TRANSPORTATION

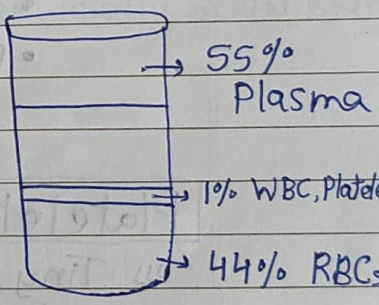
- **In humans** by circulatory System
- **In Plants** by vascular bundles (Xylem / Phloem)

Blood

- Volume - 5-6 litres
- Taste - Salty
- pH - 7.4 (Alkaline/basic)

- Colour
  - Arteries - Bright red
  - Veins - Dark red

- Composition
  - Plasma (liquid part) (yellow in colour) → due to Bilirubin pigment
  - Cells
    - RBCs
    - WBCs
    - Platelets



Human Circulatory System

- **Blood circulatory System** → Heart + Vessels + Blood (Arteries, Veins, Capillaries) (Plasma, WBC, RBC, Platelets)
- **Lymphatic System** → Vessels + Lymph

RBCs → Erythrocytes
Red cell

- Lifespan – 120 days
- Produced in Red bone marrow
- Has only haemoglobin
- No nucleus

WBCs → Leucocytes
white/ colourless cells

- Soldiers
- Fight diseases
- Produce anti-bodies

granulocytes	agranulocytes
• Basophyls	• Lymphocytes
• Neutrophyls	• Monocytes
• Eosinophyls	

Platelets → Thrombocytes

- Tiny, delicate, sticky
- Helps blood clotting (due to Vitamin K)

Functions of Blood

1. Carries digested food (nutrients)
2. Carries Oxygen
3. Carries Carbon dioxide
4. Carries Excretary materials
5. Distribution of hormones

6. Helps in defence against infection
7. Distribution of heat (thermo-regulation)
8. Helps in clotting blood
9. Maintains water balance (osmotic pressure)
10. Protects from diseases by engulfing microorganisms - (Phagocytosis)

Arteries	Veins
• Blood flows at high pressure	• Blood flows at low pressure
• Thick, muscular, elastic walls	• Thinner walls
• No valves present	• Valves are present (to prevent backflow)
• Carries oxygenated blood away from heart [heart $\xrightarrow{O_2}$ organs]	• Carries deoxygenated blood towards heart [Organs $\xrightarrow{CO_2}$ Heart]
• Located deep inside skin	• Seen superficially below skin

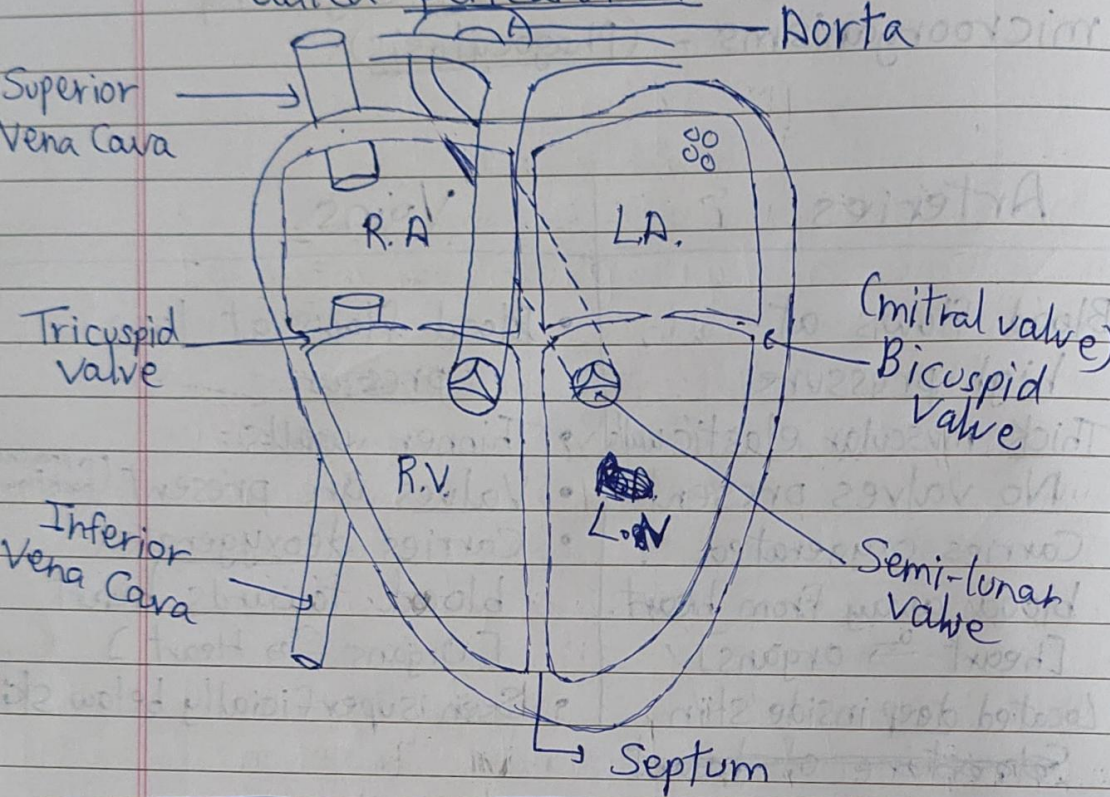
~~Structure of Heart~~

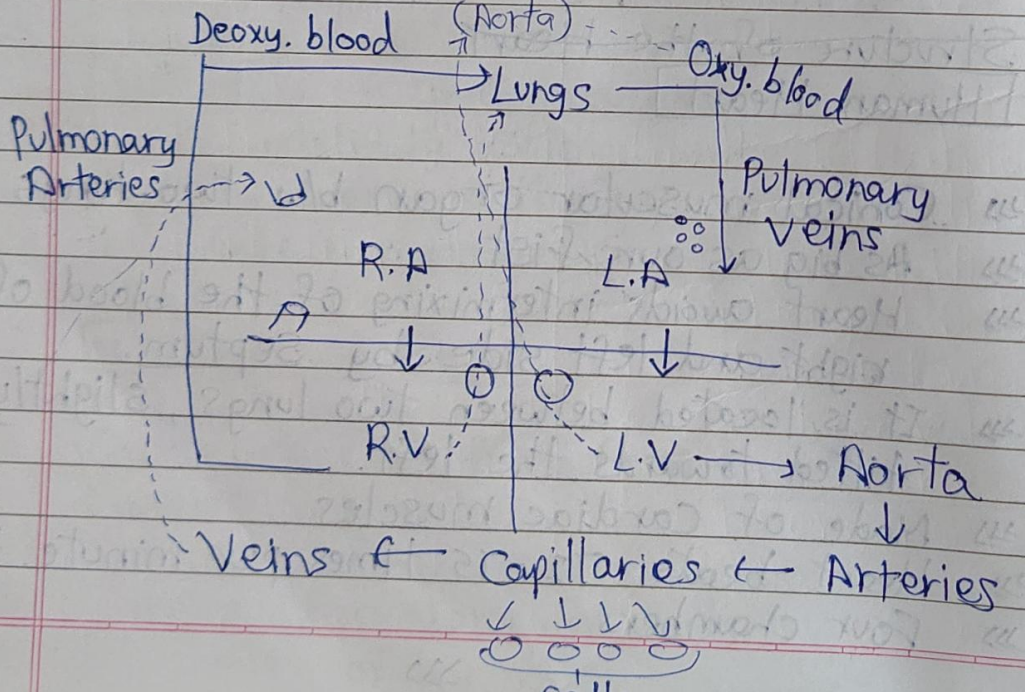
~~Structure of the Heart~~

Human Heart

- Conical muscular organ b/w two lungs
- As big as our fist
- Heart avoids intermixing of the blood of the right and left side by septum.
- It is located between two lungs, slightly tilted towards the left.
- Made of cardiac muscles
- Heart beats 72-75 times per minute.
- Four chambers

» Upper two chambers are called atrium / auricles.
» Lower two chambers are called ventricles.
» Heart is protected by a sheath of tissue called pericardium.





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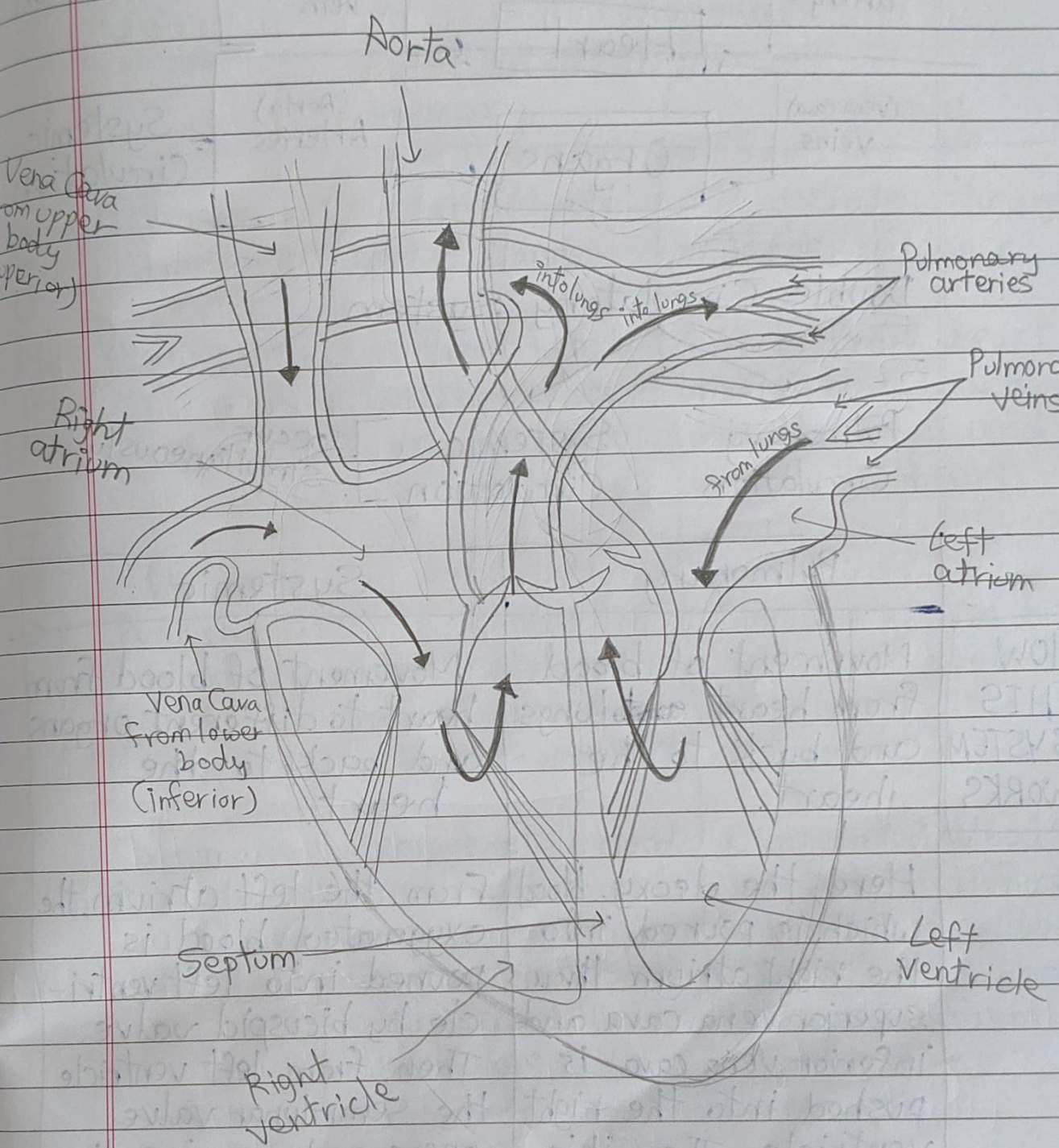
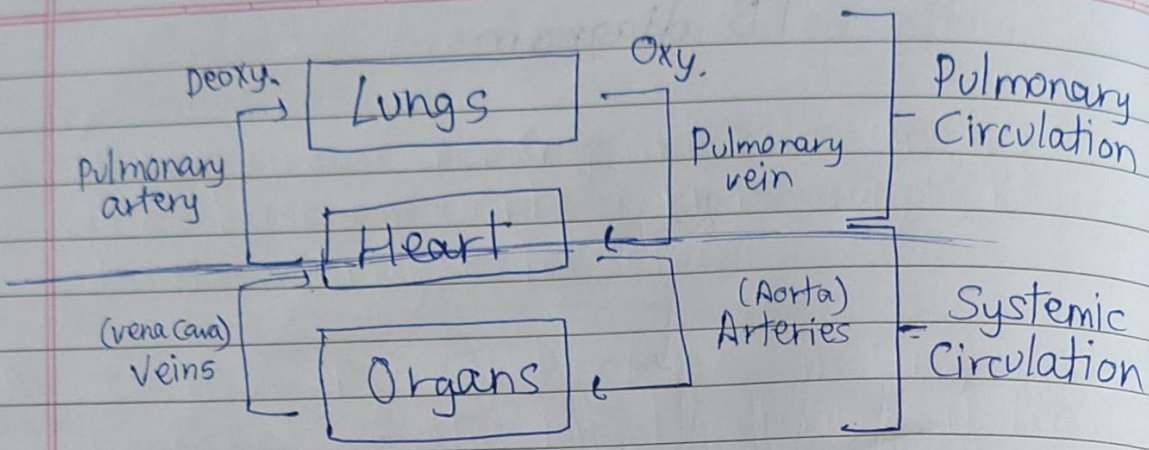
TB diagram





Double Circulatory System

Pulmonary Circulation — Systemic Circulation } occur simultaneously

	Pulmonary	Systemic
HOW THIS SYSTEM WORKS	Movement of blood from heart ~~to~~ lungs and back to the heart.	Movement of blood from heart to different organs and back to the heart.
	Here, the deoxy. blood which is poured into the right atrium thru. superior vena cava and inferior vena cava is pushed into the right ventricle. Then, it is carried by the Pulmonary artery to the lungs for oxygenation.	From the left atrium, the oxygenated blood is poured into left ventricle by bicuspid valve. Then, from left ventricle the semi-lunar valve opens and carries the blood to organs via arteries, the aorta, which supplies the blood to

Then, the oxy. blood is poured into the left atrium by pulmonary vein.	Later, the deoxy. blood is carried to the right atrium through veins (vena cava)

COMPARISON

	Pulmonary	Systemic
Distance	It opens through short distance	It operates through large distance
Flow	It is from heart to lungs and back to heart.	It is from heart to all body parts (other than lungs) and back to heart.
Pumping blood	It is pumped by right ventricle and received by left atrium.	Blood is pumped by left ventricle and received by right atrium
Oxygenation, Deoxygenation	Deoxygenated blood is pumped into the lungs Oxygenated blood is received from the lungs	Oxygenated blood is pumped to different body parts (except lungs) Deoxygenated blood is received from body organs

Since the blood flows twice in one cycle, it is called DOUBLE CIRCULATION.

» There are coronary arteries arising from the base of aorta which supply blood to the cardiac muscles.

» If there is any blockage in any of the branches of the heart (arteries), it leads to MI (Myocardial Infraction) (heart attack).

» When heart stops beating, i.e., when SAN (Sino Arterial Node) fails to produce impulse. It is called cardiac arrest. (heart fail)

Q Walls of the ventricles are thicker than the atrium. Give reason.

Ans. Because ventricles have to pressure pump blood into various organs of the body while the atriums serves to receive the blood.

Q What is a pacemaker?

Ans. It is an artificial instrument. It is a lithium battery (lifespan approx. 11 years). It is implanted in the patient's chest when SAN becomes defective. It stimulates the heart electrically at regular intervals to beat at normal rate.

Q What would be the consequences of deficiency of haemoglobin in our body?

Ans. Haemoglobin (Hb) efficiently binds with oxygen.

Deficiency is referred as anaemia. Person feels sick, weak and the skin becomes pale.

Q Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

Ans. Mammals and birds are warm-blooded animals. So they need energy constantly to maintain their body temperature. Thus, it is important that blood should not get mixed up.

SAN [Sino Artrial Node]

- Present in the Right Atrium of heart.
- Generates electrical signals, causing atrium to contract or pump.
- SAN is considered as the pace-maker of the heart.

Heart Beat

- The number of times the heart beats per minute.
  * 72 - 80 times per minute

Blood Pressure

- The pressure at which the blood is pumped around the body, i.e., the pressure created by flowing blood on the walls of the arteries.
- The maximum pressure at which the blood leaves the heart through the main artery during the contraction phase is called systolic pressure.
- The minimum pressure in the arteries during relaxation phase is called diastolic pressure.

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» Normal BP - 120/80 mm of Hg

~~BP - Systolic Pressure/Dias~~

BP = Systolic Pressure / Diastolic Pressure

» BP measuring device - Sphygmomanometer.

» High BP - Hypertension
Low BP - Hypotension

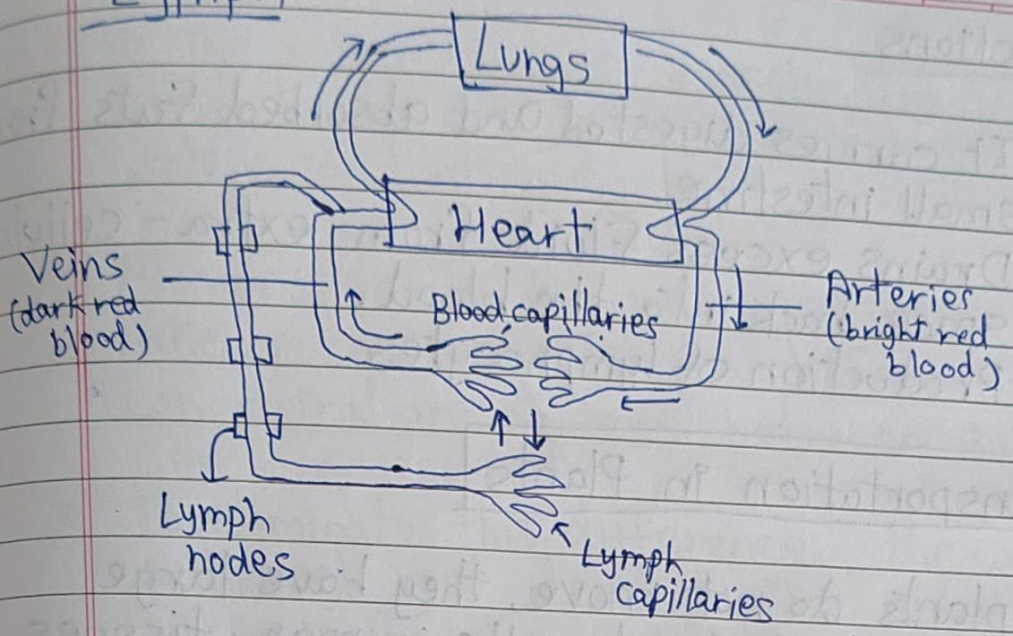
Pulse

» It is the expansion of arteries each time the blood enters it.

» Each heart beat will produce one pulse.
∴ Pulse is similar to heart beat.

» Can be felt at wrist, ankle, neck region.

Lymph



» From the capillaries, some amount of plasma, proteins and blood cells (lymphocytes) escape from intra-cellular space out through the pores present in the walls of the capillaries and forms tissue fluid / lymph.

» This excess fluid drains into the lymph capillaries → reach lymph vessels and eventually are poured into the veins.

Lymph is another type of fluid involved in trasportation ; is also known as tissue fluid.

» It is similar to plasma (yellow)
But this is colourless.

» Contains less proteins

» It is the site of production of lymphocytes. (Agranular WBCs)

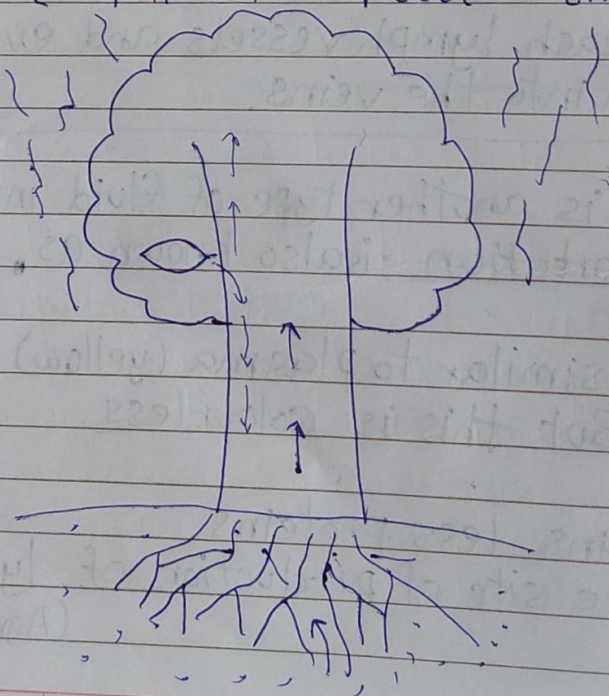
Functions

1. It carries digested and absorbed fats from small intestine.
2. Drains excess fluid from extra-cellular space back into the blood.
3. Production of lymphocytes.

Transportation in Plants

- As plants do not move, they have large proportion of dead cells in many tissues.
  Eg - cork
  ↓
- So, they have low energy needs.
- So they use slow transport system.

- Vascular Bundles { Xylem - Water, minerals [unidirectional]
  Phloem - Food [multi-directional]



Xylem

- The xylem tissues, vessels, tracheids of roots, stem, leaves are inter-connected to form a water conducting system.

- At roots, cells in contact with the soil actively take up ions, creating a difference in the concentration of ions between soil and roots.

- To eliminate this difference, the water moves up through root, developing a column of water that is pushed upwards.

- This is Root Pressure.

- However, this root pressure alone is not sufficient for tall plants.

Transpiration Pull

- Transpiration means loss of water from aerial parts of the leaves in the form of water vapour.

- This helps in absorption and upward movement of water and minerals as stomata create a suction pull so that xylem can bring up water.

- It also helps in temperature regulation

» The effect of root pressure is more important at night.

» During day, the stomata are open, so, the transpiration pull becomes the major driving force in movement of water in xylem.

Phloem

» Transportation of food - "TRANSLOCATION"

Translocation

» Done by Phloem, sieve tubes, companion cells in both upward and downward direction

» Transports soluble products like sugars, plant hormones, amino acids for storage and growth of the organs.

Eg - Sucrose transfers through ATP

↓

Increases osmotic pressure of tissue

↓

Causes water to move in

↓

This pressure moves the phloem material to tissues with less pressure.

∴ Moves food material according to the plants' need.