ORGANS ON MICROCHIPS

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Introduction. Microchips for analyzing biological materials are not new for a long time, although they are getting better, cheaper and more accurate. Scientists go further. The next step is to create a body on a chip that mimics the behavior of related organs.

Aim. The purpose of the report is to analyze the capabilities and benefits of the new 10-organ model for the human body have been created at the Wyss Institute for Biologically Inspired Engineering at Harvard University.

Materials and methods. The proposed model is called "Platform Body-on-Chips" (Fig. 1). Structurally, a body on a chip is a series of interconnected devices the size of a memory card. Each organ is two parallel channels, one of which mimics or contains specific tissues of a certain organ, and the second, adjacent one, mimics the blood vessels. Inside there are microfluidic tubes, each less than a millimeter in diameter and covered from the inside with human cells taken from an organ of interest to researchers. These tubes form a complex structure within the chip. When nutrients, blood, or test components such as experimental drugs are passed through these tubes, the cells in them replicate some of the basic functions of the living organ from which they were taken.

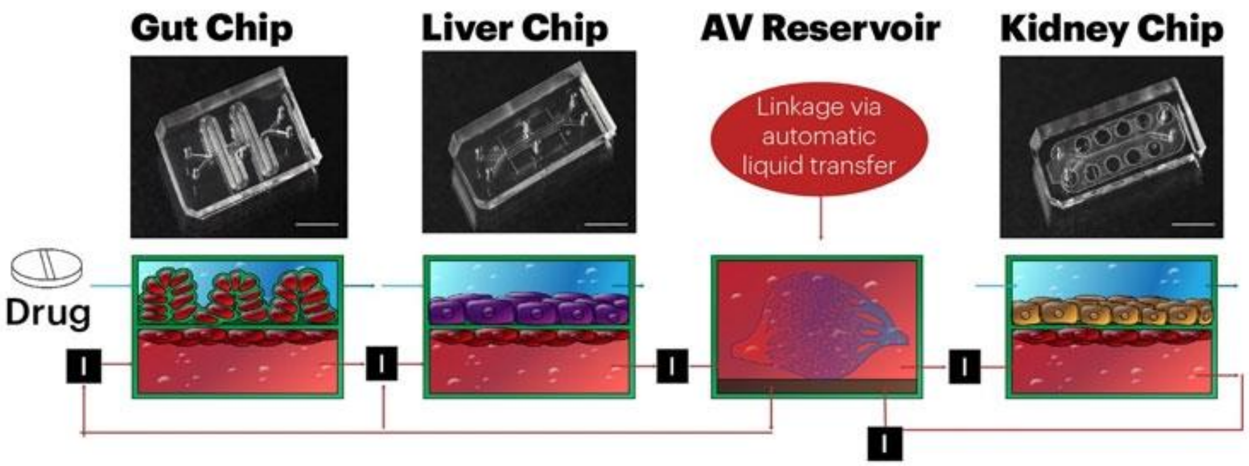

Fig. 1

Results and discussion. The tube works not only as an improved "Petri dish", but also as an electrochemical transistor. The device allows you to monitor cell growth in real time, as well as to conduct long-term experiments. Using a soft, spongy electrode instead of the traditional hard, metal electrode provides a more natural environment for the cells. In their study, the researchers sequentially linked the vascular channels of eight different organ chips, including the intestines, liver, kidney, heart, lung, skin, blood-brain barrier, and brain. With this system, researchers can monitor tissue growth and its response to drugs or toxins, as well as induce a specific disease in the tissue and study its key mechanisms or discover the right treatments.

Can also be using this model to design a gut-on-a-chip and attach it to a brain-on-a-chip to study the relationship between the gut microbiome and the brain.

A new device has been developed within the model of the "Platform Body-on-Chips" that will help create models of organs for research that will be as close to reality as possible. The device is a three-dimensional polymer tube made of soft spongy material that mimics the structure of internal tissues. The cells are grown inside this scaffold in three dimensions, not two and then the entire device is placed in a plastic tube through which the cells feed. The device was able to maintain the viability of all tissues on the chips for three weeks. Experiments with the dissemination of nicotine in the "organs" and the effect on them of one of the drugs for chemotherapy showed that the content of substances in the "organs", their negative effect on tissues, the concentration and rate of excretion from artificial organism are practically the same as in the case of a living person.

Conclusions. The proposed platform Body-on-Chips goes beyond simple imitation of organs and allows, in a complex, to track the effect of medications on the human body, and not just on its individual parts. Such a platform will significantly accelerate the development of new drugs, especially in the early stages of drug trials. The beneficial effect of a chemical on one organ can cause side effects in others, as indicated by "body on a chip" but not "organ on a chip". Also, the developed system makes it possible to select the required concentration of the drug and assess the rate of its removal from the body. In other words, the Body-on-Chips platform allows tracking both pharmacokinetics (absorption, distribution, metabolism, and excretion) and pharmacodynamics (exposure, mechanisms and side effects).

Improvement in microfluidics, tissue engineering and other technologies allows the creation of more and more complex artificial organs for a variety of studies. It is no exaggeration to say that this will change the world of pharmaceuticals and humans in the foreseeable future.

MOTIVATIONAL TARGET COMPONENT OF SELF-ORGANIZATION OF LEARNING AND COGNITIVE ACTIVITY OF STUDENTS

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Introduction. Achieving high quality education is impossible without students’ realization of self-organization of learning and cognitive activity because providing the appropriate level of knowledge, skills and professional qualities of a student, involving him in independent acquisition of knowledge in the future professional activity depends primarily on the student’s attitude to learning, skills of planning and analyzing his activity, rational use of his time.

Aim. To justify the criteria basis for self-organization of learning and cognitive activity of students of medical colleges and to present the results of diagnostics of its motivational target component.

Materials and methods. In the structure of self-organization of learning and cognitive activity of students we determined the following components: motivational target, organizational planning, operational and executive, reflective-regulatory. Such self-structuring covers all activities of students in the learning process.

Motivational target component of self-organization of learning and cognitive activity of students is characterized by the formulation of goals of their own self-organization, determination of their own tasks, students’ focus on realizing the content of this activity and the expected result.

A set of criteria and related indicators of self-organization of future medical professionals has been substantiated to determine the effectiveness of the technology of providing self-organization of learning and cognitive activity of students according to the purpose and tasks of the study.

In order to ascertain the level of self-organization students on motivational and personal criterion for diagnostic and modeling stage of the technology of providing self-organization of