

## **I. Read the text and answer 10 questions to it.**

### **Monoclonal antibodies**

Monoclonal antibodies (mAbs) are unlimited identical copies of the same antibody that are produced artificially. They were first made in 1975 by two immunologists, Cesar Milstein from Argentina and Georges Kohler from Germany, and although research is ongoing, they have already proved useful in many areas of medicine. They make up a high proportion of new drugs and diagnostic tests, from innovative treatments for cancers to identifying blood types. Antibodies are proteins the body uses to target alien cells such as germs. There are millions of kinds, each matching a different alien protein (or antigen), and they latch on to their specific antigen either to neutralize it or to identify it as a target for the body's immune cells. Paul Ehrlich coined the term "antibodies" in 1891, and went on to describe how they interact with antigens like lock and key. By the 1960s, scientists knew they are made by white blood cells called B-cells, or B-lymphocytes, each primed with its own antibody. When triggered by its matching antigen, a B-cell clones itself, producing multiple copies of plasma cells, which release floods of antibodies. As plasma cells produce more than one kind of antibody, the process is described as "polyclonal". Milstein and Kohler's breakthrough was to create limitless copies of identical "monoclonal" antibodies using cells made in the lab called hybridomas. These are artificial fusions of plasma cells and myeloma cells (abnormal plasma cells that cause cancer) primed to produce the desired antibody. Plasma cells are short-lived, whereas myeloma cells reproduce indefinitely. By fusing them, Milstein and Kohler created an endlessly multiplying source of their chosen antibody. Milstein's original intention was to find a way to make antibodies for research. But he and Kohler quickly realized that mAbs might also be a "magic bullet", offering tailor-made antibodies to target any disease. Although monoclonal antibodies have not yet proved to be a magic cure-all, they are finding new uses all the time. They can even be used to detect biological weapons. In pregnancy tests, mAbs detect the hormone HCG, and in tissue typing, they help prevent a donor organ from being rejected by blocking the immune response. They can identify blood clots and rogue cells and are used in cancer treatment to carry drugs or radiation to targeted cells. Monoclonal antibodies are also used to fight autoimmune diseases including rheumatoid arthritis, and new mAb drugs are in the pipeline for malaria, influenza, and HIV. In 2020, scientists found several mAbs that appear to neutralize the COVID-19 virus in cell cultures.

**1. Who were the immunologists responsible for creating the first monoclonal antibodies (mAbs)?**

- A.** Cesar Milstein and Georges Kohler
- B.** Paul Ehrlich and Georges Kohler
- C.** Cesar Milstein and Paul Ehrlich
- D.** Georges Kohler and Paul Ehrlich
- E.** Paul Ehrlich and Robert Edwards

**2.** What is the primary function of antibodies in the body?

- A.** To target alien cells such as germs
- B.** To create hybridomas
- C.** To clone B-cells
- D.** To trigger immune responses
- E.** To cause diseases

**3.** What is the process of producing multiple copies of plasma cells when triggered by their matching antigen referred to as?

- A.** Polyclonal
- B.** Cloning
- C.** Monoclonal
- D.** Hybridoma
- E.** In vitro

**4.** How did Cesar Milstein and Georges Kohler create limitless copies of identical monoclonal antibodies?

- A.** By using artificial fusions of plasma cells and myeloma cells
- B.** By using myeloma cells only
- C.** By using white blood cells only
- D.** By isolating plasma cells from patients
- E.** By replicating antibodies in vitro

**5.** What was the original purpose of Cesar Milstein's research on monoclonal antibodies?

- A.** To find a way to make antibodies for research
- B.** To create tailor-made antibodies for disease treatment
- C.** To cure cancer
- D.** To detect biological weapons
- E.** To neutralize the COVID-19 virus

**6.** According to the text, what is the potential use of monoclonal antibodies in the fight against COVID-19?

- A.** To neutralize the virus in cell cultures
- B.** To serve as a vaccine
- C.** To diagnose the disease
- D.** To carry drugs to targeted cells
- E.** To treat autoimmune diseases

**7.** What is the main advantage of hybridomas in the production of monoclonal antibodies?

- A.** They reproduce indefinitely
- B.** They are short-lived
- C.** They contain only plasma cells
- D.** They are used in pregnancy tests
- E.** They cause cancer

**8.** Which of the following is not mentioned as a potential future use of monoclonal antibodies in the text?

- A.** COVID-19 vaccine
- B.** Malaria treatment
- C.** Influenza treatment
- D.** Rheumatoid arthritis treatment
- E.** HIV treatment

**9.** Polyclonal antibodies are produced by white blood cells called B-cells when triggered by their matching antigen.

- A.** True
- B.** False
- C.** Not given
- D.** —
- E.** —

**10.** Monoclonal antibodies are currently used in the treatment of disease - rheumatoid arthritis.

- A.** True
- B.** Not given
- C.** False
- D.** —
- E.** —

**11.** A 50-year-old man suddenly developed intense palpitations, pain in the heart, acute weakness, increased blood pressure, and an irregular pulse with pulse deficit. ECG shows f-waves instead of a P wave; RR intervals are irregular. What heart rhythm disorder is observed in the patient?

- A.** Ciliary arrhythmia
- B.** Respiratory sinus arrhythmia
- C.** Paroxysmal tachycardia
- D.** Transverse heart block
- E.** Sinus extrasystole

**12.** The molecule of immature mRNA (pro-mRNA) contains more triplets than there are amino acids in the synthesized protein, because translation is normally preceded by:

- A.** Processing
- B.** Initiation
- C.** Repair
- D.** Mutation
- E.** Replication

**13.** During the treatment of ciliary arrhythmia, the patient developed bronchoobstructive syndrome — problematic breathing and cough. What antiarrhythmic drug can cause such a complication?

- A.** Anaprilin (Propranolol)
- B.** Ajmaline
- C.** Nifedipine
- D.** Verapamil
- E.** Novocainamide (Procainamide)

**14.** A 75-year-old patient was diagnosed with rectal cancer. Into what regional lymph nodes can the metastases spread in this case?

- A.** Into the inferior mesenteric lymph nodes
- B.** Into the lumbar lymph nodes
- C.** Into the thoracic lymphatic duct
- D.** Into the superior mesenteric lymph nodes
- E.** Into the perivesical lymph nodes

**15.** A patient with hyperthyroidism has high body temperature. What energy metabolism disorder is the leading one in the rise of the body temperature in this case?

- A.** Separation of oxidation and oxidative phosphorylation
- B.** Increased glycogen breakdown
- C.** Increased lipolysis
- D.** Enzyme activation in the Krebs cycle
- E.** Enzyme activation in the respiratory chain

**16.** A patient with scurvy presents with disturbed processes of proline and lysine hydroxylation in the collagen. What biochemical process is inhibited in this case, causing this disorder?

- A.** Microsomal oxidation
- B.** Lipid peroxidation
- C.** Tissue respiration
- D.** Peroxidase oxidation of fats
- E.** Oxidative phosphorylation

**17.** A 56-year-old man has type II diabetes mellitus and hypertension that are managed pharmaceutically. He constantly takes metformin, aspirin (acetylsalicylic acid), rosuvastatin, captopril, and furosemide. Laboratory tests show that his glycated hemoglobin (Hb A1c) is 8.0%, while fasting glucose is 12 mmol/L. The doctor decided to prescribe the

patient glibenclamide. What is the mechanism of action of glibenclamide?

- A. Stimulation of insulin release
- B. Stimulation of glucose absorption within the cells
- C. Facilitation of glucose absorption in the intestine
- D. Inhibition of insulin release
- E. —

18. A histological specimen of an eyeball shows a biconvex structure, connected to the ciliary body with the fibrous strands of the ciliary zonule and covered on top with a transparent capsule. What structure is it?

- A. Crystalline lens
- B. Vitreous body
- C. Ciliary body
- D. Cornea
- E. Sclera

19. Monoamine oxidase inhibitors are widely used as psychotropic drugs. In the synapses, they change the levels of all the neurotransmitters listed below, except:

- A. Acetylcholine
- B. Noradrenaline
- C. Adrenaline
- D. Dopamine
- E. Serotonin

20. A patient with liver cirrhosis has persistent arterial hypotension (blood pressure — 90/50 mm Hg). What causes the decrease in blood pressure in such a liver pathology?

- A. Decreased angiotensinogen synthesis
- B. Increased natriuretic hormone synthesis
- C. Excessive vasopressin inactivation
- D. Increased reflex effect of the receptor zone in the aortic arch
- E. Activation of the kinin-kallikrein system

21. Examination of a patient with a hearing impairment shows that the pathological process is localized at the level of the lateral lemniscus formation. At what level does it normally form in the brain?

- A. Metencephalon (pons)
- B. Cervical spinal cord
- C. Thoracic spinal cord
- D. Medulla oblongata
- E. Mesencephalon

22. Brain MRI shows a local dilation (aneurysm) of an artery in the lateral sulcus. What vessel has pathological changes in this case?

- A. *A. cerebri media*
- B. *A. cerebri anterior*
- C. *A. cerebri posterior*
- D. *A. communicans posterior*
- E. *A. communicans anterior*

23. During a pathological childbirth, separation of the pubic bones occurred in the woman. What type of bone junction was damaged in this case?

- A. Symphysis
- B. Syndesmosis
- C. Synchondrosis
- D. Synostosis
- E. Diarthrosis

24. During smoking, cigarette smoke exits out of the patient's auricle. What structure of the auditory organ is damaged?

- A.** Tympanic membrane
- B.** External acoustic meatus
- C.** Bone labyrinth
- D.** Membranous labyrinth
- E.** Organ of Corti

**25.** During the first year of life, children easily develop seizures that can be associated with incomplete myelination of nerve fibers. What neuroglial cells are associated with this condition the most?

- A.** Oligodendrocytes
- B.** Ependymocytes
- C.** Fibrous astrocytes
- D.** Microglial cells
- E.** Protoplasmic astrocytes

**26.** A worker was hospitalized with the bleeding, caused by an injury to the shoulder. Five days later, an increased concentration of certain blood cells will be observed in the patient's blood. Name these cells.

- A.** Reticulocytes
- B.** Megalocytes
- C.** Erythroblasts
- D.** Megaloblasts
- E.** Lymphoblasts

**27.** A 56-year-old woman complains of pain in the small joints of her hands and feet. She has been experiencing these symptoms for the last 12 years. Examination of her hands detects a subluxation of the metacarpophalangeal joints with her fingers bent outwards ("walrus flippers"). There are high molecular weight immune complexes in the patient's blood. What diagnosis can be made in this case?

- A.** Rheumatoid arthritis
- B.** Rheumatic polyarthritis
- C.** Systemic lupus erythematosus
- D.** Dermatomyositis
- E.** Gouty arthritis

**28.** A patient with signs of jaundice has been hospitalized into the surgical department. Normally, bile does not enter the blood stream from the bile capillaries. What ultrastructural features of the hepatocyte structure contribute to this phenomenon?

- A.** Close contacts between hepatocytes
- B.** Polygonal shape of hepatocytes
- C.** Biliary surface in hepatocytes
- D.** No proper wall in bile capillaries
- E.** Microvilli on the surface of the capillaries

**29.** A 55-year-old woman has mitral valve insufficiency and had myocarditis 10 years ago. Currently she has no complaints. Her hemodynamics is within the normal range. What general nosology concept corresponds with this situation?

- A.** Pathological condition
- B.** Pathological process
- C.** Typical pathological process
- D.** Pathological reaction
- E.** Compensatory reaction

**30.** In some diseases of the nervous system, damage with chromatolysis phenomena can be observed in the neurocytes. What intracellular metabolic processes become disturbed in the neurons?

- A.** Synthesis of protein
- B.** Synthesis of lipids
- C.** Synthesis of glycolipids
- D.** Synthesis of carbohydrates
- E.** Keratohyalin folding

**31.** During the surgery for

a femoral hernia, the doctor operates within the borders of the femoral triangle. What structure forms its upper border?

- A. *Lig. inguinale*
- B. *Arcus iliopectineus*
- C. *Lig. lacunare*
- D. *Lig. pectinale*
- E. *Fascia lata*

32. When stimulation frequency of an isolated heart of a rabbit increases, incomplete relaxation of the ventricles of the heart can be observed because of:

- A. Accumulation of calcium in cardiomyocytes
- B. Increased sodium levels in cardiomyocytes
- C. Inhibition of the sodium–potassium pump
- D. Increased potassium levels in cardiomyocytes
- E. Increased potassium levels in the interstitium

33. Autopsy of the body of a 72-year-old woman with rheumatoid arthritis, who died of uremia, revealed enlarged, dense, pale gray kidneys with a shiny sebaceous surface on section. What pathology can be suspected, based on the revealed changes?

- A. Renal amyloidosis
- B. Chronic glomerulonephritis
- C. Chronic pyelonephritis
- D. Primary contracted kidneys
- E. Atherosclerotic nephrosclerosis

34. Because of a cerebral hemorrhage, a patient developed impaired speech perception (sensory aphasia). What brain structure is likely to be damaged in this case?

- A. Superior temporal gyrus
- B. Inferior frontal gyrus
- C. Superior frontal gyrus
- D. Inferior temporal gyrus
- E. Postcentral gyrus

35. *S. aureus* can cause various infections — from purulent complications of wounds to pneumonia and sepsis. Why is penicillin therapy of staphylococcal infections not very effective?

- A. Penicillinase production by *S. aureus*
- B. Acetylase production by *S. aureus*
- C. Penicillin's inability to penetrate the membrane of *S. aureus*
- D. No penicillin receptors in the cell envelope of *S. aureus*
- E. Allergic response to staphylococcal proteins

36. Acute herpetic gingivostomatitis is the most common primary infection caused by herpes simplex virus, type 1. What material should a dentist obtain for the laboratory testing to confirm this diagnosis?

- A. Fluid from the vesicles
- B. Blood
- C. Saliva
- D. Sputum
- E. Urine

37. A 42-year-old man with verified HIV infection developed a fever, generalized lymphadenopathy, diarrhea, and slight weight loss. What period of HIV infection corresponds with these symptoms?

- A.** AIDS-related complex
- B.** Period of acquired immunodeficiency syndrome
- C.** Period of persistent generalized lymphadenopathy
- D.** Incubation period
- E.** HIV encephalomyelitis

**38.** Histones are small basic proteins, bound to DNA in chromatin. They contain numerous positively charged amino acid residues, which ensures their strong bond with the acidic groups of DNA. Name the most common amino acids in histones.

- A.** Lysine, arginine
- B.** Cystine, cysteine
- C.** Aspartic acid, asparagine
- D.** Glutamic acid, glutamine
- E.** Serine, methionine

**39.** Examination of a patient detected accumulation of sphingomyelins in the cell lysosomes of the patient's liver, spleen, lungs, bone marrow, and brain, caused by the lack of sphingomyelinase enzyme. What pathology is most likely in this patient?

- A.** Niemann-Pick disease
- B.** Tay-Sachs disease
- C.** Sandhoff disease
- D.** Gaucher disease
- E.** Krabbe disease

**40.** Pathologies of lipid metabolism include sphingolipidoses that can be characterized by the accumulation of excess phospholipids and sphingolipids, mainly in the nervous tissue. What disease is associated with accumulation of GM2 ganglioside in the body?

- A.** Tay-Sachs disease
- B.** Gaucher disease
- C.** Niemann-Pick disease
- D.** Krabbe disease
- E.** Fabry disease

**41.** Transcription is the reaction of mRNA matrix synthesis on DNA matrix. Name the stages of transcription.

- A.** Initiation, elongation, termination
- B.** Initiation, elongation, translation
- C.** Initiation, translation, elongation
- D.** Processing, splicing, termination
- E.** Initiation, processing, splicing

**42.** What happens, when blood pressure and stimulation of baroreceptors and atrial volume receptors are decreased?

- A.** Activation of the hypothalamic supraoptic nuclei and production of vasopressin
- B.** Increased production of atrial natriuretic peptide
- C.** Reduced production of aldosterone
- D.** Reduced production of renin in juxtaglomerular cells
- E.** Vasodilation of the systemic resistance vessels

**43.** What will be observed in a 23-year-old man with untreated type 1 diabetes mellitus?

- A.** Acidosis, hyperkalemia
- B.** Alkalosis, hypokalemia
- C.** Acidosis, hypokalemia
- D.** Alkalosis, hyperkalemia
- E.** Acidosis, normokalemia

**44.** A 29-year-old woman has a fever of  $38.3^{\circ}\text{C}$  and intense pain in her lower abdomen, observed for the last several days. What substances mediate the synaptic

transmission between the pain fibers that go from the pelvic organs and spinal cord neurons?

- A. Glutamate, substance P
- B. Acetylcholine, nitrogen monoxide
- C. Endorphins, GABA
- D. Serotonin, vasoactive intestinal polypeptide (VIP)
- E. Noradrenaline, ATP

45. A geneticist examined a pregnant woman and determined that she has monozygotic twins. What process has resulted in the development of twins?

- A. Polyembryony
- B. Fragmentation
- C. Schizogony
- D. Budding
- E. Endogony

46. Six hours have passed since the development of an acute myocardial infarction in the patient. During autopsy of the body, staining was used to identify the area of infarction. What was used to detect the area of necrosis?

- A. Tetrazolium salts
- B. Toluidine blue
- C. Picrofuchsin
- D. Congo red
- E. Methyl violet

47. A 50-year-old patient has been hospitalized with signs of a hypertensive crisis. What is associated with a sharp increase in the blood pressure?

- A. Spasm of arterioles
- B. Necrosis of arterioles
- C. Hyalinosis of arterioles
- D. Endothelial dystrophy
- E. Endothelial desquamation

48. A woman, who was undergoing treatment for insomnia, was found unconscious. Her respiration is inhibited, she is in a collaptoid state and presents with muscle hypotonia and absence of reflexes. Empty medicine packages were found at the site of the accident. What medicine could have caused such a condition in the patient?

- A. Phenobarbital
- B. Promedol (Trimeperidine)
- C. Eleutherococcus tincture
- D. Picamilon
- E. Nialamide

49. A 58-year-old woman with essential hypertension was prescribed amlodipine by her doctor. What group of drugs does it belong to?

- A. Calcium channel blockers
- B. Sodium channel blockers
- C. Beta blockers
- D. Potassium channel blockers
- E. Potassium channel activators

50. A patient with type 1 diabetes mellitus has been prescribed insulin as a substitution therapy. What is the mechanism of action of this drug?

- A. Increase of the glucose permeability of cell plasma membranes
- B. COX-2 inhibition
- C. Stimulation of  $\alpha$ -cells of pancreatic islets
- D. Blockade of H1-histamine receptors
- E. Intensification of anaerobic glycolysis