Blood Products and Blood Transfusions

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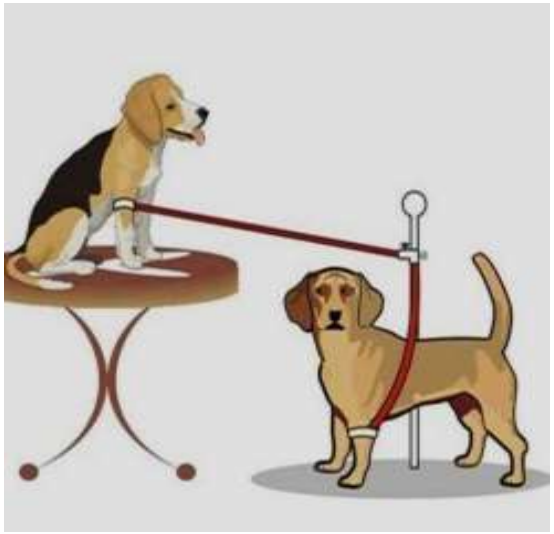
Journey to Specialist Blood Banker

- 1990 Second child experienced an in-utero stroke and a heart defect, ASD, diagnosed at 10 months – felt powerless.
- Wanted to help people – but not in a front-line way.
- An area essential for patient treatment but little stressful patient contact.
- 1992 Self-funded undergrad from Indiana University, BSc Clin Lab Science (General and Hematology).
- Worked in USA Hospitals for 12 years.
- Joined Army April 2007 - Active Duty.
- Masters Immunohematology (= Blood Banking) 2015 “Specialist Blood Banker”.

INTRODUCTION

- Blood is the the fluid of life.
- Blood transfusion is the giving of blood from one person to another.
- On the battlefield, it often means the difference between life and death.

HISTORY OF BLOOD TRANSFUSION



- **1665**
  First recorded blood transfusion in England “dog to dog" via a tied artery.
- **1818**
  first successful HUMAN blood transfusion to treat postpartum hemorrhage.
- **1900** Karl Landsteiner
  Discovery of the three basic human blood groups, A, B and O.
- **1902** Decastello and Sturli, add a fourth blood type, AB.

- **1914**

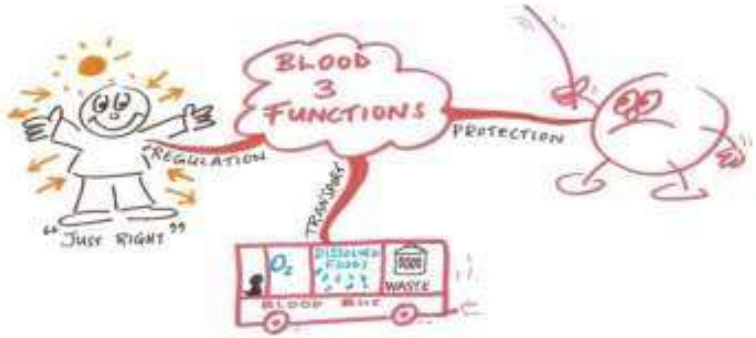
  Sodium citrate can anticoagulate blood for transfusions, allowing it to be stored and later transfused safely to patients on the battlefield.

- **1940**

  The Rh blood group is discovered when RBCs of Rhesus monkeys were injected into rabbits.

- **1985** The first HIV blood-screening test is licensed and implemented by blood banks.

FUNCTIONS OF BLOOD



TRANSPORTATION

- Respiration
- Nutrient carrier from GIT
- Transportation of hormones from endocrine glands
- Transports metabolic wastes

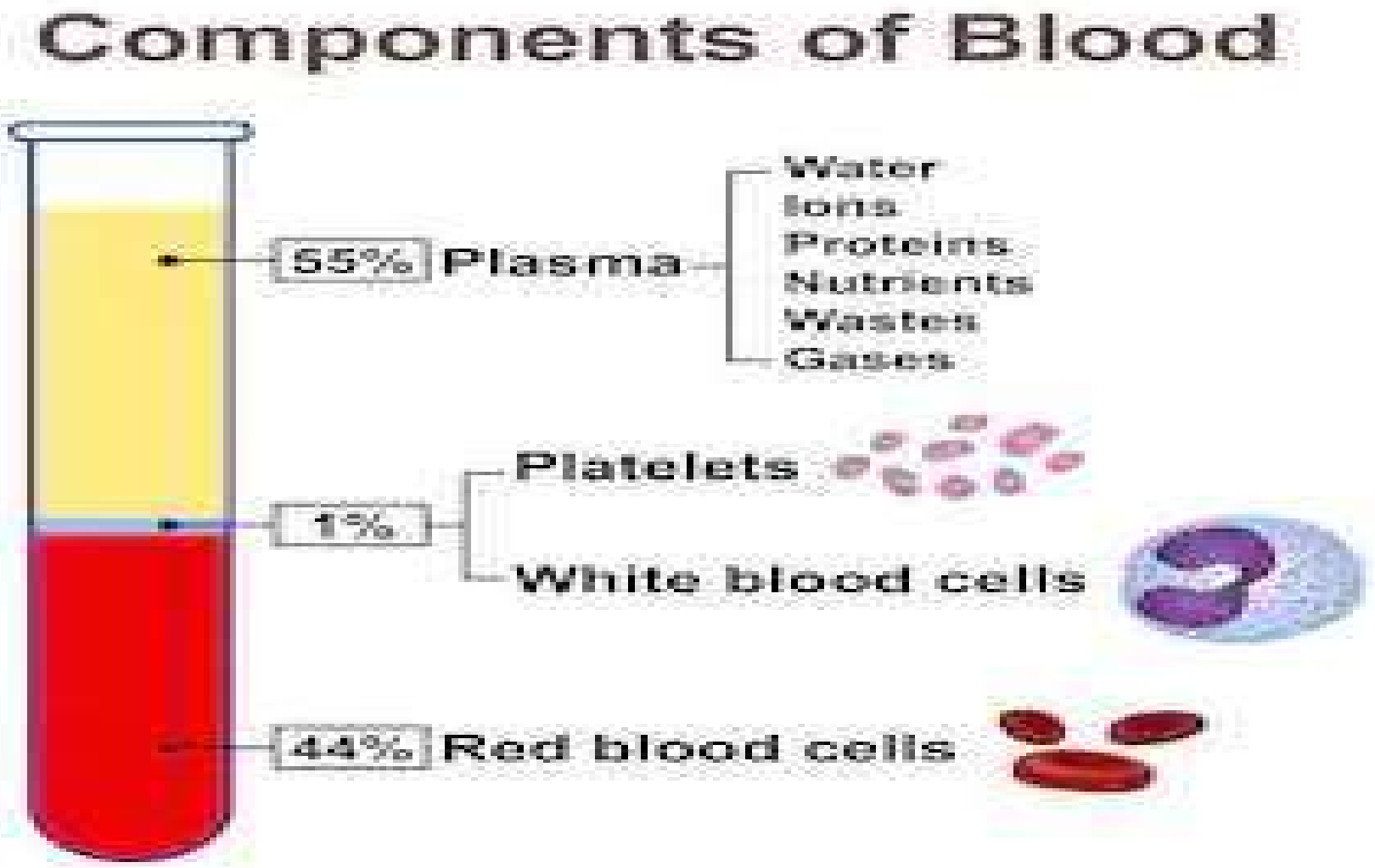
REGULATION

- Regulates pH
- Adjusts and maintains body temperature
- Maintains water content of cells

PROTECTION

- WBC protects against disease by phagocytosis
- Reservoir for substances like water, electrolyte etc.
- Performs haemostasis

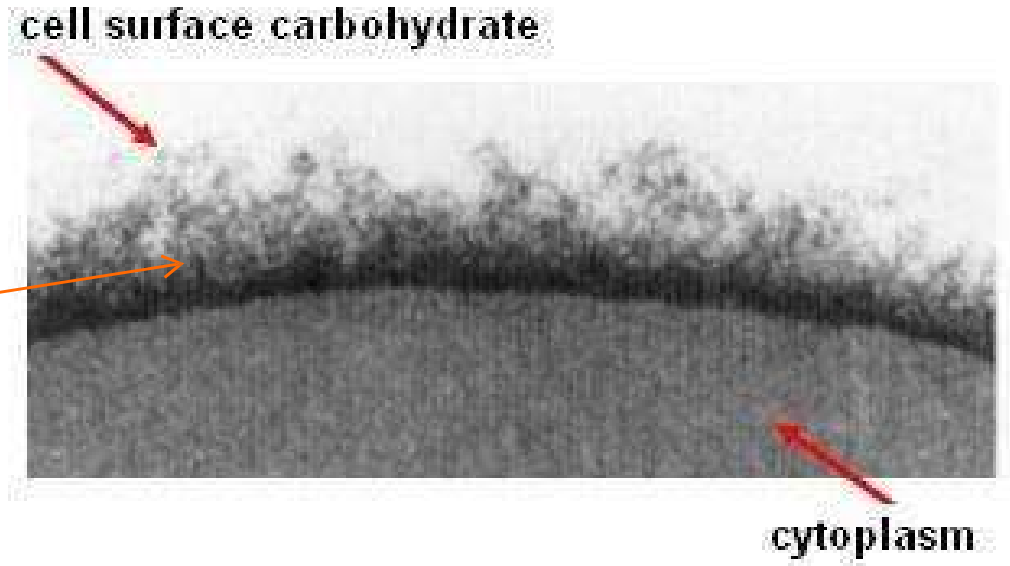
COMPOSITION OF BLOOD

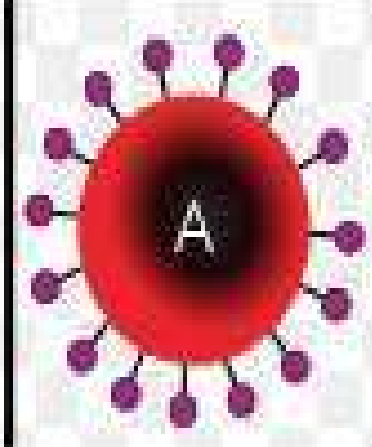
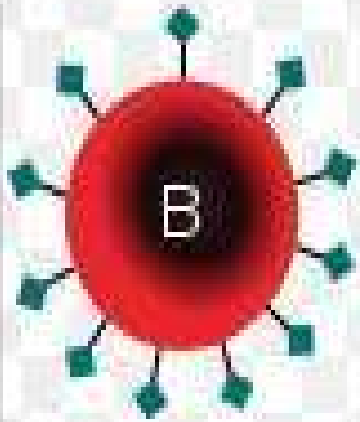
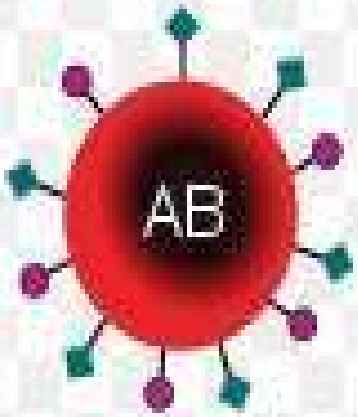
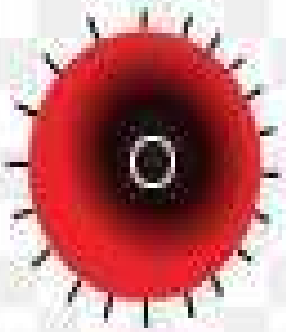
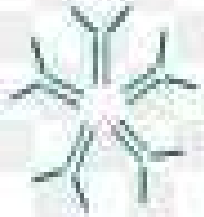
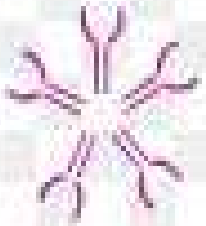


ABO BLOOD GROUPS

- The ABO antigens are carbohydrate structures which are anchored in all RBC membranes (linings).
- The RBC membranes have 0.5 - 1 million ABO antigens.

Surface of RBC
when viewed under
Electron microscope



	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in red blood cell	 A antigen	 B antigen	 A and B antigens	None

RHESUS BLOOD GROUP

- Other important antigens anchored to the RBC membranes
- Differs from the ABO system in several ways.
- It is second only to the ABO system in importance in transfusion medicine.

OTHER BLOOD GROUPS

- There are 34 other additional known blood groups systems with more than 300 known variants.
- Classified by the antigens found on the surface of the red blood cells.

Distribution of Blood Types (%)

	O	A	B	AB
USA (Asians)	40	28	27	5
USA (Blacks)	49	27	20	4
USA (Whites)	45	40	11	4
Filipinos	45	22	27	6
Thais	37	22	33	8
United Kingdom	47	42	8	3

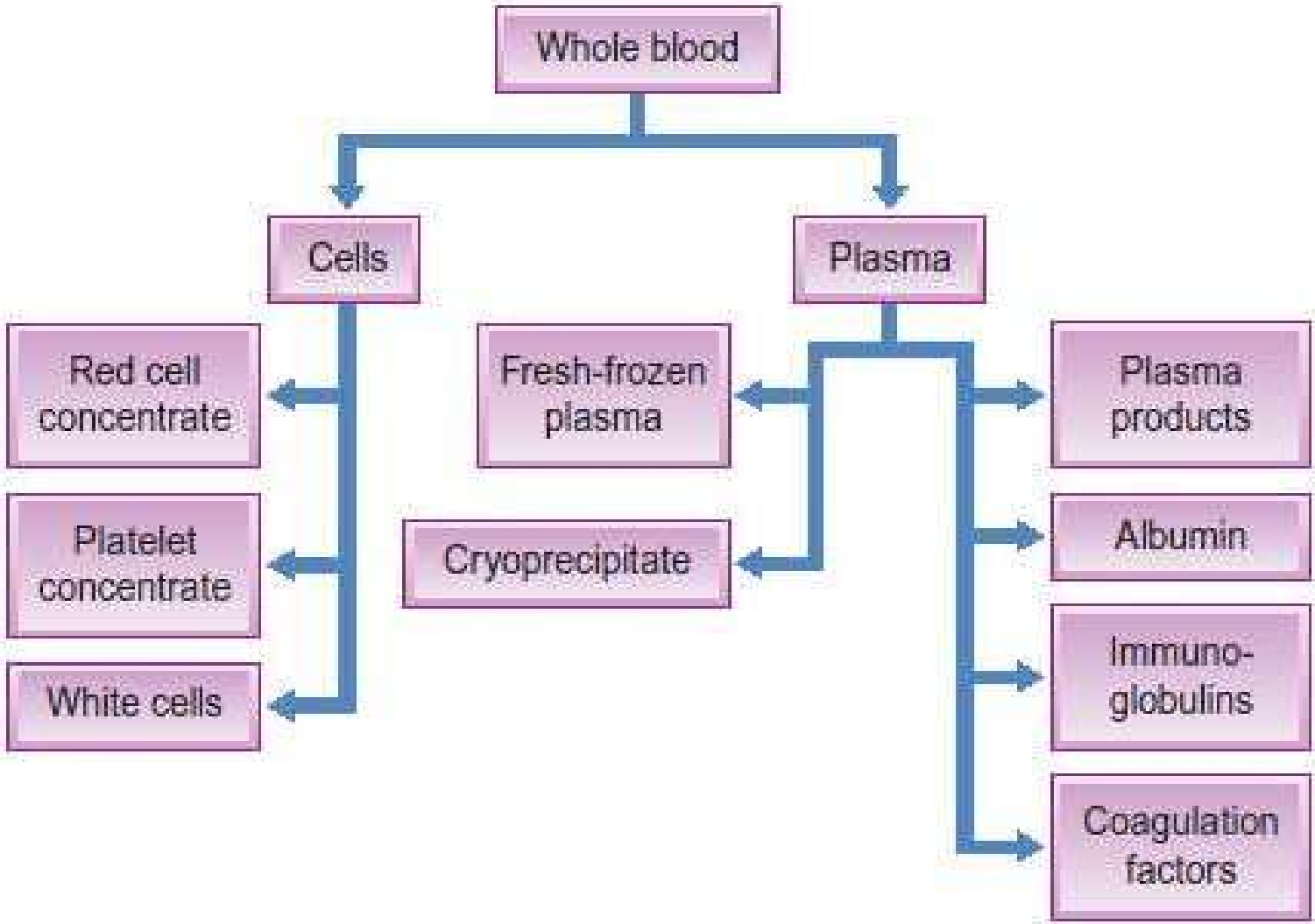
DONOR INFECTIOUS DISEASE TESTING

- Hepatitis B & C
- HIV
- HTLV [Human T-cell lymphotropic virus]
- Syphilis
- WNV (West Nile virus)
- Chaga's disease (Trypanosoma cruzi)

DONOR QUESTIONNAIRE

- High risk behaviors
- “Mad cow disease”

BLOOD PRODUCTS



BANKED WHOLE BLOOD

- No components have been removed.
- Contains RBCs ,WBCs, platelets, and plasma.
- Lasts only 4 hours at room temperature

PACKED RED CELLS

- Red cells from a donor.
- Storing red cells just above freezing allows survival for about 42 days.
- It is the product of choice for most clinical situations.

PLATELET CONCENTRATES

- Contains cellular components that help in the clotting process.
- Platelets can be stored up to 5 days at room temperature.
- Indicated in :

a) Platelet disorders
b) When massive blood loss has occurred

FRESH FROZEN PLASMA

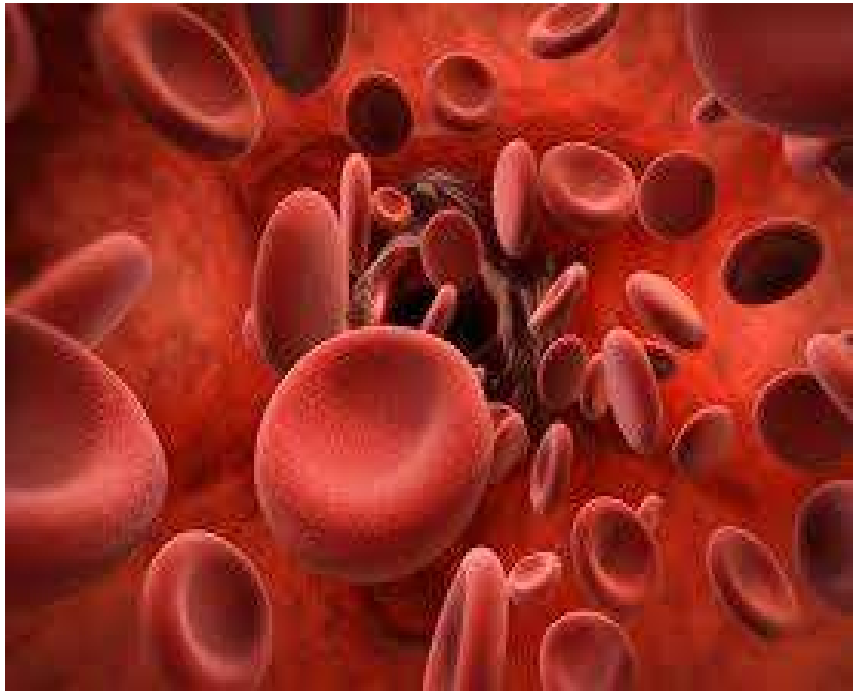
- Good source of clotting factors.
- Indicated for clotting disorders and massive transfusions.

CRYOPRECIPITATE

- Rich in clotting factors.
- Used to treat hemophilia and Von Willebrand disease to control bleeding.

GENERAL INDICATIONS FOR BLOOD TRANSFUSIONS

- Bleeding
- Anemia
- Burns
- Hereditary diseases: e.g. sickle cell, thalassemias



CROSS MATCHING & COMPLICATIONS

- Blood matching between a patient.

- In about 5-6% of transfusions, complications occur, some of which are serious and sometimes fatal.

BLOOD TRANSFUSION REACTIONS

Life threatening reactions

i. Lung injury (TRALI)
ii. Circulatory overload (TACO)
iii. Hemolytic reactions
iv. Anaphylaxis

Non-life threatening reactions

i. Fever
ii. Mild allergic reactions – rashes, etc.

HEMOLYTIC REACTIONS

- Transfusions leading to RBC hemolysis can be among the most devastating and feared complications of blood product administration.
- Within 1 hour
- Usually caused by **incorrect** ABO type tranfusion.

ANAPHYLAXIS

- Can occur within minutes to 2-3 hours.
- Severe and extreme reaction.
- Mostly associated with platelets or plasma.

NON-LIFE THREATENING REACTIONS

1. Mild allergic reactions

- Allergic reactions are the most common adverse events associated with transfusion.

- Usually, treatment is not necessary.

War stories as context

- Combat Support Hospital Iraq and Afghanistan
- Had Xray, Surgical, Apheresis machine
- Hospital role was to stabilize the injured and ship to Landstuhl Hospital Germany

Iraq – Mass Transfusion

- Armored vehicle on patrol with 5 Soldiers
- An IED called “EFP” exploded at side of vehicle
- 19 y.o. male - Both legs and arms amputated instantly
- 3 others died – 5th soldier not critical
- Only basic first aid available in Patrol unit – have coag powder (QuickClot - Chitosan) and tourniquets
- Medevac chopper arrived with paramedic – *later related thought he was dead*
- In chopper give O neg blood and check tourniquets

Iraq – Mass Transfusion

- 2 am Easter Sunday Pager bleeped
- Had only been in theater for two weeks at this time
- On arrival at Hospital - chaos in resus bay
- Stabilising care took about 14 hours
- Brought O + with me – needed over 40 units in total of different blood products
- At least 20 of 40 units PRBCs but also gave Platelets FFP Cryoprecipitate
- I was contact for doctors – my people stressed
- Needed to supervise more Blood donations “walking blood bank program”
- Needed to call for extra blood resupply from Baghdad base
- Once mass transfusion protocol only give O+ – don’t mix
- Found a young lab tech cross matching the wrong ABO blood type (will kill the patient) – Needed to manage this guy

Soldier shot Iraqi civilian M16

- Love triangle Tikrit Iraq
- Mass transfusion protocol for American contractor
- Blood slow to arrive because not labelled properly
- I was blamed for slow receipt of blood products in the OR (by only some)
- Have to be thorough!

How long Blood Lasted in Field Hospital

- Depends on fridge temp (had -20° C)
- 42 days PRBCs
- Platelets 5 days only
- Apheresis (to extract platelets in the field hospital)
- Whole blood room temp 4 HOURS
- Refridg 2-6 ° C - 42 days - lose platelets
- Plasma one year
- FIFO

Walking blood bank

- Prescreen potential donors (Soldiers and American contractors) for infectious diseases and blood types.
- Maintain database in case of mass casualty events