

Name: Genetics and immunology of cancer

Lecture language: English

Semester: summer

ECTS credits: 3

Responsible teacher:

Professor Ewa Bartnik, 1st module

Professor Elzbieta Sarnowska, 2nd module

Module summary:

The genetics module will focus on recent advances in cancer molecular genetics and its application to contemporary diagnostics and treatments. Specifically, the heritable and sporadic genetic events with respect to cancer susceptibility (tumor suppressor and DNA repair genes), tumor-specific genomics and gene expression (tumor suppressor genes and oncogenes), and therapies targeting this knowledge will be addressed. Furthermore the state of art genomic tools that enable this research, large scale-genomic data aggregation and its application to the personalized patients approach and will be presented.

The immunology module will cover the necessary background and scientific tools to understand the role of the immune system in oncogenesis. Cancer immunology is a growing field of research that aims to discover innovative cancer immunotherapies.

Module content

Lectures 10h genetics (1st module) + 5h immunology (2nd):

1. Introduction to cancer genetics (**5.03 - 9.15am**)
2. Genome instability and mutations; the hallmarks of cancer; passengers and drivers. (**19.03 - 9.15am**)
3. Familial cancer syndromes. Lynch syndrome, familial breast (and ovarian cancer), familial retinoblastoma, familial adenomatous polyposis, Li-Fraumeni syndrome, and other syndromes. (**9.04 - 9.15am**)
4. Molecular analysis of DNA in diagnosing and treating cancer. (**23.04 - 9.15am**)
5. TCGA and the Pan-Cancer analysis of whole genomes. (**7.05 - 9.15am**)
6. The immune system in cancer part 1 (**14.05 -9.15 am**)
7. The immune system in cancer part 2 (**21.05 -9.15 am**)
8. T cell exhaustion (**28.05 -9.15 am**)
9. Understanding immunotherapy (**4.06 -9.15 am**)

Teaching methods and techniques:

- Lectures: The topics presented in the lecture are shown in the form of a multimedia presentation in Google meet and Teams application

The conditions obtaining the acknowledge for the classes, including the rules of exam retaking, as well as the conditions of admission to the exam:

- In order to pass the subject a positive grade must be obtained from a test on the entirety of the theoretical material.

Participation rules in classes:

- Registration is compulsory, please send an email confirming your willingness to attend at the following address (agnieszka.niewiadomska@pib-nio.pl)

- Attendance is mandatory: **Yes**

- Participation rules in classes: Students that take part in the classes will learn subsequent topics according to the syllabus of the class. Students should systematically ask questions. Recording of the lecture can only be done with the approval of the lecturer.

The method and mode of making up for the absences

- If the requirements are met for obtaining a passing grade, the student is required to independently catch up with the material. If he/she fails to do so, he/she must obtain a positive grade on a test that pertains to the material discussed during his absence.

Prerequisites and additional requirements:

Without requirements

Recommended literature

Campbell PJ et al. Pan cancer analysis of whole genomes. 5 FEB 2020 | Nature (the whole Feb 5 issue with 6 papers on sequencing cancer genomes is available online)

Haber DA, Settleman J. Drivers and Passengers. *Nature* 2007. 466, 106-107

Hameed M., Mandelker D. Tumor Syndromes Predisposing to Osteosarcoma, *Adv Anat Pathol*. 2018 July ; 25(4): 217–222. doi:10.1097/PAP.000000000000190.

Hanahan D, Weinberg RA. Hallmarks of Cancer: The Next Generation. *Cell*. 2011 Mar 4;144(5):646-74. doi: 10.1016/j.cell.2011.02.013.

Hanahan D, Weinberg RA. The hallmarks of cancer. *Cell*. 2000 Jan 7;100(1):57-70. doi: 10.1016/s0092-8674(00)81683-9.

LI FP, Fraumeni Jr JF, et al. A Cancer Family Syndrome in Twenty-Four Kindreds *Cancer Res* 1988 Sep 15;48(18):5358-62. PMID: 3409256

Mills EW, Green R. Ribosomopathies: There's strength in numbers *Science* 03 Nov 2017: Vol. 358, Issue 6363, eaan2755 DOI: 10.1126/science.aan2755

Vlachos A. et al. Incidence of neoplasia in Diamond Blackfan anemia: a report from the Diamond Blackfan Anemia Registry *Blood*. 2012 Apr 19; 119(16): 3815–PMC3335385

Vogelstein B, Kinzler KW. Cancer susceptibility genes. Gatekeepers and caretakers, *Nature* 1997 Apr 24;386(6627):761, 763. doi: 10.1038/386761a0.

Kohli K, Pillarisetty VG, Kim TS. Key chemokines direct migration of immune cells in solid tumors. *Cancer Gene Ther*. 2021 Feb 18. doi: 10.1038/s41417-021-00303-x.

De Santis F, Fucà G, Schadendorf D, Mantovani A, Magnani L, Lisanti M, Pettitt S, Bellone M, Del Sal G, Minucci S, Eggermont A, Bruzzi P, Biccato S, Conte P, Noberini R, Hiscott J, De Braud F, Del Vecchio M, Di Nicola M. Anticancer innovative therapy congress: Highlights from the 10th anniversary edition. *Cytokine Growth Factor Rev*. 2021

Janelle V, Delisle JS. T-Cell Dysfunction as a Limitation of Adoptive Immunotherapy: Current Concepts and Mitigation Strategies. *Cancers (Basel)*. 2021 Feb 3;13(4):598. doi: 10.3390/cancers13040598. PMID: 33546277.

Kumar S, Singh SK, Rana B, Rana A. Tumor-infiltrating CD8⁺ T cell antitumor efficacy and exhaustion: molecular insights. *Drug Discov Today*. 2021 Jan 12:S1359-6446(21)00004-0. doi: 10.1016/j.drudis.2021.01.002.

Poorebrahim M, Melief J, Pico de Coaña Y, L Wickström S, Cid-Arregui A, Kiessling R. Counteracting CAR T cell dysfunction. *Oncogene*. 2021 Jan;40(2):421-435. doi: 10.1038/s41388-020-01501-x.