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Lecture title: The circulatory system

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Summary:

The circulatory system is responsible for the transport of the various essential compounds around the body, as well as the removal of the metabolic wastes that accumulate in the tissues from body activities, to the appropriate places.

❑ The compounds and other factors transported around the body are blood, nutrients, medications and antibodies to fight infection, the residue of worn out cells and the wastes of metabolism.

The circulatory system consists of a number of organs that pump it around the body (The heart), and controlling system (The valves), and (The blood vessels) such as the arteries, veins and capillaries.

Birds, like mammals, have a 4-chambered

Heart (2 atria and 2 ventricles), with complete

separation between oxygenated and

deoxygenated blood.

❑ The heart represents a pump, and the valves ensure unidirectional blood flow from one chamber to the other.

Heart Details:

The heart has a Conical shape and is found in most birds in the thorax cavity (B),

slightly to the left side from the midline of the body (A), except that the apex of the

heart is directed towards the right, and the heart is surrounded by the pericardial sac.

❑ Heart beat in chicken : 220 - 360 beats / minute.

The Heart consist of:

The right ventricle pumps deoxygenated blood to the lungs, while the left ventricle pumps oxygenated blood to the rest of the body.

❑ **The walls of the left ventricle are denser and more muscular, and the reason is the left ventricle must generate greater pressure to pump blood throughout the body.**

The heart has four valves that are naturally present in it, and are responsible for enabling it to perform its functions. They can be classified as follows:

1. The tricuspid valve

2. The pulmonary valve

3. The mitral valve

4. The aortic valve (or bicuspid aortic valve)

1- **The tricuspid valve**
located between the right atrium and the right ventricle.
 When the heart muscle contracts, this valve opens to allow blood to pass from the right atrium to the right ventricle.
It also prevents blood from flowing back into the right atrium after being pumped into the right ventricle.

2- **The pulmonary valve**
located between the right ventricle and the pulmonary artery.
 The valve opens to allow blood to pass into the lungs through the pulmonary artery to be oxygenated.
 The valve closes after the blood has passed through to prevent it from flowing back into the right ventricle.

3- **The mitral valve**
located between the left atrium and the left ventricle.
 It collects oxygenated blood from the lungs in the left atrium.
 The valve opens to allow blood to pass into the left ventricle, then closes to prevent it from flowing backward.

4- **The aortic valve (bicuspid aortic valve)**
located between the left ventricle and the aorta.
 The valve opens to allow oxygenated blood to pass to the rest of the body, then closes to prevent blood from flowing back into the left ventricle.

Blood vessels

1) Arteries: Carry oxygenated blood away from the heart.

- **Structure: Thick walls to withstand high pressure from the heart's pumping action.**

2) Capillaries: exchange between blood and tissue,

- **Structure: they are very small and very thin walled (one layer wall). This allows the nutrients being delivered to move out of the capillary into the tissues and the material to be collected from the cell to enter.**

3) Veins: Carry deoxygenated blood back to the heart.

- **Structure: Thinner walls than arteries because the pressure is lower.**

Chicken Blood:

Avian blood consists of:

1. Plasma.

2. Cells:

A. Erythrocytes (Red Blood Cells).

B. Leukocytes (White Blood Cells).

C. Thrombocytes (Platelets).

Unlike mammals, the erythrocytes of poultry contains nuclei,

mitochondria and other organelles.

Packed cell volume (PCV): is the percentage of the total blood

volume that is occupied by red blood cells (Erythrocytes).

❑ **Male chickens had higher PCV value (34.4%) as compared to female**

chickens with PCV value (30.5%)

Blood has a number of functions:

1. Respiratory functions: The blood transports oxygen from the lungs to all cells and tissues.

2. Excretory functions: It carries CO2 from the cells to the lungs for disposal, as well as water, excess salts, and waste products of metabolism to the kidneys and sweat glands for disposal.

3. Regulatory functions: It maintains acidity, regulates the water content of tissues, and regulates body temperature.

4. Transport function: Transferring heat from one location to another in the body. It also transports the products of digestion after absorption to all body tissues (glucose, amino acids, fatty acids, vitamins, minerals, etc.).

5. Protective functions: Blood is considered the most important immune factor, and white blood cells engulf foreign bodies. They work with the immune system to neutralize the harmful effects of microbes and their toxins.