

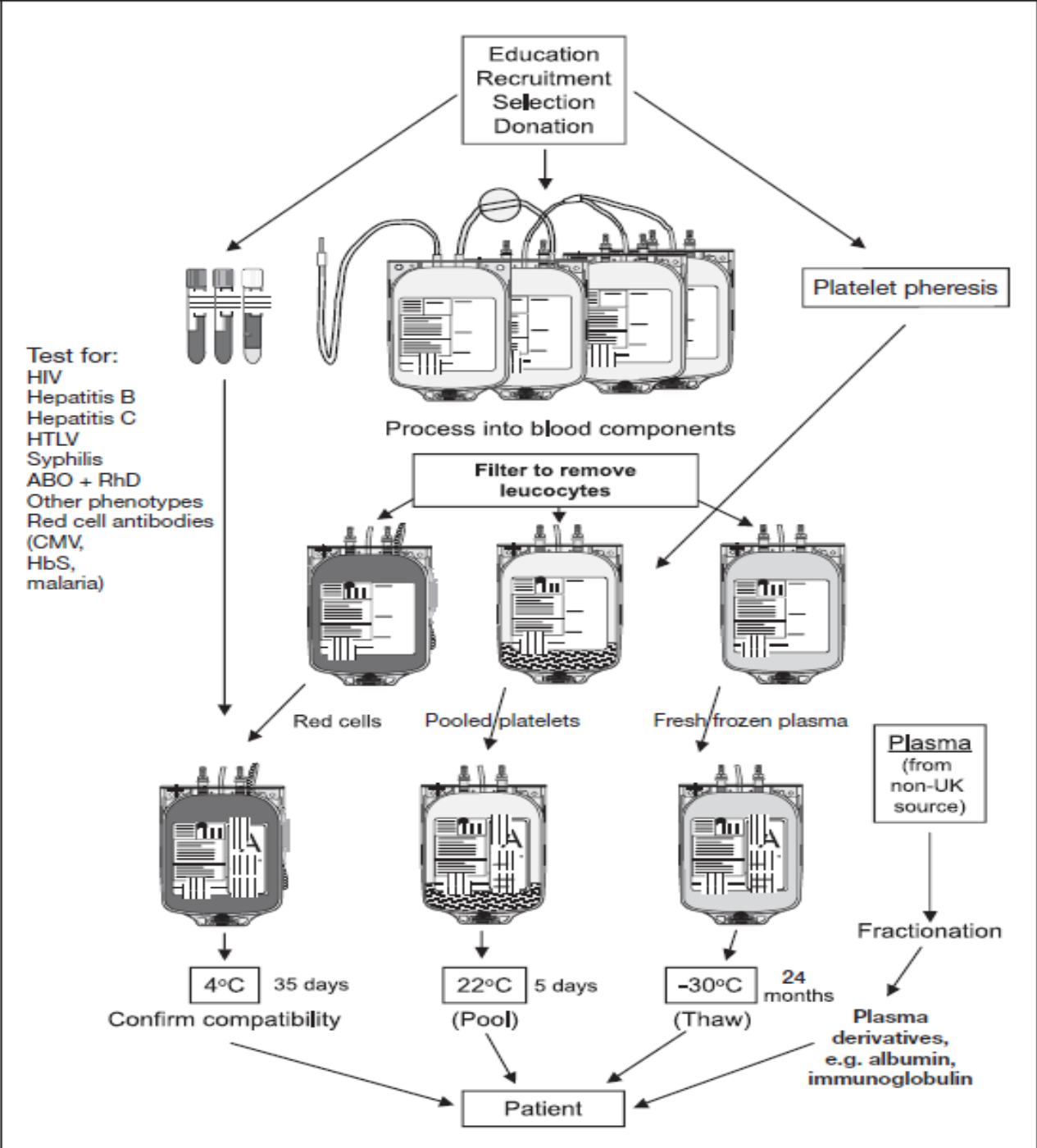
# Blood components

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# Introduction

- Whole blood unit obtained from donors is separated in the donor processing area of blood bank into various components.
- This allow for effective use of donated blood and lowers the exposure risk of the transfused patient.
- Blood is composed of plasma and blood cells.
- Plasma contains vital proteins such as coagulation factors, fibrinogens, albumin, and globulin (including immunoglobulins).
- The clinical requirement of a patient determines which blood product should be transfused.

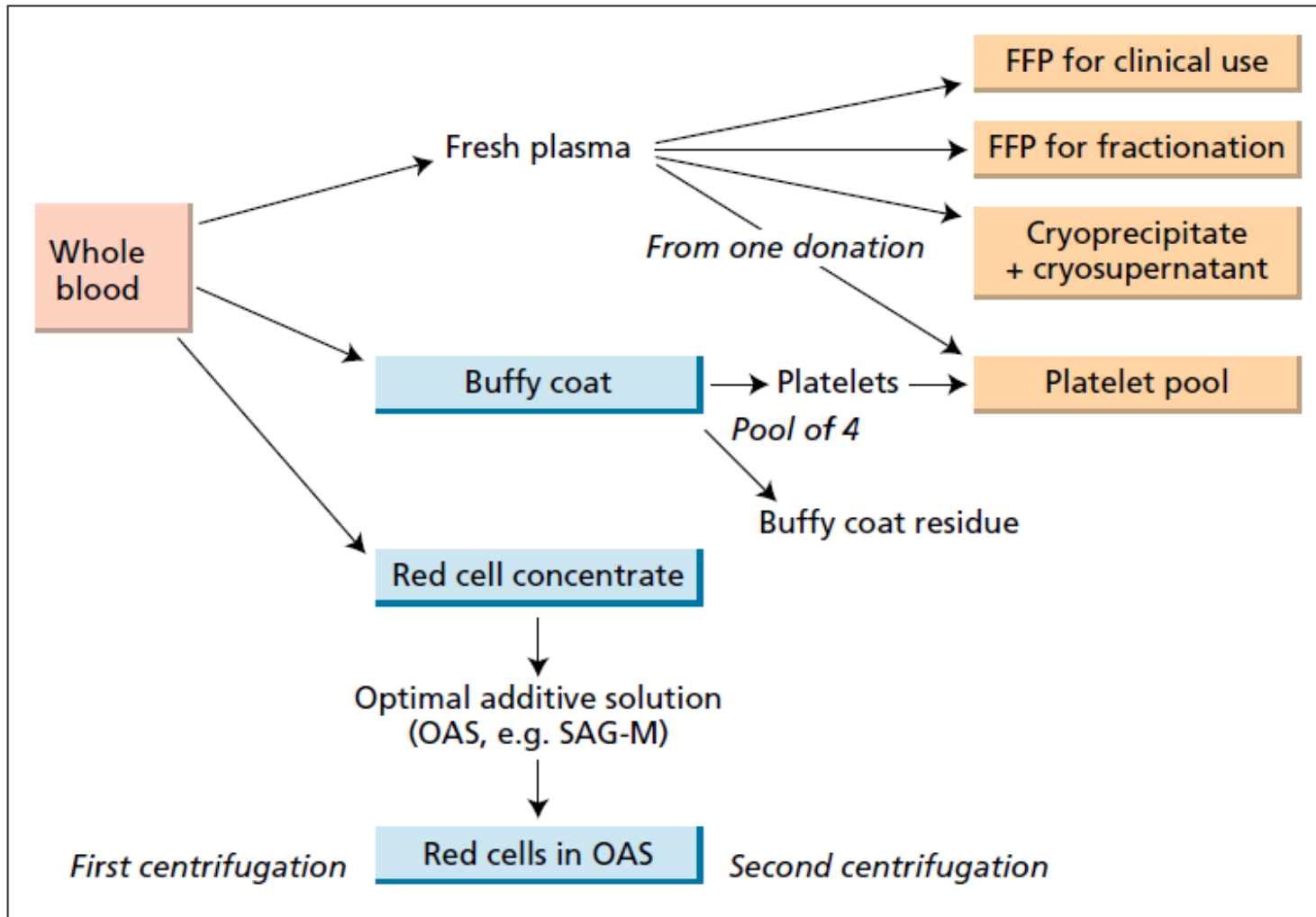


# Blood components

- Blood components and products are obtained by donors.
- A donated blood unit consists of around 450-500 ml of blood mixed with anticoagulant.
- An alternative process for the collection of blood is that of **apheresis**, which uses cell separation equipment and centrifugation.

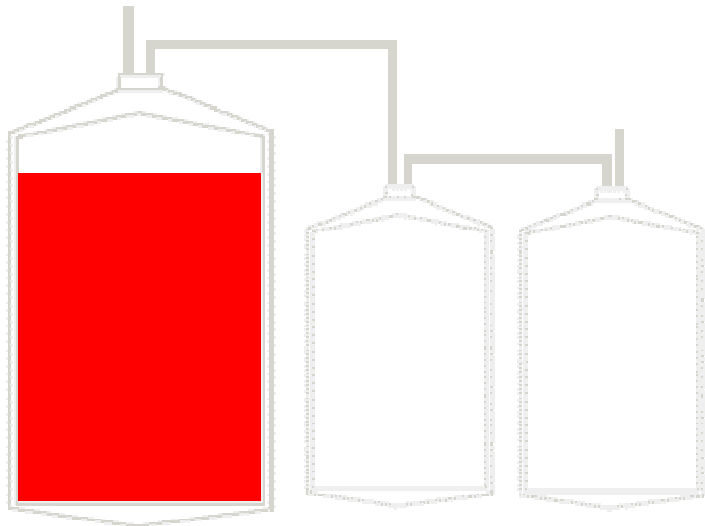
# Blood components

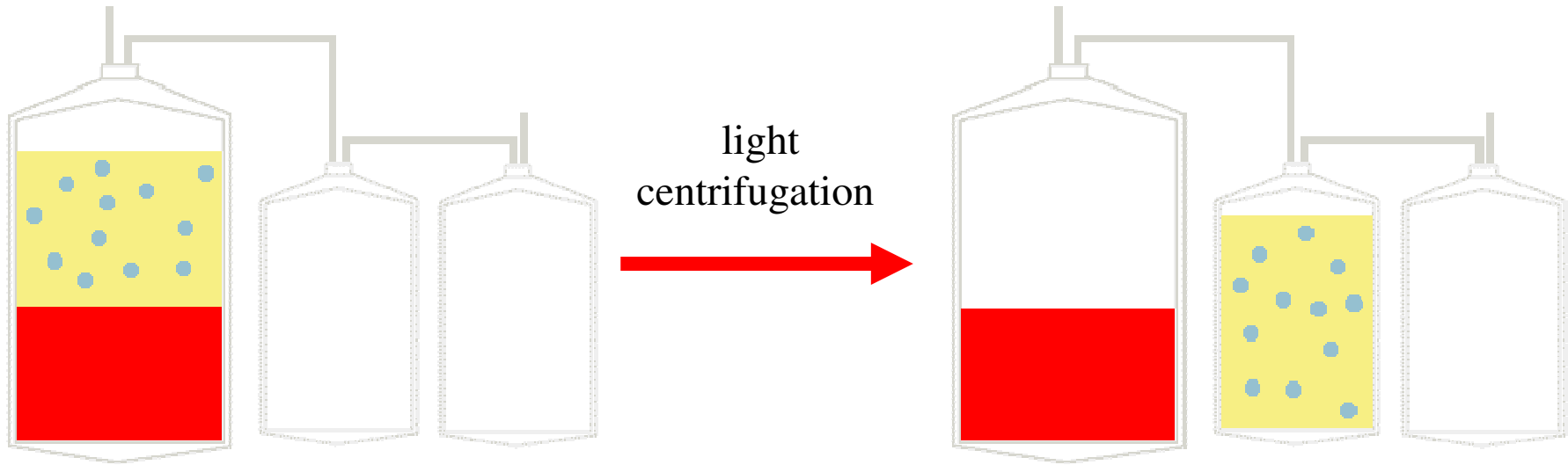
- **Blood components available from whole blood include:**
- Red cell concentrates (packed RBCs).
- Platelets concentrates.
- Fresh frozen plasma
- Cryoprecipitate
- **Products derived fro pooled plasma:**
- (human albumin, immunoglobulins, coagulation factor concentrates)



# Processing of blood components

Blood is collected as whole blood, as shown below



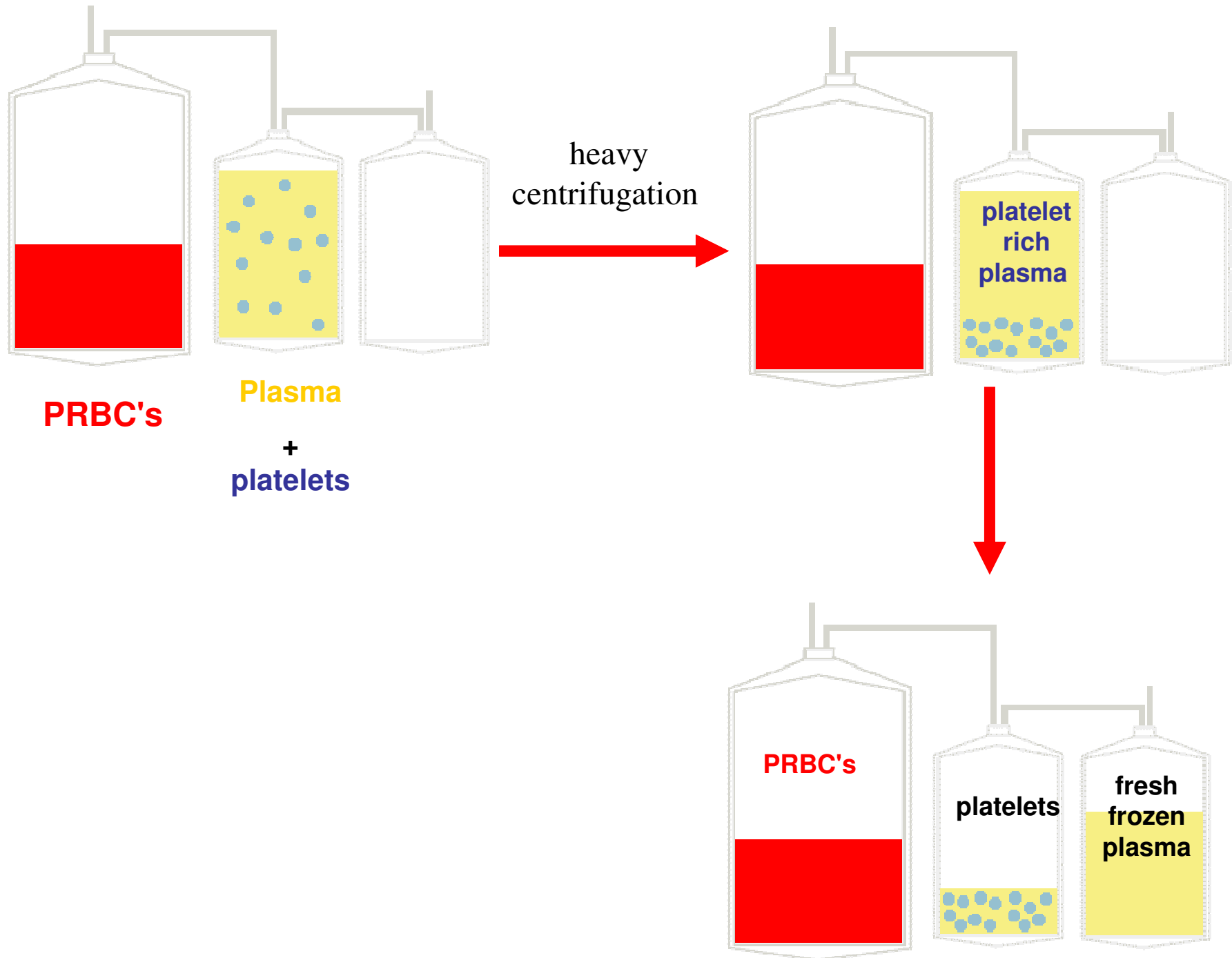


packed red blood cells (PRBC's) is prepared by light centrifugation

**PRBC's**

**Plasma +  
platelets**







▲ Closed system of blood collection. (A) The components of blood are spun down but not separated into satellite bags. (B) The components of blood (i.e., pRBCs, plasma) have been separated and transferred to satellite bags.

# Red cell concentrates



- Red cell concentrates are obtained by centrifugation and removal of plasma.
- Red cells contain the oxygen carrying molecule haemoglobin.
- A solution of citrate, phosphate, dextrose-adenine (CPD-A) is used as anticoagulant in the blood unit.
- Citrate prevents blood from clotting by removing calcium ions.
- Adenine is required to maintain the metabolic activity of red cells in the blood pack.
- Red cell concentrates in CPD-A are kept @ 2-6 C and their shelf life is 35 days.

# Red cell concentrates

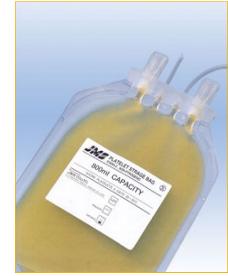


- As the blood ages, the 2,3-DPG levels and the oxygen carrying capacity are reduced.
- The shelf life of red cell concentrates can be increased by using preservative substances to prolong the activity of 2,3-DPG and maintain the ATP level required by RBCs.
- An example of these is SAGM (Saline, Adenine, glucose and mannitol).

# Leukocytes-depleted blood components

- Leucocytes in the blood units may cause infections and non-haemolytic transfusion reactions to the recipients.
- Therefore, leucocytes are removed from blood components by filtering through leucocytes specific filters prior to transfusions.
- This process called leucocytes depletion.
- Examples of infections transmitted by leucocytes in blood products: Creutzfeldt-Jakob disease (CJD) and CMV.

# Plasma derived components



- Plasma is separated from whole blood by high centrifugation.
- Aspiration of plasma components is performed in a 'closed system' to prevent infection of the blood.
- 1) Human albumin** is important as a binding protein. It is also critical for providing osmotic activity and maintaining blood in blood vessels.
- Human albumin is produced from plasma and treated to inactivate viruses and bacteria before it is given to burns patients.
- 2) Immunoglobulins:** produced from standard donation or apheresis.
- Can be stored for 12 months at 4-6 C.
- Indicated for patients with immunodeficiency conditions (SCID).
- 3) Coagulation factors:**
- Factor VIII can be derived from plasma to treat haemophilia A patients.
- Recombinant factor VIII is now available.
- Factor VII and factor IX concentrates are also of clinical use.

# Fresh frozen plasma (FFP)



- FFP is produced from single donors.
- Plasma is harvested within 6 hours of donation from the red cells and rapidly frozen @ -70 C, and stored @ -30 to maintain coagulation factors at optimum conditions.
- FFP is leucodepleted and may be virally inactivated before being given to patients.
- **Clinical indications:**
  - 1) coagulation deficiencies and haemorrhage conditions (massive blood loss, infection or surgery of the liver).
  - 2) acquired coagulation factor deficiencies such as DIC.
- **Compatibility:**
  - Only compatible FFP should be given (ABO specific or AB units) to prevent transfusion reactions.

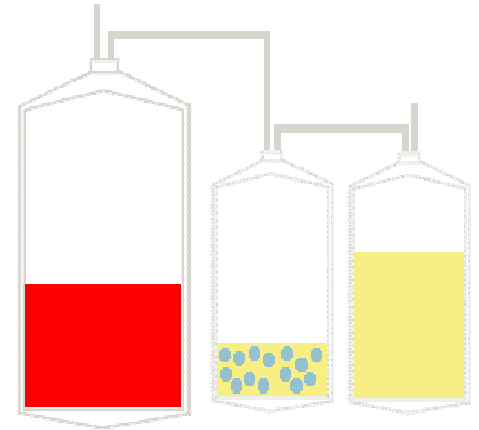
# Cryoprecipitate

- Cryoprecipitate is a source of factor VIII and fibrinogen extracted from single donor plasma.
- It is prepared by slowly thawing FFP @ 4C. This process precipitate and enrich a fraction of FFP with factor VIII.
- Cryoprecipitate is then stored @ -30.
- Cryoprecipitate is used mainly for patients with DIC and patients with factor VIII deficiency.



# Platelets concentrates

- Platelets are essential for preventing blood loss by forming the platelet plug at the site of damaged vessel wall.
- Patients lacking platelets are prone to bruising and bleeding.
- Platelets concentrates are prepared from platelets rich plasma by aspiration into another satellite pack.
- 4 packs pooled to provide one adult unit.
- Platelets units can also be collected by plasmapheresis.
- Platelets are stored @ RT for 5 days.
- Platelets units should be leucodepleted before transfusion.
- Blood group-specific platelets should be given.



# Transfusion requirements for massive blood loss

- Surgical haemorrhage or traffic accidents cause severe blood loss.
- Patients who had **massive blood loss** has 3 major requirements: replacements of the lost volume of blood and to provide oxygen carrying capacity, and replacement of lost coagulation factors.
- **Blood volume** is replaced by whole blood or solutions such as (human albumin, saline).
- **Oxygen carrying capacity** is provided by giving whole blood or packed RBCs (red cell concentrates).
- Coagulation factors are replaced by giving fresh frozen plasma.

# Transfusion requirements pre and post surgery

- To compensate for blood loss during surgery a 'top up' of packed RBCs is needed.
- Fresh frozen plasma may be required post surgery as well to compensate for coagulation factors.

# Transfusion requirements for certain blood diseases

- Certain blood disorders such as leukaemia and aplastic anaemia require supportive therapy to correct for anaemia and low platelets count.
- Supportive therapy can be achieved by giving various blood products such as packed RBCs, platelets concentrates, and coagulation factors.

## Clinical indications for blood components therapy

Component	Major indications	Volume (ml)
Whole blood	Symptomatic anemia with large volume deficit	750
Red blood cells (RBCs)	Symptomatic anemia	330
RBCs (washed)	Symptomatic anemia Sever allergic reactions	180
RBCs (Leukocyte-reduced)	Symptomatic anemia Febrile reactions due to WBC antibodies Reduce CMV transmission Reduce HLA alloimmunization	330
Platelets	Thrombocytopenia or platelet function abnormality Bone marrow hypoplasia	60
Platelets pheresis	Crossmatched and or HLA matched	300
Platelets (WBC reduced)	Prevention of febrile reactions Prevention of HLA-alloimmunization	300
Granulocytes pheresis	Neutropenia (resistant to antibiotics)	220
Fresh frozen plasma	Coagulation factors deficiency TTP	220
Thawed plasma	Deficiency of stable coagulation factors	220
Cryoprecipitate	Hypofibrinogenemia Factor XIII deficiency	15