ZOO516 – ANIMAL FORM & FUNCTION I

FINAL TERM IMPORTANT QUESTIONS

Prepared by: *Sir Mughal*

Admin: **BS Biological Sciences** (One place to all your solutions)

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1. Write function of lateral line in fishes.

The lateral line in fishes is a specialized sensory system present along the sides of the body and head. Its main function is to detect vibrations, water currents, and pressure changes in the surrounding water. It helps fishes sense the movement of nearby objects, predators, prey, and other fishes even in dark or murky water where vision is limited. The lateral line contains sensory receptors called neuromasts, which respond to mechanical disturbances in water. Through this system, fishes can maintain schooling behavior, avoid obstacles, locate prey, and coordinate swimming movements efficiently.

2. Write classification of Rohu.

The classification of *Labeo rohita* (Rohu) is as follows:
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Superclass: Pisces
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Labeo
Species: *Labeo rohita*

3. What is single circulation circuit?

Single circulation circuit is a type of blood circulation in which blood passes through the heart only once during one complete cycle of circulation. In this system, the heart pumps deoxygenated blood to the respiratory organ (such as gills), where it becomes oxygenated, and then the oxygenated blood flows directly to the body tissues before returning to the heart again. This type of circulation is found in fishes such as Labeo rohita. In fishes, the heart has two chambers (one atrium and one ventricle). The blood flows from the heart to the gills for oxygenation, then to the rest of the body, and finally back to the heart, completing a single circuit.

4. Write characteristics of hormones.

Hormones are chemical messengers produced by endocrine glands and released directly into the bloodstream. The main characteristics of hormones are as follows:

1. They are secreted by endocrine (ductless) glands.
2. They are transported through blood to target organs or tissues.
3. They act only on specific target cells that possess appropriate receptors.
4. They are effective in very small quantities.
5. Their action is usually slow but long-lasting.
6. They regulate various physiological processes such as growth, metabolism, reproduction, and homeostasis.
7. Their secretion is controlled by feedback mechanisms, mainly negative feedback.
8. Chemically, hormones may be proteins, peptides, steroids, or amino acid derivatives.

5. What is cutaneous respiration?

Cutaneous respiration is a type of respiration in which exchange of gases takes place through the skin. In this process, oxygen diffuses through the moist skin into the blood capillaries, and carbon dioxide diffuses out from the blood to the external environment. For effective cutaneous respiration, the skin must be thin, moist, and richly supplied with blood vessels. This type of respiration is commonly seen in earthworms and amphibians such as *Rana tigrina*. In amphibians, cutaneous respiration becomes especially important during hibernation or when they remain underwater.

6. How many types of lymphocytes are present in blood?

There are three main types of lymphocytes present in blood:

1. ***B lymphocytes (B cells)*** – These are responsible for humoral immunity. They produce antibodies against specific antigens. B cells mature in the bone marrow.
2. ***T lymphocytes (T cells)*** – These are responsible for cell-mediated immunity. They mature in the thymus and are further divided into:
    - Helper T cells ($CD4^+$)
    - Cytotoxic T cells ($CD8^+$)
    - Regulatory T cells
3. ***Natural Killer (NK) cells*** – These are part of the innate immune system and destroy virus-infected cells and tumor cells without prior sensitization.

7. Write role of prolactin hormone in fishes.

Prolactin is a hormone secreted by the anterior pituitary gland, and in fishes it plays an important role mainly in osmoregulation and reproduction. In fishes, prolactin is primarily known as a freshwater-adapting hormone. It helps fish survive in freshwater by reducing the loss of essential salts (like sodium and chloride ions) from the body. It acts on the gills, kidneys, and intestine to increase ion absorption and decrease ion permeability. This helps maintain proper osmotic balance when the surrounding water is less concentrated than body fluids. In freshwater fishes, prolactin levels are generally higher, while in marine fishes its role is reduced.

Prolactin also participates in reproductive functions. In some species, it influences gonadal development, parental behavior, and brood care. For example, in certain teleost fishes, prolactin is involved in nest building and care of eggs or larvae.

Additionally, prolactin contributes to metabolic regulation and growth-related processes, and may influence skin and mucus production, which provides protection in freshwater environments.

8. What are neurotransmitters?

Neurotransmitters are chemical messenger substances that transmit nerve impulses from one neuron to another neuron, muscle cell, or gland cell across a synapse. They are released from the presynaptic nerve terminal in response to an action potential and diffuse across the synaptic cleft to bind with specific receptors on the postsynaptic membrane, thereby producing a response.

Neurotransmitters may be excitatory, increasing the likelihood of a new nerve impulse (such as acetylcholine in many neuromuscular junctions), or inhibitory, decreasing the likelihood of impulse generation (such as GABA). Some neurotransmitters can act as both depending on the receptor type.

Common examples include acetylcholine, dopamine, serotonin, norepinephrine, and gamma-aminobutyric acid (GABA). These chemicals play essential roles in regulating movement, mood, memory, learning, sleep, and many other physiological processes in the nervous system.

9. What role do thyroxine and triiodothyronine play in amphibians during metamorphosis?

Thyroxine (T_4) and triiodothyronine (T_3) are thyroid hormones that play a crucial role in amphibian metamorphosis by regulating the transformation of a tadpole into an adult frog. These hormones, secreted by the thyroid gland, initiate and control major structural and physiological changes such as resorption of the tail through programmed cell death, development of limbs, and replacement of gills by lungs for aerial respiration, and remodeling of the digestive system from a long herbivorous intestine to a shorter carnivorous one. They also influence changes in skin structure, nervous system maturation, and overall growth. Triiodothyronine (T_3) is the more active form and acts directly on target tissues, while thyroxine (T_4) is converted into T_3 in peripheral tissues, together coordinating the complete metamorphic process in amphibians.

10. How many layers does wall of human heart consists of? Write names.

The wall of the human heart consists of three layers:

1. ***Epicardium*** – the outermost layer, which is a thin serous membrane that also forms part of the pericardium.
2. ***Myocardium*** – the middle layer, made of cardiac muscle tissue, responsible for the pumping action of the heart.
3. ***Endocardium*** – the innermost layer, a smooth lining that covers the heart chambers and valves.

11. What is pleural cavity?

The pleural cavity is the thin, fluid-filled space located between the two layers of the pleura, which are the membranes surrounding the lungs. The pleura consists of the visceral pleura, covering the surface of the lungs, and the parietal pleura, lining the inner surface of the thoracic cavity. The pleural cavity contains a small amount of serous fluid that lubricates the surfaces, allowing the lungs to expand and contract smoothly during breathing while reducing friction between the lung and chest wall.

12. Write a short note on Renal Portal System.

The renal portal system is a special type of blood circulation found in some vertebrates, such as fishes, amphibians, and reptiles, in which blood from the hind limbs and tail passes through a network of veins (renal portal veins) into the kidneys before returning to the heart. This system allows the kidneys to receive blood directly from the posterior part of the body, enabling efficient filtration of nitrogenous wastes and regulation of water and salt balance. It functions alongside the general systemic circulation, helping in excretion and osmoregulation, and is particularly important in animals where the kidney plays a central role in controlling the internal environment.

13. What Trimodal breathing?

Trimodal breathing refers to the ability of some animals, especially amphibians like frogs, to breathe using three different modes depending on their environment and activity. These three modes are:

1. ***Cutaneous respiration*** – gas exchange through the moist skin, which is important when the animal is underwater or inactive.
2. ***Buccal (or buccopharyngeal) respiration*** – air is pumped into the lungs by movements of the floor of the mouth.
3. ***Pulmonary respiration*** – breathing through well-developed lungs, mainly used when the animal is active on land.

14. Write a brief note on kidney hormones.

The kidneys produce several important hormones that help regulate blood pressure, red blood cell production, and mineral balance. Erythropoietin (EPO) is secreted by the kidneys in response to low oxygen levels in the blood and stimulates the bone marrow to produce more red blood cells. Renin, an enzyme with hormonal action, is released when blood pressure drops and activates the renin-angiotensin-aldosterone system (RAAS), helping to increase blood pressure and sodium retention. The kidneys also convert vitamin D into its active form (calcitriol), which regulates calcium and phosphate metabolism, supporting healthy bones. These hormones collectively allow the kidneys to play a key role in homeostasis and overall metabolic balance.

15. Name major endocrine glands.

The major endocrine glands in the human body are:

1. ***Pituitary gland*** – located at the base of the brain, often called the "master gland."
2. ***Thyroid gland*** – located in the neck, regulates metabolism.
3. ***Parathyroid glands*** – small glands on the thyroid that regulate calcium levels.
4. ***Adrenal glands*** – located on top of the kidneys, produce stress and metabolic hormones.
5. ***Pineal gland*** – in the brain, regulates biological rhythms and melatonin secretion.
6. ***Pancreas (endocrine part)*** – produces insulin and glucagon to regulate blood sugar.
7. ***Gonads (ovaries and testes)*** – produce sex hormones like estrogen, progesterone, and testosterone.
8. ***Thymus*** – involved in immune regulation, secretes thymosin.

16. What is the function of coelomic fluid?

The coelomic fluid is the fluid that fills the coelom, the body cavity of coelomate animals such as annelids, mollusks, and some vertebrates. Its main functions are:

1. ***Transport of nutrients, gases, and wastes*** – it helps distribute oxygen, carbon dioxide, and metabolic products between tissues.
2. ***Hydrostatic skeleton support*** – in soft-bodied animals like earthworms, the fluid provides turgor pressure that helps in movement.
3. ***Immune defense*** – it contains coelomocytes that help in phagocytosis and defense against pathogens.
4. ***Lubrication and protection*** – it cushions organs and reduces friction between internal structures.

17. What is acquired immunity?

Acquired immunity, also called adaptive immunity, is the type of immunity that develops after exposure to a specific pathogen or foreign substance. Unlike innate immunity, which is present from birth, acquired immunity is specific to particular antigens and has the ability to remember them, providing long-lasting protection. It involves lymphocytes—B cells, which produce antibodies for humoral immunity, and T cells, which carry out cell-mediated immunity. Acquired immunity can develop naturally through infection or artificially through vaccination, enabling the body to respond faster and more effectively if the same pathogen invades again.

18. How pacemaker works? Write it's working.

The pacemaker is a medical device that regulates the heartbeat in people with irregular or slow heart rhythms (arrhythmias). It works by sending electrical impulses to the heart muscle to stimulate contraction when the heart's natural pacemaker (the sinoatrial node) is not functioning properly.

Working of a pacemaker:

1. The pacemaker has a pulse generator (battery and circuitry) and leads (wires) that connect to the heart.
2. It monitors the heart's electrical activity continuously.
3. When it detects that the heart rate is too slow or irregular, it sends small electrical impulses through the leads to the heart muscle.
4. These impulses cause the heart to contract, maintaining an adequate and regular heartbeat.
5. Modern pacemakers can adjust the rate according to the person's activity level, increasing the heart rate during exercise and slowing it during rest.

19. Write a detailed note on granulocytes.

Granulocytes are a type of white blood cell (leukocyte) characterized by the presence of granules in their cytoplasm and a lobed nucleus. They are part of the innate immune system and play a crucial role in defending the body against infections, particularly bacterial and fungal pathogens. Granulocytes are produced in the bone marrow and are usually short-lived in circulation, surviving from hours to a few days.

There are three main types of granulocytes:

1. ***Neutrophils*** – These are the most abundant granulocytes and are the first responders to infection. Their granules contain enzymes and antimicrobial proteins that help digest pathogens. Neutrophils engulf bacteria and debris by phagocytosis and release substances that kill microbes, making them essential in acute inflammation.

2. ***Eosinophils*** – These cells have granules that stain red with eosin dye. They are involved in combating parasitic infections (like worms) and play a role in allergic reactions and asthma. Eosinophils release toxic proteins and inflammatory mediators that help destroy parasites and modulate immune responses.

3. ***Basophils*** – The least common granulocytes, basophils have granules containing histamine, heparin, and other chemicals**.** They are involved in allergic responses and inflammation, promoting blood vessel dilation and attracting other immune cells to sites of infection or injury.

20. Write a note on RBCs.

Red blood cells (RBCs), also called erythrocytes, are the most abundant type of blood cells in humans and other vertebrates. Their primary function is to transport oxygen from the lungs to body tissues and carry carbon dioxide from tissues back to the lungs for exhalation. RBCs are biconcave, disc-shaped cells without a nucleus in mammals, which increases their surface area for gas exchange and allows flexibility to pass through narrow capillaries. They contain hemoglobin, an iron-containing protein that binds oxygen and gives blood its red color. RBCs are produced in the red bone marrow through a process called erythropoiesis, regulated by the hormone erythropoietin secreted by the kidneys. They have a lifespan of about 120 days in humans, after which old RBCs are removed by the spleen and liver. Besides gas transport, RBCs help maintain acid-base balance and contribute to blood viscosity and circulation efficiency.

21. What are neuropeptides?

Neuropeptides are small protein-like molecules produced and released by neurons that act as signaling molecules in the nervous system. Unlike classical neurotransmitters, which typically act quickly and locally, neuropeptides often have slower, longer-lasting effects and can influence both the brain and peripheral organs. They modulate a variety of physiological processes, including pain perception, appetite, and stress response, sleep, reproduction, and mood regulation. Examples of neuropeptides include substance P, oxytocin, vasopressin, neuropeptide Y, and endorphins. They often work by binding to specific receptors on target cells, triggering changes in cellular activity and coordinating complex body functions.

22. How transportation is done in vertebrates?

In vertebrates, transportation of substances such as gases, nutrients, wastes, and hormones is primarily carried out by the circulatory system, which consists of the heart, blood vessels, and blood. The heart acts as a muscular pump that maintains blood flow throughout the body. Arteries carry oxygenated blood from the heart to tissues (except in fish, where arteries to gills carry deoxygenated blood), veins return deoxygenated blood back to the heart, and capillaries allow exchange of gases, nutrients, and wastes between blood and tissues.

Red blood cells (RBCs) transport oxygen from the lungs or gills to tissues and carry carbon dioxide back for excretion. Plasma, the liquid component of blood, carries nutrients, hormones, and metabolic wastes like urea. The lymphatic system assists by transporting excess tissue fluid (lymph), proteins, and fats from the digestive system back to the blood. In some vertebrates like fish, the single circulatory system moves blood through the heart once per cycle, while in amphibians, reptiles, birds, and mammals, a double circulatory system separates pulmonary and systemic circulation for efficient oxygen delivery.

23. What is fixed membrane receptor?

A fixed membrane receptor is a type of cell-surface receptor that is permanently embedded in the plasma membrane of a cell and does not move freely within the membrane. These receptors bind specific ligands such as hormones, neurotransmitters, or growth factors, triggering a cellular response without entering the cell. The binding of a ligand to a fixed membrane receptor usually activates intracellular signaling pathways through second messengers or protein phosphorylation, leading to changes in gene expression, metabolism, or cell behavior. Examples include G-protein-coupled receptors (GPCRs), receptor tyrosine kinases (RTKs), and ion-channel-linked receptors, which are critical for communication between cells and their environment.

24. Write a note on Lymphatic system.

The lymphatic system is a network of vessels, tissues, and organs that plays a key role in fluid balance, immunity, and fat absorption in vertebrates. It consists of lymph, lymphatic vessels, lymph nodes, spleen, thymus, and tonsils. Lymphatic vessels collect excess tissue fluid (lymph) from body tissues and return it to the blood circulation, preventing tissue swelling. Lymph nodes act as filters, trapping pathogens and foreign particles, and contain lymphocytes that mount immune responses. The spleen removes old red blood cells and participates in immune defense, while the thymus is essential for the maturation of T lymphocytes. The lymphatic system also absorbs fats and fat-soluble vitamins from the digestive tract through specialized lymph vessels called lacteals. Overall, it supports the immune system, maintains fluid homeostasis, and aids in nutrient transport.

25. Explain air work flows in humans.

In humans, air flows through the respiratory system in a sequence that allows efficient gas exchange between the body and the environment. Air enters through the nose or mouth, where it is filtered, warmed, and humidified. It then passes through the pharynx and larynx, which contains the vocal cords, into the trachea. The trachea divides into two primary bronchi, each leading to a lung, and these further branch into secondary and tertiary bronchi and finally into bronchioles, which end in tiny air sacs called alveoli.

In the alveoli, oxygen from the inhaled air diffuses into the blood in the surrounding capillaries, while carbon dioxide from the blood diffuses into the alveoli to be exhaled. The oxygen-rich blood is then transported by red blood cells to body tissues, and carbon dioxide is carried back to the lungs for removal. Breathing is driven by the diaphragm and intercostal muscles: during inhalation, the diaphragm contracts and the chest cavity expands, drawing air in, and during exhalation, the diaphragm relaxes and air is expelled. This continuous airflow ensures that cells receive oxygen for metabolism and that waste carbon dioxide is eliminated efficiently.

26. What are exocrine and endocrine glands?

Exocrine glands and endocrine glands are two main types of glands in the body that differ in how they secrete their products.

1. Exocrine glands release their secretions through ducts either onto an external surface (like skin) or into a body cavity. Their secretions include enzymes, sweat, saliva, and digestive juices. Examples are salivary glands, sweat glands, and pancreas (exocrine part).

2. Endocrine glands are ductless and release their secretions, called hormones, directly into the blood or lymph. These hormones regulate metabolism, growth, reproduction, and homeostasis. Examples include the pituitary gland, thyroid gland, adrenal glands, and ovaries/testes.

27. Explain mechanism of inhalation.

Inhalation (inspiration) is the process of drawing air into the lungs and occurs through a coordinated action of the diaphragm, intercostal muscles, and thoracic cavity. The mechanism works as follows:

1. The diaphragm contracts and moves downward, while the external intercostal muscles contract, pulling the ribs upward and outward.
2. These movements expand the thoracic cavity, increasing its volume.
3. As the thoracic cavity expands, the lungs also expand because they are attached to the thoracic wall via the pleura.
4. Expansion of the lungs reduces the air pressure inside the alveoli (intrapulmonary pressure) below the atmospheric pressure.
5. Due to this pressure difference, air flows from the higher-pressure atmosphere into the lower-pressure lungs, filling the alveoli.

28. What are chromafin tissues?

Chromaffin tissues are specialized groups of cells that stain with chromium salts (hence the name "chromaffin") and are primarily found in the adrenal medulla of vertebrates. These cells are neuroendocrine in nature, meaning they have features of both nerve cells and endocrine cells, and they secrete catecholamine hormones such as adrenaline (epinephrine) and noradrenaline (norepinephrine) directly into the bloodstream.

Chromaffin tissues are part of the sympathoadrenal system and play a crucial role in the fight-or-flight response by increasing heart rate, blood pressure, blood glucose, and blood flow to muscles during stress. Besides the adrenal medulla, smaller clusters of chromaffin cells, called paraganglia, may be present along sympathetic ganglia in the body.

29. What are veins?

Veins are blood vessels that carry blood toward the heart from various parts of the body. In most cases, veins transport deoxygenated blood, except for the pulmonary veins, which carry oxygenated blood from the lungs to the heart. Veins have thin walls compared to arteries, with less smooth muscle and elastic tissue, because blood pressure in veins is lower. Many veins, especially in the limbs, contain one-way valves that prevent backflow of blood and assist in returning blood to the heart against gravity. Veins play an essential role in circulation, helping maintain blood volume and venous return, which is critical for efficient cardiac function.

30. Explain Blood Portal system.

The blood portal system is a special type of vascular arrangement in which blood from one capillary network passes through a vein directly into a second capillary network before returning to the heart. This system allows substances carried by the blood, such as nutrients or hormones, to be transported efficiently between two organs without first mixing with general circulation.

A classic example is the hepatic portal system, where blood from the digestive organs (stomach, intestines, pancreas, and spleen) flows through the hepatic portal vein into the capillaries of the liver. This allows the liver to process nutrients, detoxify harmful substances, and store or release chemicals before the blood enters the systemic circulation. Another example is the **h**ypothalamo-hypophyseal portal system, which carries hormones from the hypothalamus to the anterior pituitary, enabling precise regulation of pituitary hormone secretion.

31. How gaseous exchange occurs in respiratory system of humans?

In humans, **gaseous exchange** occurs in the **lungs**, specifically in the **alveoli**, which are tiny air sacs with thin walls and a large surface area. When air is inhaled, **oxygen-rich air fills the alveoli**, bringing oxygen into close contact with the **pulmonary capillaries**. Oxygen **diffuses across the thin alveolar and capillary walls** into the blood because of the **higher oxygen concentration in the alveoli** compared to the blood. At the same time, **carbon dioxide**, which is at a higher concentration in the blood, **diffuses from the capillaries into the alveoli** to be exhaled. This **diffusion process** is driven purely by **concentration gradients** (partial pressures of gases) and does not require energy. Oxygen binds to **hemoglobin in red blood cells** for transport to tissues, while carbon dioxide is carried mostly as **bicarbonate ions** in plasma. This continuous exchange ensures that **body cells receive oxygen** for metabolism and **waste carbon dioxide** is removed efficiently.

32. How cuticle is formed in arthropods by Central Nervous System?

In arthropods, the cuticle is an external protective exoskeleton secreted by the epidermal cells, but its formation is controlled by the central nervous system (CNS) through hormonal regulation. The CNS, particularly the brain (supraesophageal ganglion), secretes neurohormones such as the ecdysiotropin or X-organ hormones in crustaceans, which stimulate the molting (ecdysis) glands to release molting hormones (ecdysteroids).

These hormones act on the epidermal cells beneath the old cuticle, signaling them to secrete new layers of cuticle composed of chitin, proteins, and sometimes minerals. The process involves deposition of the epicuticle (outer layer), exocuticle, and endocuticle, followed by sclerotization (hardening). The CNS also coordinates timing of molting, ensuring the old cuticle is shed and the new cuticle is properly formed, allowing growth and protection.

33. Write functions of Thyroid glands.

The thyroid gland is an endocrine gland located in the neck that produces thyroid hormones—mainly thyroxine (T_4) and triiodothyronine (T_3)—and calcitonin. Its primary functions include:

1. ***Regulation of metabolism*** – T_4 and T_3 increase the basal metabolic rate**,** promoting energy production and heat generation in the body.
2. ***Growth and development*** – thyroid hormones are essential for normal growth, bone development, and maturation of the nervous system, especially during childhood.
3. ***Control of protein, carbohydrate, and fat metabolism*** – they influence the breakdown and utilization of nutrients for energy.
4. ***Calcium homeostasis*** – calcitonin lowers blood calcium levels by inhibiting calcium release from bones and promoting calcium deposition.
5. ***Regulation of cardiovascular and respiratory functions*** – thyroid hormones increase heart rate, cardiac output**,** and oxygen consumption.

34. Define antibodies.

Antibodies, also called immunoglobulins (Ig), are specialized protein molecules produced by B lymphocytes (plasma cells) in response to the presence of foreign substances called antigens (such as bacteria, viruses, or toxins). Antibodies recognize and bind specifically to their corresponding antigens, neutralizing them or marking them for destruction by other immune cells. They play a key role in humoral immunity, helping the body fight infections, prevent disease, and provide long-term immunity. Examples include IgG, IgA, IgM, IgE, and IgD, each with specific functions in immune defense.

35. What is passive immunity?

Passive immunity is a type of immunity in which an individual receives ready-made antibodies from another source instead of producing them through their own immune system. This provides immediate but short-term protection against infections, as the body does not generate memory cells. Passive immunity can occur naturally, such as when a baby receives antibodies from the mother through placental blood (IgG) or breast milk (IgA), or artificially, through injections of antibodies (antiserum) to protect against diseases like rabies or tetanus.

36. How many types of vaccine are there?

Vaccines are broadly classified into four main types based on how they stimulate the immune system:

1. ***Live attenuated vaccines*** – contain weakened forms of the pathogen that can replicate without causing disease (e.g., measles, mumps, rubella (MMR)**)**.
2. ***Inactivated (killed) vaccines*** – contain pathogens that are killed or inactivated, so they cannot replicate (e.g., polio IPV, hepatitis A).
3. ***Subunit, recombinant, or conjugate vaccines*** – include only parts of the pathogen, such as proteins or polysaccharides, to trigger immunity (e.g., hepatitis B, HPV, pneumococcal vaccines).
4. ***mRNA or viral vector vaccines*** – deliver genetic instructions to cells to produce antigenic proteins that stimulate immunity without using live pathogens (e.g., some COVID-19 vaccines).

37. Write a note on pumping of human heart.

The pumping of the human heart is the coordinated contraction and relaxation of the atria and ventricles to circulate blood throughout the body. The heart has four chambers—two atria and two ventricles. Blood enters the right atrium from the body through the superior and inferior vena cava, then passes into the right ventricle, which pumps it to the lungs via the pulmonary artery for oxygenation. Oxygen-rich blood from the lungs enters the left atrium, moves into the left ventricle, and is then pumped through the aorta to supply the entire body. The rhythmic pumping is regulated by the sinoatrial (SA) node, which acts as the natural pacemaker, generating electrical impulses that cause atrial contraction followed by ventricular contraction. Valves between chambers (atrioventricular and semilunar valves) ensure unidirectional blood flow and prevent backflow, while the cardiac cycle—comprising systole (contraction) and diastole (relaxation)—maintains continuous blood circulation.