SYLLABUS

Name of the department / clinic providing the course: Department of Functional Genomics

Course title: Functional assays used in biomedical sciences to assess the hallmarks of cancer cells.

Course profile: molecular

Discipline: medical sciences

Level of course unit: international doctoral school
Course unit title: Functional assays used in biomedical sciences to assess the hallmarks of cancer cells.

Course unit code:-
Type of course unit: elective
Course aims: The aim of the course is to familiarize PhD students with the selection of appropriate laboratory tests for assessing cytotoxicity and genotoxicity, biological activity, changes in cell morphology, cell cycle, gene expression and protein levels used in *in vitro* assays, and to acquire practical skills in quantitative analysis of results using selected tools.
Form of study: on-line
Year and semester of study: summer semester (all years)
Types of educational activities and number of hours allocated:

Subject	Language course	Self-study	Lecture	Exercises	Laboratory	Seminar	Practical	e-learning	Profession practice	Other (what?)	ECTS points
						10					

Number of ECTS credits allocated and their structure according to students' form of learning:-

Names of course unit's faculty: Faculty of Biomedical Sciences, Faculty of Medicine

Prerequisites: None

Learning activities and teaching methods:
Seminars - verbal communication; multimedia presentation, individual work

Course unit content: During the seminar, the most frequently used tests used to assess viability and proliferation (MTT, XTT, trypan blue, MTS, Alamar Blue, WST-1), apoptosis (comet test, DNA ladder, TUNEL, determination of caspase activity), and cell morphological changes will be presented. - staining with acridine orange and ethidium bromide, Hoecht 33342, annexin V), cell cycle, growth ability in suspension, creation of colonies, migration of the so-called wound healing, invasion and metalloproteinase activity tests, as well as determination of gene expression using the RT-qPCR method and proteins using the Western Blot technique. In the second, more practical part, the doctoral student will also acquire the skills to calculate the number of colonies, surface overgrowth in the wound healing test, relative gene or protein expression using free tools.
Course objectives:

Knowledge:
After graduating, the student knows and understands:
(P8S_WG) scientific research methodology

Skills:
After graduating, the student is able to:
- (P8S_UU) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex problems or perform research tasks

- (P8S_UW) use knowledge from various fields of science to creatively identify, formulate and innovatively solve complex research problems, and in particular: define the purpose and subject of scientific research, formulate a research hypothesis; develop research methods, techniques and tools and apply them creatively; draw conclusions based on the results of scientific research; critically analyze and evaluate the results of scientific research, expert activity and other creative work and their contribution to the development of knowledge; transfer the results of scientific activities to the economic sphere
- (P8S_UU) prepare and present data and draw conclusions based on research results
- (P8S_UK) communicate on specialist topics to an extent that enables active participation in the international scientific community
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Attitudes and transferrable (generic) competencies:

After graduating, the student is able to:

(P8S_KK) critical assessment of achievements within a given scientific discipline, critical assessment of one's own contribution to the development of the discipline, recognition of the importance of knowledge in solving cognitive and practical problems

Required and recommended learning resources (readings):

Required:

1. Ramesh A., Pattabhi A. and Ravi M. Assays Used in vitro to Study Cancer Cell Lines. Life Science Research 2016 Apr 1(1)
2. Vikas B and Anil S. Cell-Based Assays in Cancer Research. Cell Growth 2019 DOI: 10.5772/intechopen.90226
3. Bobadilla A.V.P., Arévalo J., Sarró E. , Byrne H.M., Maini P.K., Carraro T., Balocco S., Meseguer A., Alarcón T. In vitro cell migration quantification method for scratch assays. J R Soc Interface . 2019 Feb 28;16(151):20180709
4.Bouchalova P., Bouchal P. Current methods for studying metastatic potential of tumor cells. Cancer Cell Int. 2022 Dec 9;22(1):394
5.Pijuan J., Pijuan J., Barceló C., Moreno D.F., Maiques O., Sisó P., Marti R.M., Macià A., Panosa A.. In vitro Cell Migration, Invasion, and Adhesion Assays: From Cell Imaging to Data Analysis. Front Cell Dev Biol. 2019.
6.Menyhárt O., Harami-Papp H., Sukumar S., Schäfer R., Magnani L., de Barrios O., Győrffy B. Guidelines for the selection of functional assays to evaluate the hallmarks of cancer. Biochim Biophys Acta. 2016 Dec;1866(2):300-319.
7.Liang C, Park AY, Guan J. 2007. In vitro scratch assay: a convenient and inexpensive method for analysis of cell migration in vitro. Nat Protoc. 2(2):329-333.
8.Chen H. Boyden Chamber Assay.015-022. https://doi.org/10.1385/1-59259-860-9:015

Recommended:

1.https://www.sigmaaldrich.com/PL/pl/applications/cell-culture-and-cell-culture-analysis/cell-analysis/cell-based-assays
2.Hanahan D. , Weinberg R.A. Hallmarks of cancer: the next generation. Cell. 2011 Mar 4;144(5):646-74.
3.Mahmood T., Yang P.Ch.Western Blot: Technique, Theory, and Trouble Shooting N Am J Med Sci. 2012 Sep;4(9):429–434
4.https://www.thermofisher.com/pl/en/home/life-science/protein-biology/protein-biology-learning-center/protein-biology-resource-library/pierce-protein-methods/overview-western-blotting.html
5. Vandooren J., Geurts N., Martens E., Van den Steen P.E. & Opdenakker G. Zymography methods for visualizing hydrolytic enzymes Nature Methods volume 10, pages 211–220 (2013)
6.https://www.gene-quantification.de/chapter-3-pfaffl.pdf

Assessment methods and criteria:

Attendance at the seminar, active participation and completion of planned tasks during classes.

Additional information:

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Statement and signature of the course leader:

I hereby state that the content of the curriculum included in the syllabus below is the result of my individual work completed as part of a work contract/cooperation resulting from a civil law contract and that author rights to this title are not the property of a third party.

