



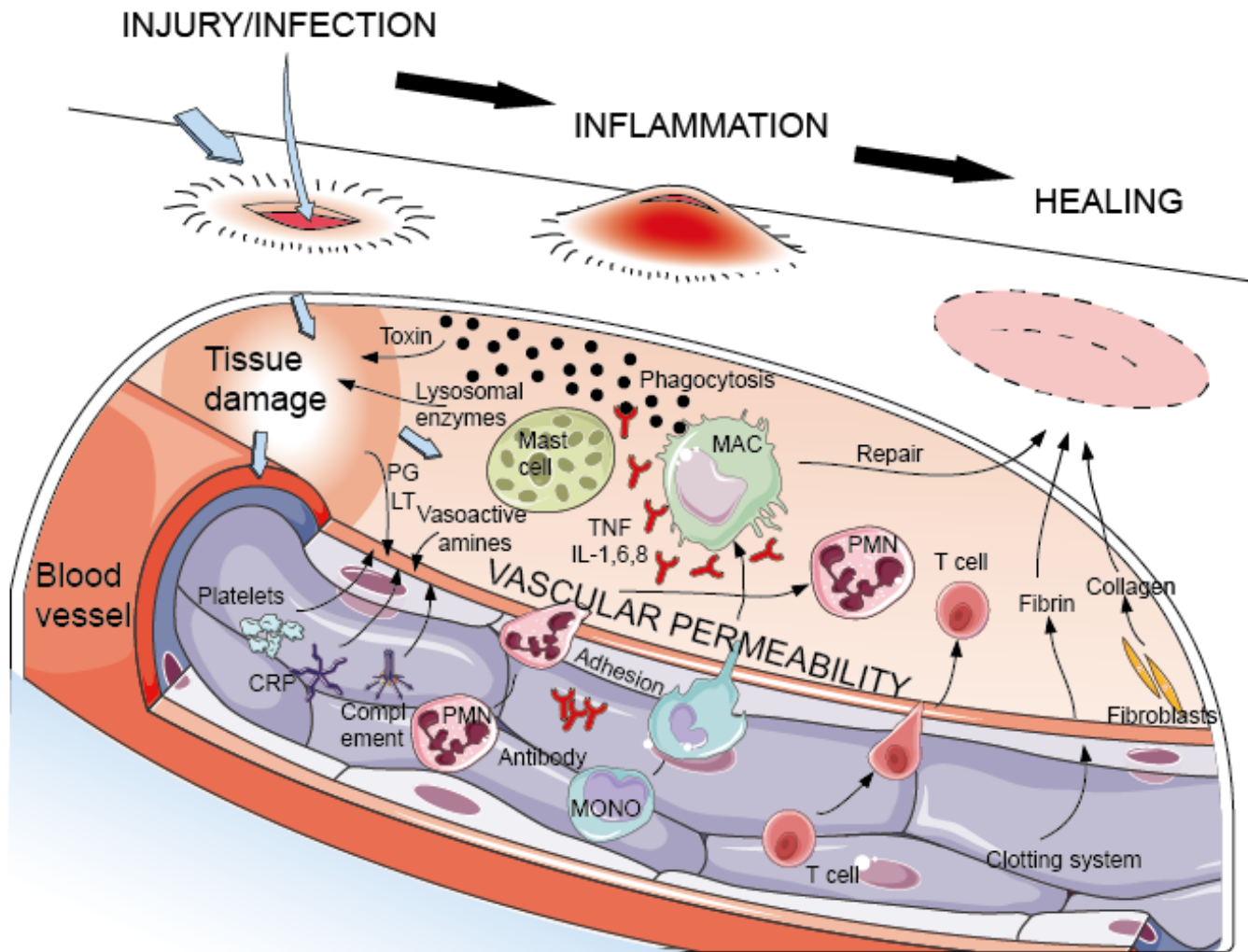
Modern approaches to laboratory diagnostics of inflammatory conditions

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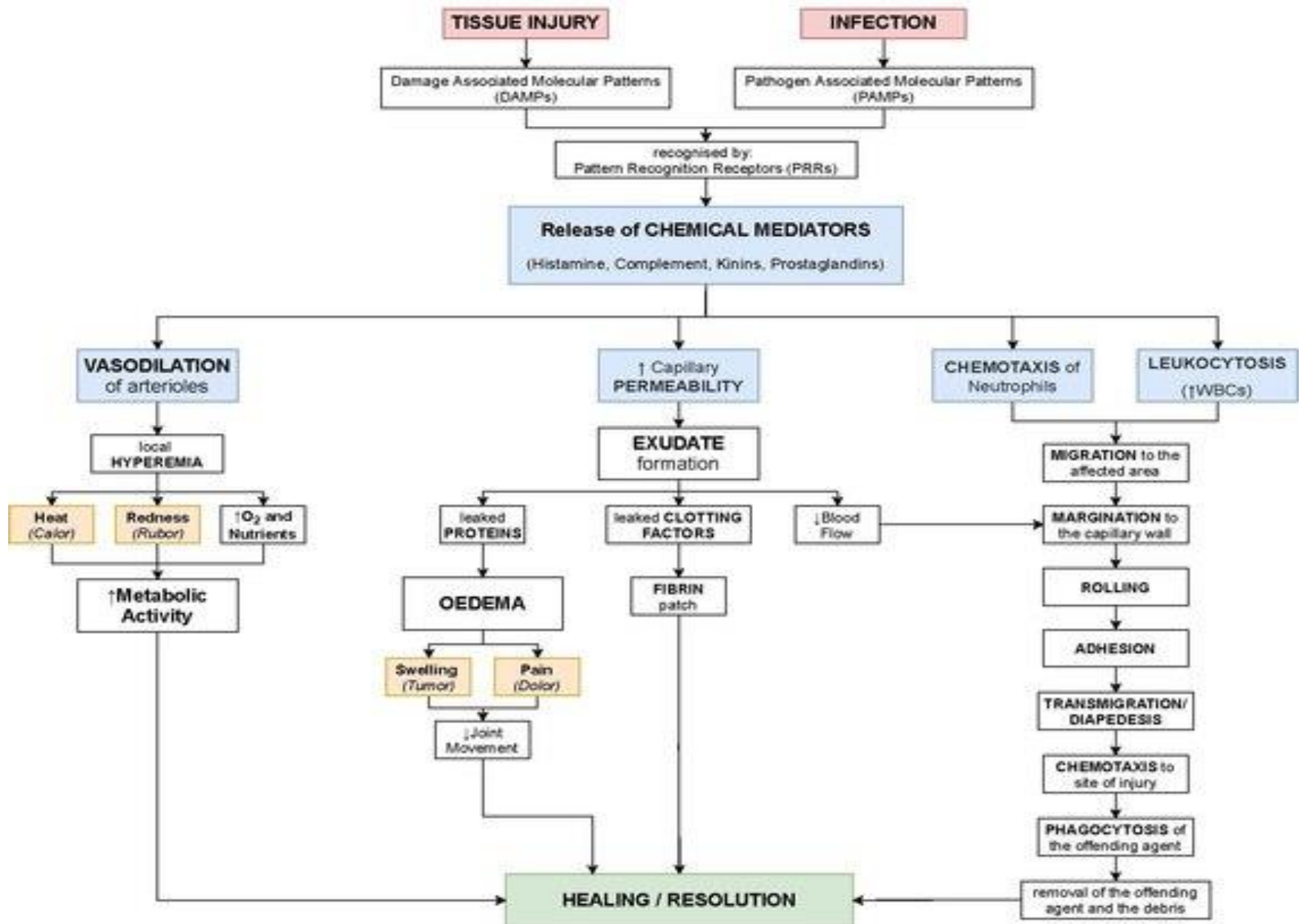
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- ❖ **Inflammation** (lat. inflammatio) is a typical pathological process, a complex protective reaction of the body to the action of harmful agents, which was formed during long evolution and is a complex of tissue and vascular changes
The biological meaning of inflammation is to prevent the spread of pathogens in the body, sometimes the inflammatory process contributes to their destruction
- ❖ **Inflammation** is a local adaptive response of the body in response to injury. This cyclic reaction ends with the elimination of the disease-causing cause, regeneration of tissues and restoration of organ function (I. V. Davydovskiy)
- ❖ **Inflammation** is a complex local vascular-mesenchymal reaction to tissues, caused by the actions of various agents and aimed at destroying the agent and restoring damaged tissue
- ❖ **Inflammation** is a reaction produced during the course phylogeny, has protective and adaptive character and contains elements not only pathology, but also physiology





Cells and molecular which involved in acute inflammation



Various research methods are used to diagnose inflammatory conditions:

❖ **clinical blood analysis:**

one of the most common tests, it allows you to detect changes in indicators that indicate an inflammatory process, important markers: an increased level of leukocytes, a shift in the leukocyte formula, changes in the sedimentation rate of erythrocytes

❖ **biochemical blood analysis:**

allows you to assess the level of certain substances, such as proteins, enzymes, electrolytes, gases, cytokines and other markers of inflammation

❖ **urinalysis:**

is used to determine inflammatory processes in the kidneys or urinary tract

❖ **secret analysis:**

in case of localization of inflammation in specific areas of the body - analysis of secretions: sputum, mucus or others

❖ **immunological studies:**

include studies of factors of cellular and humoral immunity, the presence of autoimmune antibodies or markers associated with specific diseases



General changes blood analysis



- **ESR is increased** - in inflammatory conditions: infections, poisoning, inflammation of the lungs, tuberculosis, myocardial infarction, anemia, diseases of the kidneys, joints
physiologically during pregnancy
- **ESR is reduced** - with blood clotting, polycythemia, anaphylactic shock
- **Increased leukocytes** (total number) - in inflammatory processes, viral or bacterial infections, allergies, asthma, intensive training, severe stress
- **Leukocytes are reduced** (total number) - with a lack of nutrients, autoimmune diseases, bone marrow dysfunction, severe infections, diseases of the immune system, HIV, AIDS, lymphomas
- **Neutrophils are increased** - bacterial infections, trauma, burns, heart attack, inflammatory processes, rheumatoid arthritis, Cushing's syndrome, some types of leukemia, severe stress, intense training
- **Neutrophils are reduced** - viral infections, drug reactions, autoimmune diseases, chemotherapy, radiation therapy, acute leukemia

- **Lymphocytes are increased** - with viral infections - chickenpox, rubella, herpes, tuberculosis, whooping cough, chronic inflammatory processes - ulcerative colitis, blood diseases (leukemias)
- **Lymphocytes are reduced** - in immunodeficiency states, viral hepatitis, influenza, typhoid fever, HIV infection, rheumatoid arthritis, lupus
- **Monocytes are increased** - tuberculosis, syphilis, fungal infections, bacterial endocarditis, collagen vascular diseases - lupus, vasculitis, rheumatoid arthritis, scleroderma
- **Monocytes decreased** - bone marrow damage or failure, aplastic anemia, hairy cell leukemia, corticosteroids
- **Eosinophils are increased** - helminthiasis, specific allergic reaction, bronchial asthma, drug intolerance, inflammatory bowel diseases, celiac disease, Addison's disease
- **Eosinophils are reduced** - normally the concentration in the blood is very low
- **Increased platelets** - blood clotting, ulcerative colitis, tuberculosis, liver cirrhosis, hemolytic anemia, iron deficiency anemia, treatment with corticosteroids, rheumatoid arthritis, lupus, inflammatory bowel disease



Platelets are reduced - in blood diseases - thrombocytopenic purpura, leukemia, some drugs, mononucleosis, hepatitis, measles, cirrhosis, leukemia, lymphoma

Blood plasma proteins

More than **100 different species**

Five fractions are distinguished according to mobility during electrophoresis: **albumin**,

α 1-, α 2-, β - and γ -globulins and **fibrinogen**

Blood plasma proteins make up 8% of the plasma mass (65-85 g/l)

- **albumins** (60%) - 38-50 g/l;
- **globulins** (30-40%) - 20-30 g/l;
- **fibrinogen** (0.3-0.4%) - 2-4 g/l

The level of blood proteins reflects: the state of protein synthesis in the body, the amount of oncotic pressure, the buffering properties of blood, the viscosity of plasma, the ability of blood to carry out transport function and immune protection

- **Albumins**

hypoalbuminemia:

with alimentary dystrophy,

with secondary exhaustion as a result of severe general diseases,

with liver and kidney diseases - with amyloid and lipoid nephrosis,

with flu, croup pneumonia

- **Globulins** - coarsely dispersed proteins with a molecular weight of more than **100,000 Da**
 - during electrophoresis are divided into **α 1-, α 2-, β - and γ -globulin fractions**



α 1-globulins

α 1-acid glycoprotein, α 1-antitrypsin, thyroxine-binding protein, transcortin, erythropoietin, plasminogen, prothrombin

α 2-globulins

α 2-macroglobulin, haptoglobin, ceruloplasmin, antithrombin III, retinol-binding protein, bradykininogen and kallidinogen

β -globulins

- VLDL, VLDL, VLDL
- β 1-globulin - transferrin, antihemophilic globulin
- acute phase proteins: C-reactive protein, haptoglobin, C3 complement component, cryoglobulins

γ -globulins

- antibodies or immunoglobulins of 5 classes: **Ig A, Ig G, Ig M, Ig D and Ig E**
 γ -globulins - α - and β -agglutinins of blood
- Hyperglobulinemia
in infectious diseases: croup inflammation, catarrhal pneumonia, liver diseases (acute parenchymal hepatitis, cirrhosis),
relative hyperglobulinemia - chronic debilitating diseases, alimentary dystrophy, wound exhaustion, inflammation, suppuration

Fibrinogen

- hypofibrinogenemia - severe liver damage with prolonged jaundice, hemolytic anemia, pernicious anemia, severe forms of hepatorenal syndrome
- hyperfibrinogenemia - malignant tumors, leukemia, hypothyroidism, amyloidosis, generalized tuberculosis, influenza, croup pneumonia

PROTEIN FRACTIONS

Alpha-1-globulins:

- increase - in various inflammatory processes:
- acute, subacute and chronic exacerbation, liver damage;
- all processes of tissue decay or intensive cell division
- decrease - with a lack of alpha-1-antitrypsin, hypo-alpha-1-lipoproteinemia

Alpha-2-globulins:

- increase - in all types of acute inflammatory processes, especially with pronounced discharge of fluid in the body cavity or purulent nature (pneumonia, empyema of the pleura, other types of purulent processes);
- connective tissue diseases (collagenosis, autoimmune diseases, rheumatic diseases);
- malignant tumors;
- in the recovery stage after burns;
- nephrotic syndrome
- decrease - with diabetes, occasionally with pancreatitis, toxic hepatitis and congenital jaundice of newborns

Beta-globulins

include transferrin, hemopexin, immunoglobulins and lipoproteins

- increase - in primary and secondary hyperlipoproteinemias, liver diseases, nephrotic syndrome, bleeding stomach ulcer, hypothyroidism
- decrease - with hypo-beta-lipoproteinemia

Gamma globulins

immunoglobulins Ig A, Ig G, Ig M, Ig D and Ig E

increase in the reaction of the immune system, when the synthesis of antibodies and autoantibodies occurs:

- in viral and bacterial infections, inflammation, collagenosis, tissue destruction and burns
 - active hepatitis and cirrhosis
 - rheumatoid arthritis, systemic lupus erythematosus, chronic lymphocytic leukemia, endothelioma, osteosarcoma, candidomycosis
- decrease physiological - in children aged 3-5 months
- congenital
 - diseases and conditions that lead to exhaustion of the immune system and a decrease in the level of immune response

Cryoglobulins

Cryoglobulins belong to fractions of γ -globulins

increase at -

- chronic kidney diseases, liver cirrhosis, tuberculosis, myocardial infarction, malaria,
- malignant neoplasms, myeloma, leukemia, Waldenström's disease
- Cryoglobulinemia occurs in patients with Waldenström's macroglobulinemia, myeloma, chronic kidney disease (uremia), liver cirrhosis, malignant tumors, leukemia, malaria, tuberculosis,
- myocardial infarction

Acute phase proteins

a number of protective proteins that are intensively synthesized during the acute phase of any inflammatory process

- almost all acute-phase proteins are produced by hepatocytes under the influence of pre-immune cytokines, and are also produced by activated macrophages. In a state of rest, such proteins are either completely absent in the plasma, or are contained there in insignificant concentrations

Acute phase proteins **include:**

- C-reactive protein (CRP),
- serum amyloid A-protein, alpha-1-acid glycoprotein, alpha-1-antitrypsin,
- alpha-1-macroglobulin, fibrinogen,
- ceruloplasmin, C9 component of the complement system, haptoglobin, cryoglobulin, α 2-macroglobulin, lactoferrin

Diagnostic value:

- interpretation of the result of infection, systemic connective tissue diseases, inflammatory bowel diseases, acute pancreatitis,
 - myocardial infarction, postoperative period, malignant tumors
- insignificant, weight gain, atherogenic dyslipidemia,
- type 2 diabetes, hypertension, hormone replacement therapy, cardiovascular disease risk assessment

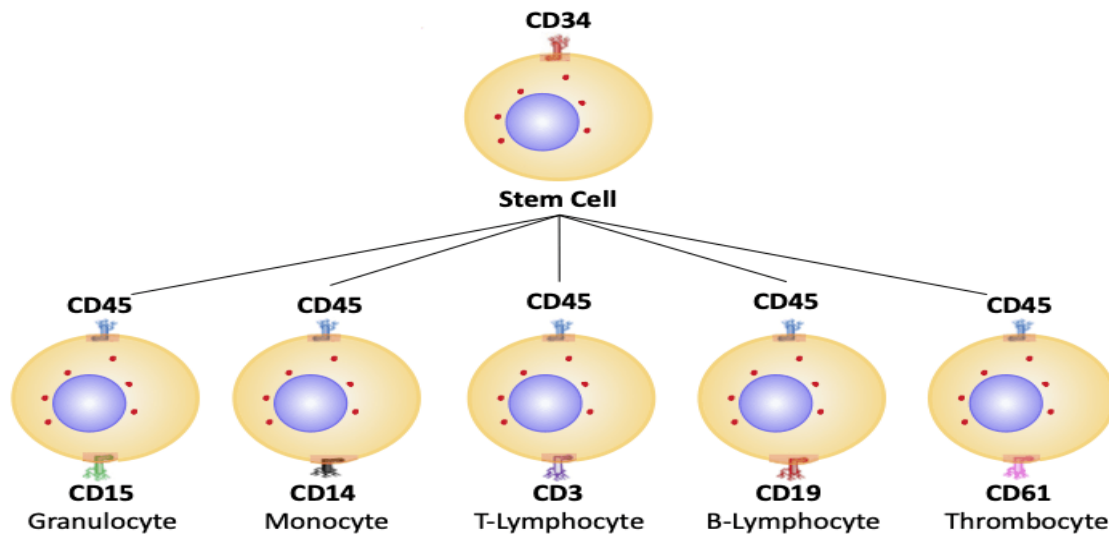
Paraproteins

Paraproteins - are proteins of the acute phase of inflammation, which are formed in the body in some pathological conditions

- This is a type of immunoglobulins produced by pathological immunocompetent cells (pathological immunoglobulins - PIg):
 - tumor cells of the β -lymphocyte system,
 - consist of structural units - two H- and two L-polypeptide chains, which are contained in normal immunoglobulins
- With paraproteinemia, the number of normal immunoglobulins decreases sharply or they are not detected at all. A significant increase in the level of β -fractions with a low content of γ -globulins against the background of hyperproteinemia allows us to conclude about the appearance of paraproteins

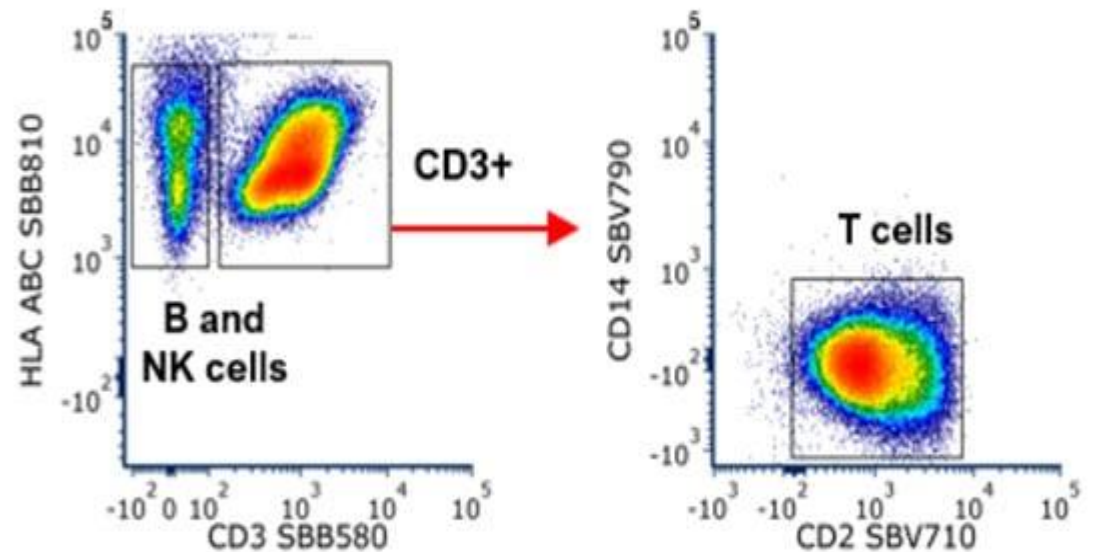
Paraproteinemias:

- benign type - collagenosis; chronic hepatitis; cirrhosis and other chronic inflammatory diseases, in healthy people after 60 years
- malignant type - myeloma disease and its manifestation - plasmacytoma, Waldenström's disease, heavy chain disease, other diseases of the lymphoplasmacytic system - malignant lymphomas, leukemias
- The number of paraproteins significantly increases in myeloma, chronic lymphocytic leukemia, Waldenström's disease, endotheliomas, osteogenic sarcoma



<https://fluorofinder.com/immunophenotyping/>

<https://www.bio-rad.com/en-ua/feature/flow-immunophenotyping.html>





THANK YOU!