

investigators working with serum. The remedy is to allow the clotting to occur at a higher temperature in a incubator.

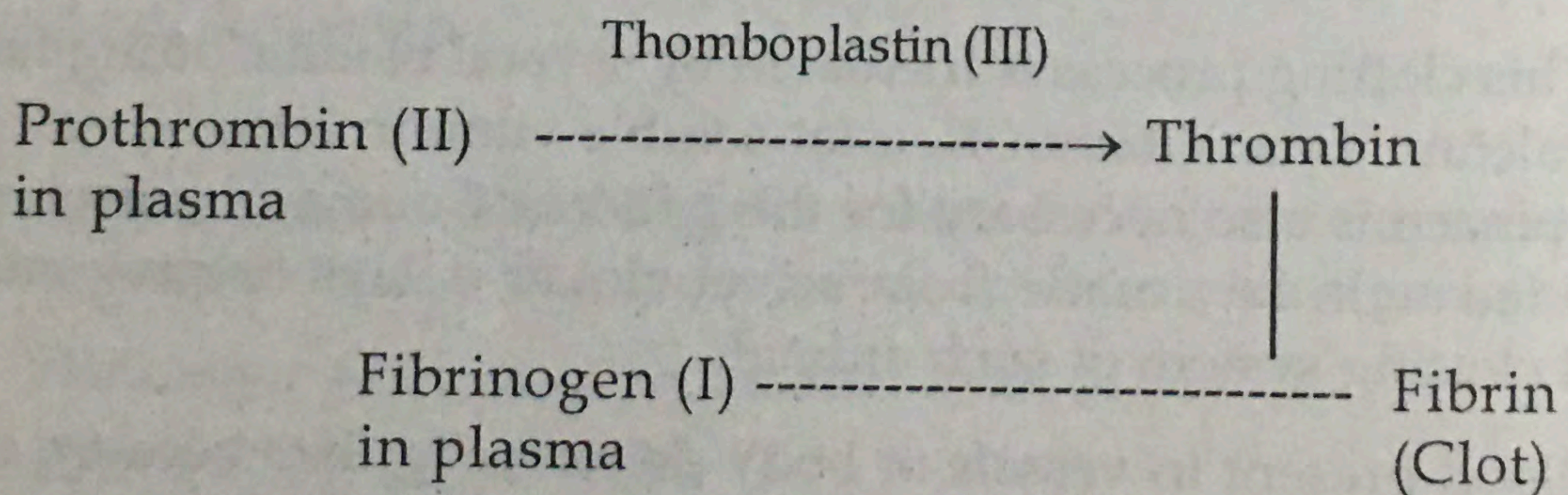
*Coagulation time* : Coagulation time is the length of time required for coagulation to set in after the blood has been shed. The coagulation time for blood of buffalo calves was 7.3 minutes.

### Mechanism of Blood Clotting

Blood clotting is essentially a series of enzymatic reactions involving a number of plasma proteins. Under normal conditions, these enzymes are present in the form of inactive precursors. However, when blood comes in contact with a wettable surface such as glass, a series of autocatalytic reactions are initiated.

In mammals, the blood clot consists of a matrix of an insoluble fibrous protein, called fibrin, in which are entangled the red blood corpuscles. Fibrin, is formed from another soluble protein present in blood called fibrinogen. The fibrinogen content of the blood approximates 0.3%. The transformation of fibrinogen to fibrin is catalysed by the enzyme, thrombin. Thrombin, too, is formed from a inactive precursor, prothrombin, present in the blood plasma.

These are only the final steps in the complex sequence of biochemical events leading to the process of clotting of blood.



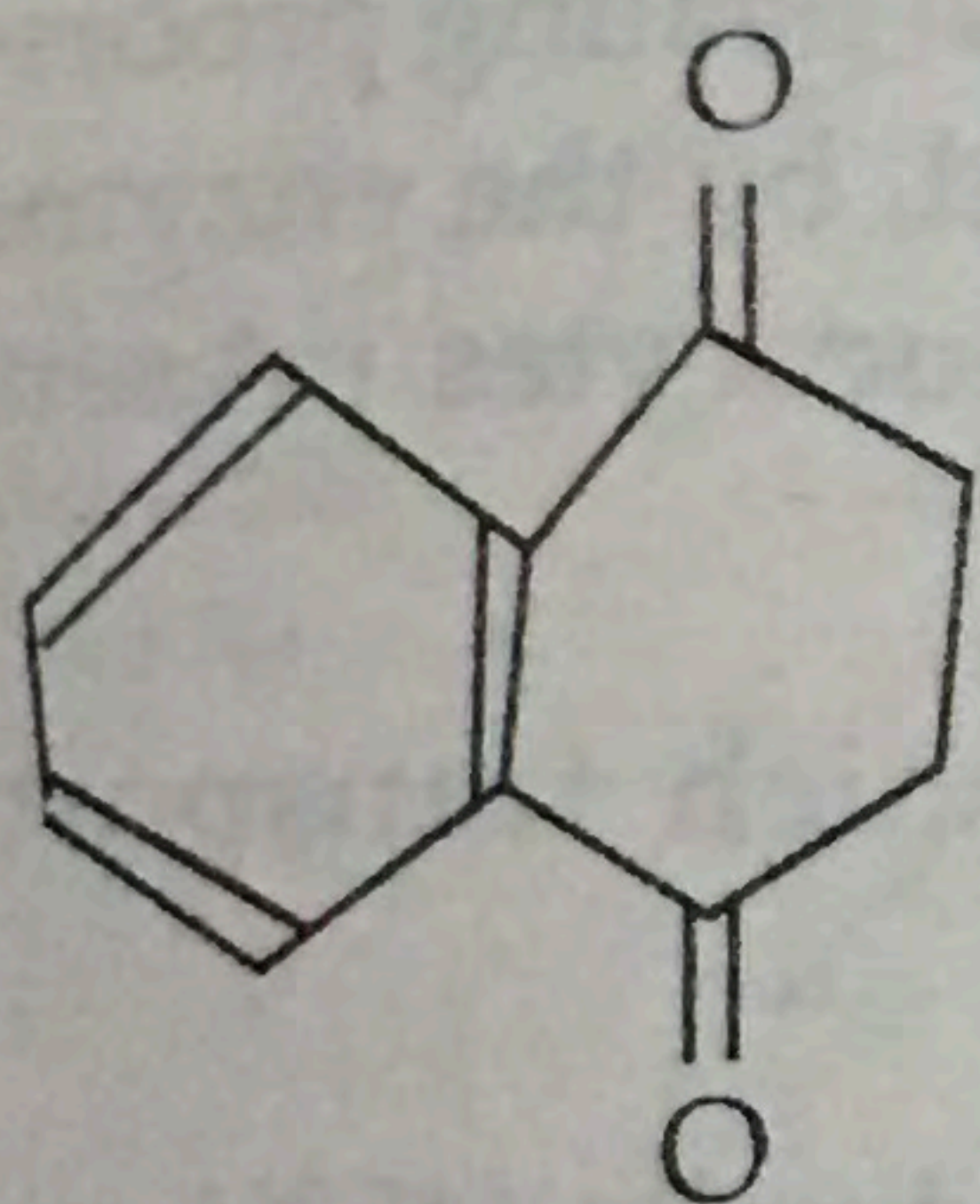
More than 12 clotting factors have been identified, using human patients with various deficiencies in clotting mechanisms.

### Vitamin K and Blood Clotting

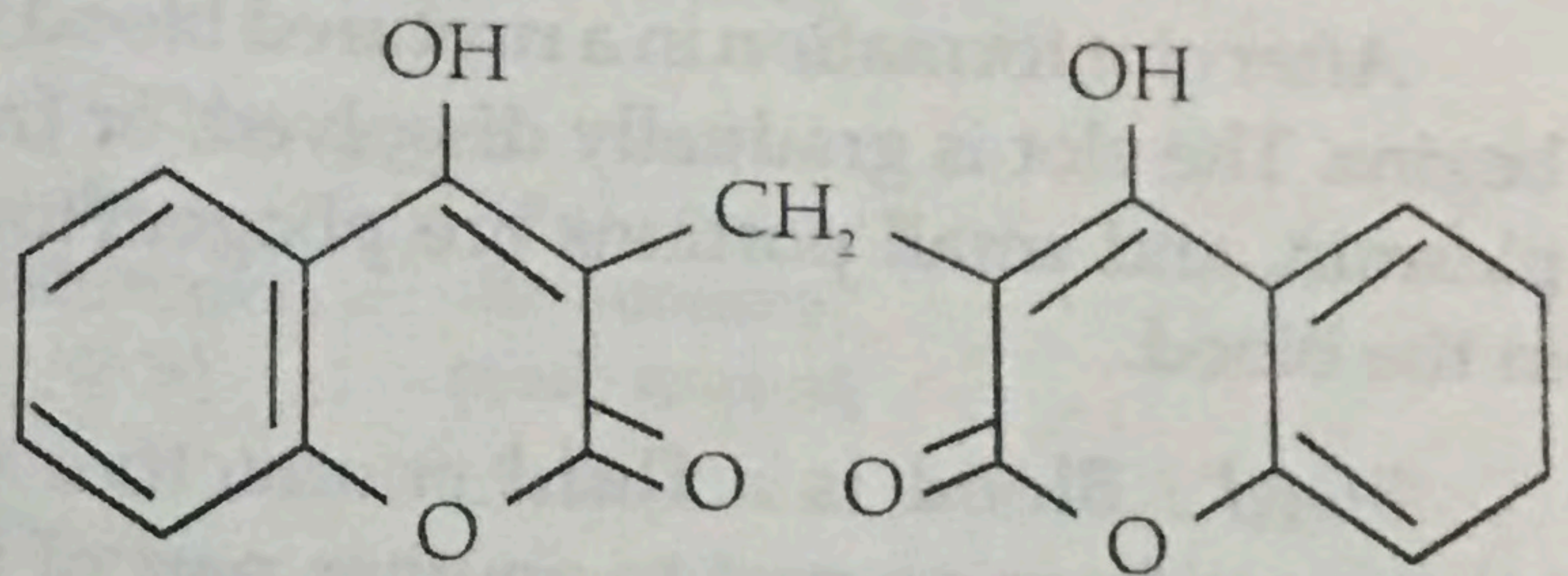
Vitamin K is a complex naphthoquinone derivative which is indispensable for the synthesis of prothrombin by the liver. The deficiency of vitamin K leads to a decrease in plasma prothrombin concentration and a corresponding prolongation of the coagulation time of the blood.

Vitamin K is widely distributed in nature; thus it is found in green vegetables, cereals and animal tissues generally. It is synthesized by bacteria in the rumen and those present in the human intestine. Vitamin K deficiency from dietary abnormalities is very rare in man and domestic animals.

Dicoumarol discussed earlier as preventing coagulation is actually a vitamin K antagonist. This substance is related to the naphthoquinone derivatives which has vitamin K activity. Because of chemical resemblance, dicoumarol acts as an anti vitamin K by the process of substrate competition. Dicoumarol replaces vitamin K in the liver, at the latter's normal site of action and thus prevents the vitamin from carrying out normal physiological function.



1: 4 naphthoquinone



Dicoumarol

## Hemorrhagic Diseases

### Haemophilia

In such condition, the coagulation time is unusually long with the result that a minor wound or cut will result in excessive loss of blood. Such a condition is transmitted from parents to offspring as a sex linked recessive character. This disease is found in several domestic animals and man.

The clotting mechanism works as a biochemical amplifier in a series of enzymatic steps, in which the enzymes formed in the first step serves as a catalyst or activator for the next step or so on. The enzymatic amplification allows clotting to take place rapidly, yet provides a considerable safety margin to prevent spontaneous coagulation within the vascular system.

Severe blood loss leads to a decrease in blood pressure and thus reduces the flow of blood to the damaged area. Damaged blood vessels constrict and thereby decrease blood flow.

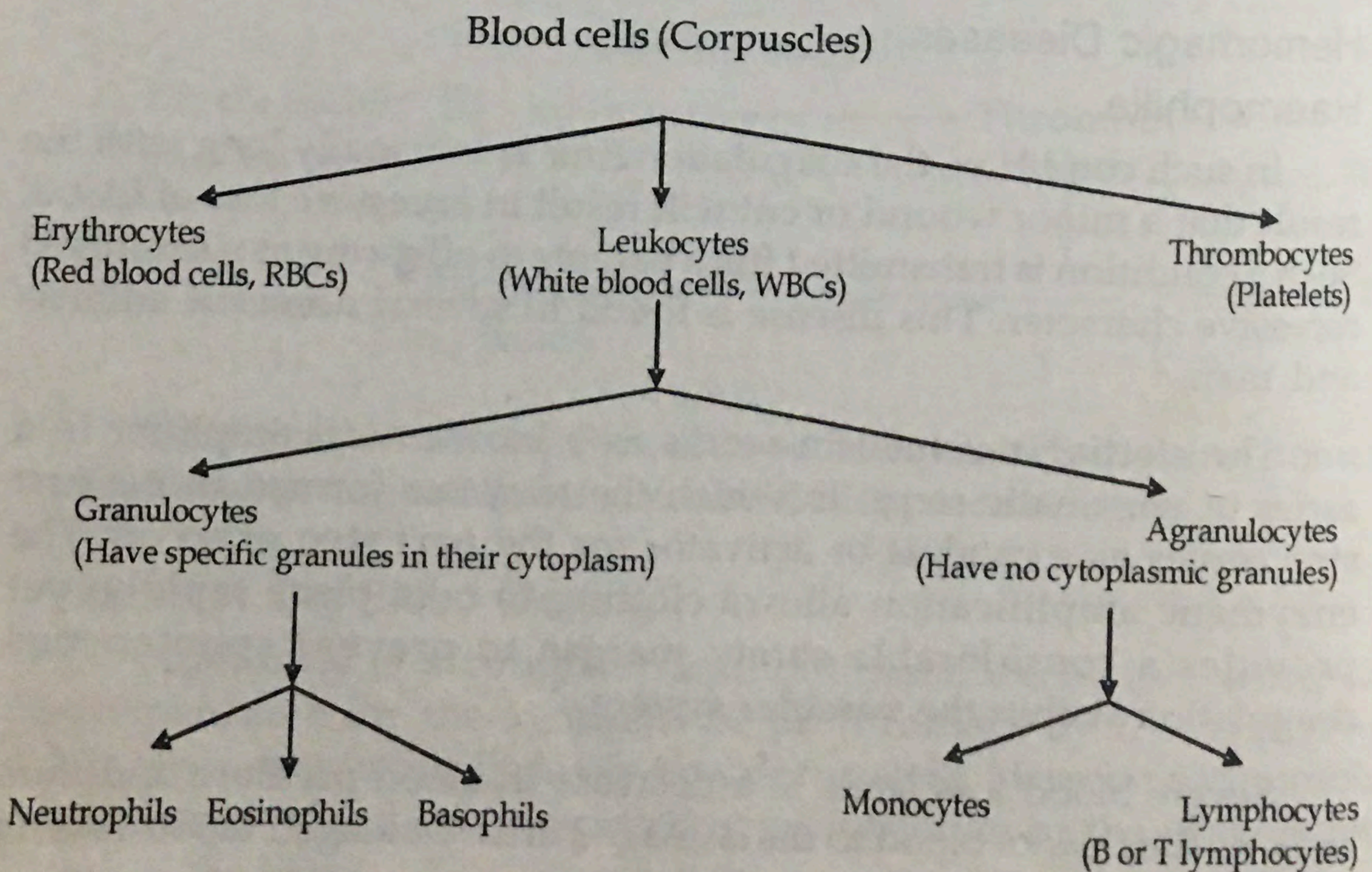
During the winter of 1921, a new disease among cattle was reported in Canada and north-central United States, in which cow might merely scratch herself on a barbed wire fence and bleed to death. The faulty clotting mechanism was related to the fact that the cattle had been eating mouldy sweet clover hay. It became known as sweet clover hay disease. Link and Campbell at the University of Wisconsin were able to extract the substance dicoumarol from mouldy hay. Later it was found that Dicoumarol acts on the liver, inhibiting the formation of prothrombin, so that within a few days the blood fails to clot. Now a days, after this discovery dicoumarol found extensive use as an anticoagulant.

### Healing Process

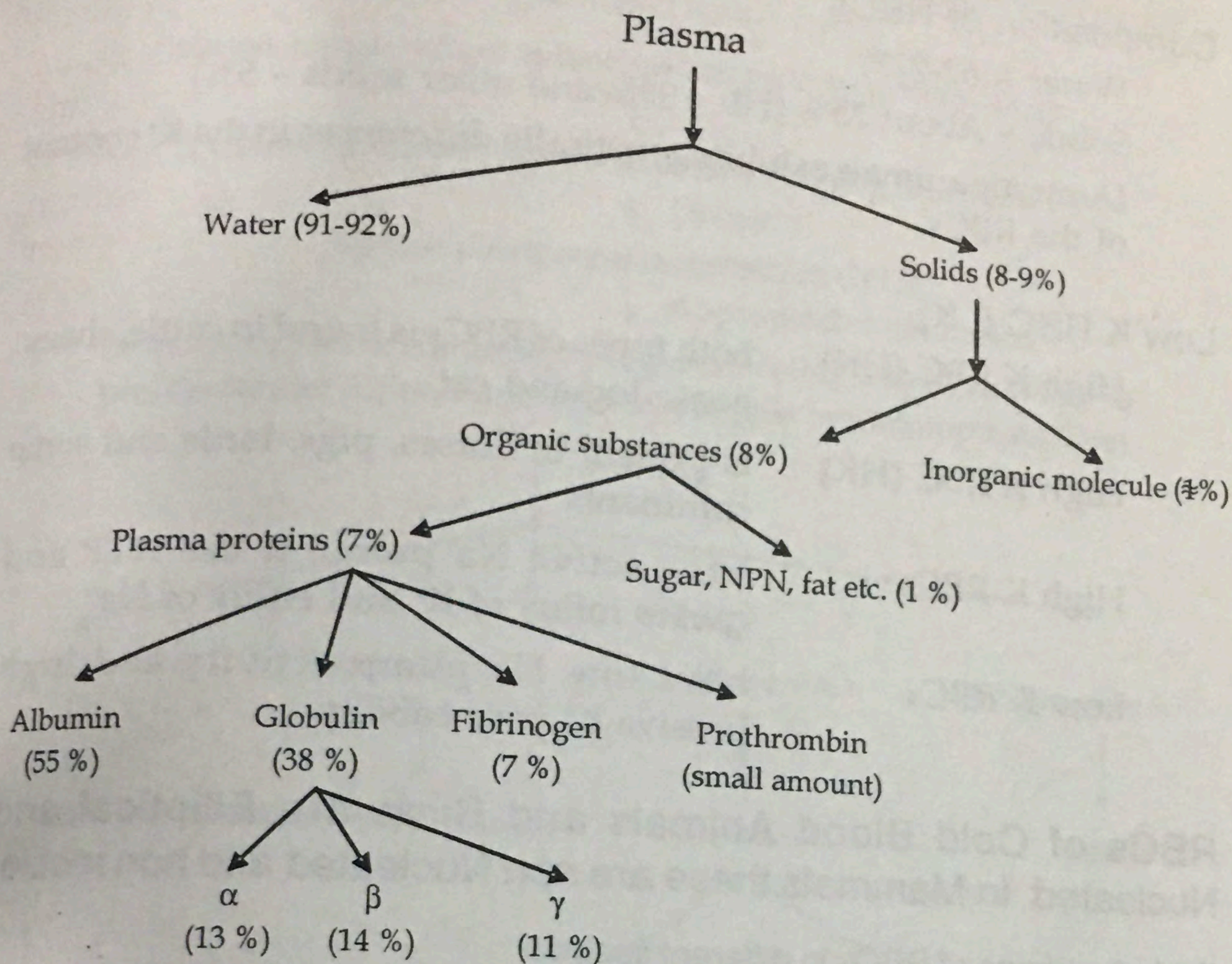
After clot formation in a ruptured blood vessel, the healing process begins. The clot is gradually dissolved, or fragmented, by the enzyme plasmin, and small portions are phagocytosed by leucocytes present in the blood.

*Blood* : Blood is a fluid connective tissue which transports substances from one part to another part of body.

*Composition of blood* : Blood is composed of blood cells (45%) and plasma (55%). Blood cells are suspended in plasma.



## Composition of Plasma



## Function of Blood

1. *Nutritive function* : Blood carries nutritive substances from the gut to the tissue where they are utilized.
2. *Respiratory functions* : It transports  $O_2$  from lung to the tissue and  $CO_2$  from tissue to lung.
3. *Excretory function* : It transport various metabolic waste products to the excretory organs (kidney, skin, intestine and lungs).
4. *Transport function* : Various hormones, enzymes, antibodies are transported by blood.
5. *Protective functions* : It plays important role in defence mechanism of the body.
6. Maintenance of body temperature.
7. *Storage functions* : It store various nutrients such as glucose, protein, electrolytes and water for use in emergency conditions.
8. Maintain fluid balance and pH equilibrium in the body.

## Composition of RBCs

Water - 62-72%

Solids - About 35% (Hb - 95% and other solids - 5%)

Domestic animals exhibits genetically differences in the  $K^+$  content of the RBCs.

### Low K RBC (LK)

High K RBC (HK) both types of RBCs is found in cattle, sheep, goat, dog and cat

High K RBC (HK) is present in horses, pigs, birds and some ruminants

High K RBCs have active Na pump, it use ATP and causes influx of  $K^+$  and efflux of  $Na^+$

Low K RBCs have low Na pump activity and high passive  $K^+$  permeability.

RBCs of Cold Blood Animals and Birds are Elliptical and Nucleated. In Mammals these are non Nucleated and non motile.

**Table 9 :** Shape of RBCs in different species

Species	Shape of RBCs
Dog	Markedly biconcave
Cat and horse	Slightly biconcave
Goat	Little biconcave
Camel and other members of family camellidae (llama, alpaca, vicuna)	Elliptical
Birds	Elliptical with nuclei
Cold blood animals	Elliptical with nuclei

### Sites of erythropoiesis

Stage of life	Sites of erythropoiesis
Early embryonic development	Yolk sac
Late embryonic development	Liver, spleen and lymph node
Later part of gestation	Bone marrow
After birth	Bone marrow