15. EPIGENETIC MODIFICATIONS IN CANCER

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Introduction. In order to treat effectively any disease, including cancer, it is necessary to understand the various biological processes that underlie its origin. Cancer is based on disorders of certain types of genes, such as: proto-oncogenes, which normally contribute to gene proliferation; tumour suppressor genes that inhibit proliferation and caretaker genes that repair or prevent DNA damage. There are many pathways that can lead to disruption of these genes, thereby causing uncontrolled proliferation and cell escape from apoptosis: from molecular genetic changes that transform cells by mutating their DNA to epigenetic modifications which transform cells by changing the chemical environment of DNA. In this review, we will focus on the epigenetic aspects of oncological diseases.

Aim of study. The goal of this thesis is to study epigenetic mechanisms and impact thereof on evolution and progressing of oncological diseases.

Methods and materials. This thesis was based on the review of literature references from the open access databases: PubMed, SpringerLink, MEDLINE.

Results. The importance of epigenetic modifications in the development of cancer cannot be doubted. Epigenetic modifications, including DNA methylation, histone modifications, and non-coding RNAs contribute to the development of neoplasms through their participation in tumour initiation, progression, metastasis, and resistance to therapy. This gives the ground for assuming that epigenetic modifications could be used as diagnostic and prognostic markers for many types of cancer. A good example is an MLH1 gene involved in DNA repair, the mutation of which leads to colon cancer. It has been shown that the drugs that deactivate DNA methylation reactivate the actions of the MLH1 gene in cancer cells, confirming that the structure of the gene is intact and that the loss of function was not caused by a mutation but by an epigenetic mechanism. Epigenetic modifications also contribute to the cellular plasticity and formation of cancer stem cells, which can self-renew and differentiate into other cell types. It is considered that this subtype of cancer cells is involved in resistance to therapy and cancer recurrence. Many cases of cancer recurrence occur because conventional chemotherapy does not kill cancer-producing cells. Pre-treatment with epigenetic drugs in different types of leukemia reduces the rate of cancer recurrence, indicating that these drugs are able to kill cancer progenitor cells.

Conclusion. The assessment of the perspectives of use of epigenetic markers as therapeutic targets for treating the oncological diseases has shown that this field is very promising.