ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
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Basic Information:

Course Title: Introduction to Cell and Tissue Engineering
Lecturer: prof. Radostina Alexandrova, PhD
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Total Teaching Hours: 30 academic hours

Annotation (up to 150 words)

The aim of the course is to familiarize participants with the experimental models and approaches used in modern cell and tissue engineering. The advantages, challenges, and future perspectives of this new and attractive field in biology and medicine will be presented. The creation of genetically manipulated cell lines and animals – why “For” and when “Against”? Can stem cells help in the fight against cardiovascular and cancer diseases, diabetes, and neurodegenerative processes? Why is it difficult to create “artificial” organs and tissues? What is the role of nanotechnologies? These are only some of the questions that will be discussed during the course. Special attention will be paid to hybridoma technology, the production and application of monoclonal antibodies, as well as the possible role of mesenchymal stem cells in the treatment of bone defects and cancer diseases. Demonstrations of methods for studying the biocompatibility of new materials are also planned.

Course content (brief description by topics or modules):

Topic / Module 1: Cells and tissues. Extracellular matrix. Stem cells – types, characteristics, behavior. Cell differentiation and transdifferentiation. Cell adaptation. Cell interactions. Individual cell cycle and coordinated cell growth. Morphogenesis and morphogenic factors. Aging and cell death, regeneration.

Topic / Module 2: Cell cultures. Basic principles and challenges in cell cultivation. 2D and 3D cell cultures: advantages, limitations, applications. Organ and tissue cultures, organs on a chip. Hybridoma cells secreting monoclonal antibodies.

Topic / Module 3: Assisted reproduction: approaches, challenges, successes. Animal cloning, “restoration” of extinct animal species. Scientific and ethical challenges.

Topic / Module 4: Potential applications of tissue engineering and regenerative medicine (muscular dystrophies, myocardial infarction, diabetes, neurodegenerative diseases, liver and kidney failure, etc.). Challenges of aging and tissue engineering.

Topic / Module 5: Cell therapy and tissue engineering: basic principles, approaches and challenges. Cells - differentiation factors - scaffolds. Mesenchymal stem cells. Angiogenesis. Bone tissue modeling. New materials for wound healing. Bioengineered skin. Examples of approved cell therapies. CAR-T therapy. Scientific and ethical challenges.

Topic / Module 6: Synthetic biology and synthetic human genome. What we learned from the Human Genome Project. The challenges of our time. Is the horizon the only limit to our dreams and possibilities.

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Teaching and assessment methods:
Written assignment and oral interview

Competencies acquired as a result of training (3–5 points):
The PhD students will build on and expand their knowledge of cell cultures and their capabilities and limitations; the biology and behavior of stem cells; the principles, approaches, applications and challenges in the field of cell therapy, tissue engineering and regenerative medicine; they will peer into the world of cloning and synthetic biology; they will touch on some of the most heated scientific and public debates of our time.

Literature:

- Стволови клетки. Стоян Чакъров, Румена Петкова, Румен Панков. АИ "Проф. Марин Дринов", 2014.
- Principles of Tissue Engineering 5th Edition. Robert Lanza (Editor), Robert Langer (Editor), Joseph P. Vacanti (Editor), Anthony Atala MD (Editors). Elsevier, 2020. ISBN: 9780128214015.
- Lectures continuously updated based on new scientific publications