Doctoral School: **Biology Doctoral School**
Doctoral Program: Neuroscience and Human Biology

Subject code: **BIO/7/45**
Subject title: **Experimental stem cell biology L**
Teacher and Neptun code: **Dr. Schlett Katalin (KDC2T1)**
Credits: 4
Class hours: 2 hours/week, lecture

Goal of the course
The course includes the following topics: The concept of stem cells, the properties of stem cells. Regulation of differentiation, individual development. Presentation of stem cells occurring in different organ systems. Tissue replacement options. Possibilities in stem cell therapy, induced pluripotent stem cells.
Contents of the course
1. Stem cell therapy: basic concepts. Transdifferentiation: reality or experimental artifact? Practical applications and future possibilities of stem cell therapy. Ethical aspects.
2. The general concept of a stem cell. General description of commitment steps. An overview of experimental techniques and markers (SSEA-1, Nanog, Oct4, nestin) commonly used to identify stem cells.
3. Signaling pathways involved in stem cell engagement. Description of the main signaling pathways of tissue differentiation (Wnt, TGF / BMP, shh, Notch-Delta).
4. Basics of embryology, fate mapping. Origin of extraembryonic tissues. Engagement steps of embryonic stem cells (ES), germ plate formation. Fate mapping in major germ plates - practical approaches.
5. Location of genital stem cells, regulation of gonadal development. The role of the tissue microenvironment (niche) in differentiation and in maintaining the undifferentiated state. Sex-specific characteristics. Development of teratocarcinomas.
6. Muscle tissue stem cells in embryonic age and adulthood. Factors regulating smooth-, cardiac- and skeletal muscle differentiation. Post-injury cell replacement options in heart, smooth, and skeletal muscle.
7. Stem cells of the endoderm (liver, intestine, pancreas). Location and origin of stem cells of the endoderm (liver, intestine, pancreas), regulation of their differentiation. Cell replacement options, stem cell isolation and transplantation.
8. The iPS saga I. In 8 years to the Nobel Prize. Improvements to the original iPS and technology.
9. The iPS saga II. Ethical and clinical applicability of the iPS principle. Pharmaceutical approaches: patient-specific treatment or screening?
10. Differentiation of surface ectoderm. Separation and embryonic development of each cell type. Location, steps of differentiation and regulation of adult stem cells. Skin tissue replacement options.
11. Central Nervous System Cell Replacement Options I. Central Nervous System Cell Replacement Options: Goals, Hopes, and Limitations (Parkinson's Disease, Alzheimer's Disease, ALS, Spinal Cord Injuries).
12. Possibilities of central nervous system cell replacement II. Replacement options for CNS cells: goals, hopes, and limitations (Parkinson’s disease, Alzheimer’s disease, ALS, spinal cord injuries).
13. Cell differentiation of nerve tissue. Formation of the ganglionic chain, formation of the peripheral nervous system. Environmental factors influencing the formation, development and migration of each cell type. Receptor cell replacement options.
14. Structure of the bone and cartilage system. Stem cells involved in the formation of the skeletal and cartilage system in embryonic age and in adulthood. Artificial cartilage and bone formation, therapeutic options.
Requirements
oral exam
Literature
Power point slides available in pdf format, circa 300 slides