

Molecular biology of tumors

Supervisor: Dr. Edina Pandur assistant professor

Description: During the course we will discuss the molecular mechanisms of tumor development. We will deal with characteristic features of tumor cells, and cancers. The function of influencing factors, risk factors, causes, the underlying molecular mechanisms, e.g. mutations, the role of oncogenes and tumor-suppressor genes, DNA repair, epigenetics and the role of immune system will be discussed in detail. We will emphasize the function of cell signaling pathways and the failure of apoptosis in tumorigenesis. We will speak about the molecular mechanisms of invasion and metastasis of tumors, the genes and proteins which have a crucial role in these processes. The participants will get an insight into the molecular diagnosis, genetic aberrations, and molecular alterations of human cancers. We will discuss the possibilities for cancer therapies, the new approaches such as gene therapy and immunotherapy.

Syllabus:

1. Introduction to cancers: classification and characterization of cancers, causes of cancer, properties of cancer cells, principles of therapies, targets of therapies
2. Tumor genetics: mutations, carcinogenic agents, inheritance, tumor genes, defects in DNA repair and predispositions to cancer, cell protection mechanisms
3. Tumor epigenetics: mechanisms of epigenetic inheritance, imprinting, DNA methylation, epigenetics of cell differentiation and tissue homeostasis
4. Oncogenes and tumor-suppressor genes
5. The cell cycle, apoptosis and senescence: checkpoints, therapeutic targets and inhibitors, molecular mechanisms of apoptosis, replicative senescence and its disturbances in human cancers
6. Signaling pathways in tumors: MAPK, PI3K, TP53 network, NF κ B, TGF β , STAT signaling
7. Invasion and metastasis: genes and proteins involved in cell-to-cell, cell-matrix adhesion, in extracellular matrix remodeling during tumor invasion; angiogenesis.
8. The role of immune system in tumors: inflammation, infections, cancer vaccines, inhibition of the immune system
9. Stem cells and cancer: Wnt signaling, Hh signaling, differentiation therapy
10. Cancer prevention: nutrients, energy metabolism of tumors, hormones and gene interactions
11. Diagnosis of tumors: molecular diagnosis, molecular detection and classification
Human cancers I.: common properties, genetic aberrations, molecular alterations, histology and etiology of cancers
12. Human cancers II.: common properties, genetic aberrations, molecular alterations, histology and etiology of cancers
13. Drugs in cancer therapy: molecular mechanisms of cancer chemotherapy, targeted drug therapy, immunotherapy, gene therapy.