HIGH THROUGHPUT BIOREACTOR FOR ENGINEERING AND STUDYING THE RESPONSE TO CHEMICAL AND PHYSICAL STIMULI OF VASCULAR CONDUITS

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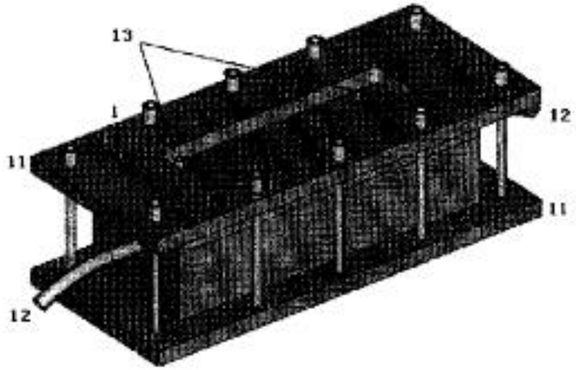
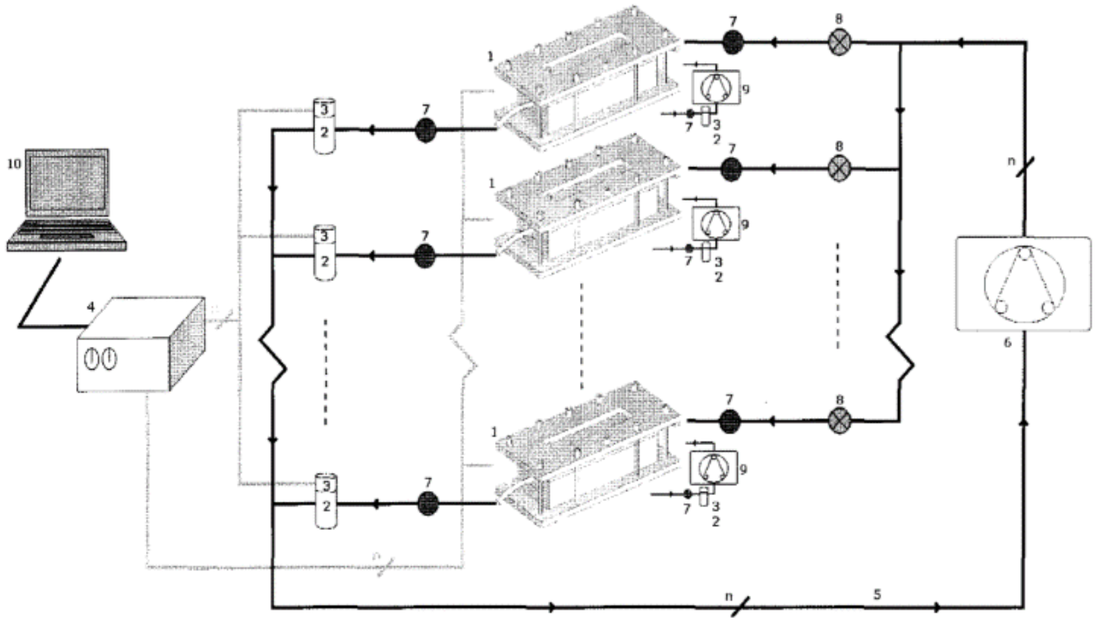
Invention

The invention relates to a **sensorized high throughput bioreactor**, that can be placed in series and/or parallel with similar systems, to subject vascular conduits of different sizes to chemical-physical, mechanical and electromagnetic stimuli, **simulating physiological and pathological conditions** present within an organism.

The device can be used for perfusion of vascular segments of various sizes, autonomous from an incubator (free-standing), with contained volumes of culture medium. The culture chambers are made of **biocompatible and easily sterilized material**. Within such chambers, the perfused blood vessels may be exposed to various simulated pathophysiological environments by means of physical, chemical, mechanical and electromagnetic stimuli.

Drawings & pictures





Industrial applications

The invention finds application in various fields including **tissue engineering** for guided "remodeling" of blood vessels and development of biological constructs; the **pharmaceutical industry** for "testing" new drugs; and the **medical area** for the study, diagnosis and treatment of diseases.

The studies aim to validate a **device for culture and perfusion of intact vascular segments** that is self-contained, i.e., independent of an incubator that guarantees, within the chamber, the required pH and temperature values. In particular, the presence of an incubator does not allow for real-time management and monitoring via a calculator of experimental parameters.

The blood vessel bioreactor possesses a culture cell structure, that allows the experiment to be observed in real time by optical and/or fluorescence microscope, and thus to evaluate the evolution of the processes of the cells in the vessel wall. **No other device allows electronic control of mechanical stimuli** that simulate the biological environment, nor are there any devices for electromagnetic stimulation, nor is there found, in any device, the presence within the culture and perfusion chamber of sensors able to performe precise and careful analysis of metabolites produced or consumed by the cells, so as to provide accurate and timely information.

Possible developments

The innovation lies in the construction and **design of the device with flexible and transparent material** and the particular use for **simulation of physiological and pathological conditions in vessels with diameters ranging from 2 mm to 1 cm**. The modes of use in "high-throughput " and sensorized configurations are also to be considered innovative.

The change in mechanical properties of vessels after undergoing physiological and pathological conditions reproduced inside the device was studied. Results show an increase in vessel stiffness, following hypertensive conditions.

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

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