that not all genetic disorders are hereditary, since they are often not passed on to children. For a genetic disorder to be inherited, the altered gene must be found in the germline cells of the affected individual. In other words, in the eggs or in the sperm cell; that is why the genetic combination of the biological parents is influential when it comes to passing on diseases to our children.

Hereditary disorders do not necessarily present symptoms from birth. However, congenital ones do. With the information we have provided so far, we can make these distinctions. Genetic disorders: these are the result of the alteration of one or more genes and may or may not be hereditary. Hereditary disorders: these all have a genetic origin, i.e. they are the result of the alteration of one or more genes and are passed on through generations. Symptoms may not necessarily present themselves from birth. Congenital disorders: these can be hereditary or not, and in these disorders, individuals present symptoms from birth. Genetics and environment. All the examples of hereditary diseases we have seen so far are the result of a gene alteration, i.e. they have a genetic origin. However, there are many diseases that have both genetic and environmental risk factors. The genetic load carries a lot of importance in these cases, but certain circumstances are also needed to trigger the disease.

Conclusions. As we have seen, genetics and the development of disorders are intrinsically linked, which is not surprising, since our genes contain the instructions that tell our bodies how to function properly, and if these are altered it is likely that disorders will appear.

IMMUNOTHERAPY AND CANCER VACCINES: PRINCIPLE OF ACTION AND MECHANISM OF MODERN DEVELOPMENTS

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Introduction. Immune system`s responses are not always able to prevent the development of tumors because the tumors have escape mechanisms that can evade the immune system. In addition, the tumor cells are derived from the host cells and therefore they are very similar to these cells and tend to be weakly immunogenic. The basic relationship between cancer and immunity involves three principles of how the immune system acts to protect and defend the individual: it detects "foreign" antigens from pathogens or infected/malignant cells, antigens from pathogenic or infected/malignant cells; it engages in effector functions to target the destruction of pathogenic or infected/malignant cells while protecting the body; and it develops immunological memory through adaptive immune responses to further protect mechanisms after injury or attack on the host.

Aim. In order to protect and maintain normal homeostasis, the immune system consists of two forms of immune response: innate and adaptive (Fig. 1) Nonspecific and immediate immune responses are classified as innate because of their rapid nonspecific response to foreign antigens (pathogenic microbes, allergenic antigens, or molecules (Fig. 1). It is still able to form foreign immunological memory, to recognize "self" and "non-self" or different groups of pathogens using receptors.

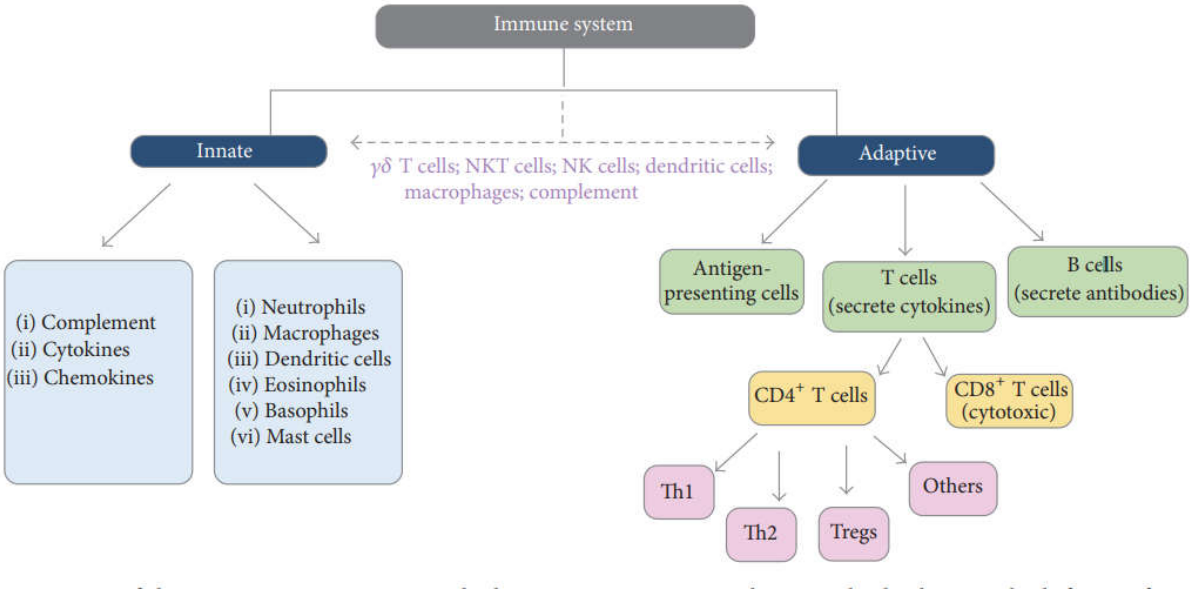

Figure 1. Overview of the immune system: innate and adaptive immunity

The ability to induce an adaptive immune response indicates the presence of different tumor antigens compared to those of the normal cell. Antigens that are expressed selectively on tumor cells are called TSA-specific tumor antigens, while cancer antigens that are expressed by healthy cells are called tumor-associated antigens TAA. Inventing the inhibitory immunologic checkpoints has truly changed the approach to cancer treatment, making the treatment target T-lymphocyte instead of the neoplastic cell. Some strategies suggest *in vivo* immunization practices. The most promising ones use vaccines with tumor antigens or whole allogeneic cells. Some have registered that the usage of dendritic cells and the use of antibodies aimed at the immune control of T-lymphocytes. Immunization of cancer patients with tumor antigens can impove the immune response to the tumor. The identification of peptides recognized by specific tumor CTLs has led to the development of different vaccines depending on the type of antigen.

Materials and methods. Some vaccines use special product of mutated genes called FNDC3B. Notably, a few studies have demonstrated that FNDC3B expression levels are correlated with glioblastoma. Furthermore, a newly integrated analysis of RNA binding proteins in glioma revealed that FNDC3B can not only serve as a useful prognostic biomarker but also promote glioma cell proliferation. In recent study, it was found that long-lived cytotoxic T-cell responses against peptides generated from personal tumor mutations in FNDC3B presented on chronic lymphocytic leukemia cells. Until now, there are very limited studies on the correlation between FNDC3B and tumor-infiltrating lymphocytes in glioma.

Research results. NeoVax was the most popular peptide vaccine. It is usually put subcutaneously and can be combined with other treatments, such as nivolumab. Also Was used for patients suffering from chronic lymphocytic leukemia. NeoVax was also tested as monotherapy (in addition to surgery) against melanoma. Peptide vaccines (the multi-epitope folate receptor alpha peptide vaccine) were tested in treating triple-negative breast cancer.

Antigene NY-ESO-1 is an ingredient of anti-tumor vaccine, NY-ESO-1 expression has been detected in a wide range of tumor types, including neuroblastoma, myeloma, metastatic melanoma, synovial sarcoma, esophageal cancer, hepatocellular carcinoma, head and neck cancer, lung cancer, ovarian cancer, prostate cancer, and breast cancer.

One approach to induce and active TlLs is using vaccines. One of the most well-developed PDAC vaccines is GVAX, which is an allogenic wholecell vaccine derived from two irradiated human PDAC cell lines engineered to release GM-CSF at the vaccination site. Initial phase I trials of GVAX or GVAX in combination with low-dose cyclophosphamide to deplete Treg in patients with advanced PDAC patients showed minimal treatment-related toxicity and evidence of CD8+ T cell activation, as well as induction of intratumoral tertiary lymphoid aggregates.

Vaccinogen's lead product, OncoVAX®, is an active specific immunotherapeutic agent (ASI) that stimulates a patient's immune response to autologous tumor cells. Thus, OncoVAX is a targeted, patient-specific therapy. To prepare OncoVAX, the patient's own tumor is excised, enzymatically dissociated to separate the tumor cells from normal tissue, sterilized and irradiated with gamma radiation (200,000 rads) to prevent the tumor cells from dividing and tumorigenicity, but still remain metabolically active. According to the OncoVAX protocol, the first two injections consist of irradiated tumor cells mixed with freshly frozen mycobacteria of the TICE strain Bacillus Calmette Guérin (BCG). The third and fourth immunizations consist of irradiated tumor cells alone.

In Ukraine, the Kavetsky Institute of Oncology Problems conducted a clinical validation of an antitumor vaccine. It was proved that immunization of patients with malignant gastric tumors with antitumor autovaccine made from autologous tumor tissue of the patient and products of vital activity of Vasillus mesentericus AB-56 led to statistically significant increase in life expectancy in comparison with patients who underwent surgical treatment or surgical treatment in combination with chemotherapy.

Conclusions. Immunotherapy is an instrument, which is usually used with cancer surgery, chemotherapy. There are some mostly used vaccines: Vaccinogen's lead product, OncoVAX®; NeoVax; product of mutated genes FNDC3B; Antigene NY-ESO-1.

DIVERSE APPLICATIONS OF NANOMEDICINE

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Introduction. The design and use of materials in the nanoscale size range for addressing medical and health-related issues continues to receive increasing interest. Research in nanomedicine spans a multitude of areas, including drug delivery, vaccine development, antibacterial, diagnosis and imaging tools, wearable devices, implants, high-throughput screening platforms, etc. using biological, nonbiological, biomimetic, or hybrid materials. Many of these developments are starting to be translated into viable clinical products. Here, we provide an overview of recent developments in nanomedicine and highlight the current challenges and upcoming opportunities for the field and translation to the clinic.

Properties of nanoscale objects are transitional between molecular and bulk regimes. Nanoscale properties exist for all materials, regardless of whether they are found in nature or are synthetic.

Nanomedicine is an interdisciplinary field, where nanoscience, nanoengineering and nanotechnology interact with the life sciences. It is expected that nanomedicine will lead to the development of better devices, drugs, and other applications for early diagnoses or treatment of a wide range of diseases with high specificity, efficacy, and personalization, with the objective being to enhance patients' quality of life.

Aim. Analyze the literature on the use of nanotechnology in medicine and pharmacy.