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Basic Information:
Course Title: Molecular Mechanisms of Carcinogenesis and New Approaches in the Prevention, Diagnosis and Treatment of Cancer Diseases
Lecturer: Prof. Radostina Alexandrova, PhD
Phone: 02 9793678; 0889654253
Email: rialexandrova@hotmail.com
Total Teaching Hours: 30 academic hours

Annotation (up to 150 words)

The course will summarize the available data on the molecular mechanisms of carcinogenesis, including signal pathways, oncogenes, tumor suppressor genes, tumor progression, spontaneous regression, and metastasis. In vitro and in vivo model systems, as well as the principles and methods of experimental oncology and oncopharmacology, will be presented. Challenges in contemporary cancer chemotherapy, such as tumor cell heterogeneity, multidrug resistance, cancer stem cells, and the escape of cancer cells from the immune system, will be discussed. Particular attention will be paid to promising new strategies for targeted cancer therapy, including the application of monoclonal antibodies, photodynamic and boron neutron capture therapy, gene therapy, and nanotechologies. Special emphasis will also be placed on new opportunities for early diagnosis and prevention.

Course content (brief description by topics or modules):

Topic / Module 1: Characteristics of malignantly transformed cells and tissues. Benign and malignant tumors – 1 hour.

Topic / Module 2: Molecular mechanisms of carcinogenesis. Signal pathways. Participation of oncogenes and tumor suppressor genes. MicroRNAs – 3 hours.

Topic / Module 3: Virus-induced carcinogenesis. Retroviruses, papilloma, polyoma and herpes viruses. Viral hepatitis. Endogenous retroviruses – 3 hours.

Topic / Module 4: Bacteria, parasites and carcinogenesis – 1 hour.

Topic / Module 5: Participation of chemical agents and physical factors in the etiology and pathogenesis of cancer diseases – 1 hour.

Topic / Module 6: Main approaches in modern cancer therapy. Challenges in drug treatment of neoplasms – heterogeneity of cancer cells, multidrug resistance, side effects, cancer stem cells – 2 hours.

Topic / Module 7: Molecular mechanisms of metastasis. Angiogenesis and cancer – 1 hour.

Topic / Module 8: Tumor immunology. Escape of tumor cells from the immune response. Spontaneous regression of cancer diseases – 2 hours.

Topic / Module 9: Tumor antigens and tumor markers – 1 hour.

Topic / Module 10: Experimental tumor models – in vitro and in vivo. Advantages and disadvantages – 2 hours.

Topic / Module 11: Main principles and methods in experimental oncology and oncopharmacology. Pharmacogenetics – 3 hours.

Topic / Module 12: Antitumor activity of metals, synthetic compounds and natural products – 2 hours.

Topic / Module 13: New approaches in cancer therapy. Targeted therapy of cancer diseases:

13.1. Monoclonal antibodies in the diagnosis and treatment of cancer diseases – 2 hours.
13.2. Gene therapy of cancer diseases – 1 hour.
13.3. Photodynamic and boron neutron capture therapy – 1 hour.
13.4. Nanotechnologies in the diagnosis and treatment of cancer diseases – 1 hour.
13.5. Tumor vaccines – 1 hour.
13.6. Oncolytic viruses – 1 hour.
Topic / Module 14: Breast cancer as an example of a treatable cancer disease. Challenges of brain tumors – 1 hour.

Teaching and assessment methods:
Written assignment and interview

Competencies acquired as a result of training (3–5 points):
Basic knowledge in the field of tumor biology and immunology, the current state and challenges of modern cancer therapy, and innovative therapeutic approaches in this field.

Literature:

1. *Medical Oncology*, Volumes 1 and 2. Second revised and expanded edition. Edited by K. V. Timcheva. Paradigma Publishing House, Sofia, 2018.
2. *General and Clinical Oncology 2021*, 1, 2021, ISBN: 9786199179420.
3. *Oncology 2024. Molecular Biology and Targeting Pathways in Oncology*, 3, Alsoko Advertising, 2024, ISBN: 978-619-04-0262-6, pp. 101–120.
4. *Epigenetics and Cancer*. F.H. Sarkar (Ed.). Springer, 2013.
5. *Molecular Oncology. Causes of Cancer and Targets for Treatment*. Gelman E.P., C.L. Sawyers, F.J. Rauscher III (Eds.). Cambridge University Press, 2014.
6. *Oncogenes and Carcinogenesis*. P. Erkekoglu (Ed.). IntechOpen, 2019.
7. *Principles of Molecular Oncology*. M.H. Bronchud, M. Foote, M. Giaccone, O.I. Olopade, P. Workman (Eds.). Springer, 2004.
8. *Tumor Immunology and Immunotherapy*. Edited by R.C. Rees. Oxford University Press, 2014.
9. Lectures continuously updated based on new scientific publications