been tested on hepatocytes, intestinal cells, liver and brain organoids, fibroblasts, chondrocytes, adipocytes, and endothelial cells. The system resulted in a **10-fold reduction in the volumes of culture medium used per experiment** compared with other commercially available devices (20 mL compared with 300-500 mL), resulting in significant **cost savings**, both in terms of the culture medium and in the analysis of the substances it contains. The capacity of a bioreactor ranges from a minimum of 1 mL up to a volume of liters.

The research team is interested in collaborating with industrial partners, to increase the TRL of the invention, and to consider licensing or transferring the patented technology for commercialization by interested companies.

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