An introduction to blood
Blood – The ‘River of the life’

Key Discoveries

350 years ago:
It was discovered that Blood circulates around the human body.

200 years ago:
1st human blood transfusion was performed.

100 years ago:
Different blood types are discovered.

30 years ago:
Tests are developed to detect viruses that can transmit diseases to another person through blood transfusion.

Karl Landsteiner
Key Changes

In 1915, glass bottles were used to store blood.

Millions of bottles of blood were transfused during WWII.
World Blood Donor Day

14th June was designated as World Blood Donor Day by World Health Organization, the International Red Cross and Red Crescent Societies, International Federation of Blood Donor Organizations and the International Society of Blood Transfusion **in 2004**.

14th June is the birthday of Nobel Prize laureate **Karl Landsteiner** who discovered the ABO blood group system.

Purpose of celebrating World Blood Donor Day:
- To thank voluntary unpaid blood donors;
- To raise awareness of the need for safe blood;
- Since 2004, World Blood Donor Day celebration has been held in Macao in response to the call of the international organizations.
What is in the blood?
Blood

- The average adult has about 5 liters of blood living inside of their body. Without blood, the human body would stop working.
- 8 million blood cells die in human body every second with the same number being born each second.
- It takes a mere 20 seconds for a red blood cell to circle the whole body.
The blood looks like a red liquid. It is made up of billions of cells in a pale yellow-coloured fluid called **plasma**.

There are 3 main types of blood cells: **red blood cells**, **white blood cells** and **platelets**.

The red blood cells give blood its red color.
Plasma is the liquid mostly water, in which all of your blood cells ‘swim’.

It contains needed minerals, vitamins, sugars and hormones.

This is how blood looks after being spun in a centrifuge. The different parts of the blood are separated in a test tube.
Red blood cells exchange oxygen for carbon dioxide. When you breathe, you take in fresh oxygen, you also breathe out excess carbon dioxide brought to your lungs by your blood.
Oxygen and Carbon Dioxide Exchange in the Capillaries
Your body is in constant battle against invaders. Every day, viruses and bacteria may find their way into your body and can make you sick. White blood cells of various kinds spring into action to combat these invaders. These cells form the immune system!
Platelets

When you cut yourself, you create a hole in both your skin & vessel. When this happens, many processes go into action to:

- Plug the hole to stop the loss of blood.
- Remove dirt and germs that find an easy way into your body through the hole.
- Repair the damage done to your body.
Normally your body easily makes all the blood you need. But accidents or disease can cause people to need more blood than their bodies can produce.

- Accident victims and patients having major surgery
- People with blood diseases
- Cancer patients
- Burn patients
Blood groups
Are you my type?

Example:
ABO- Blood group system
Blood Group

Membrane surface

Red cell membrane

H antigen  A antigen  B antigen

- L-Fucose
- D-Galactose
- N-Acetylgalactosamine
- N-Acetylgluosamine
Blood group determined by the presence of different proteins on the red cell membrane.

- Group A - A antigen
- Group B - B antigen
- Group AB - A and B antigen
- Group O – None
ABO inheritance
100 years ago, was discovered that different people have different types of blood. Major types are ‘O’, ‘A’, ‘B’ and ‘AB’.

For a blood donation to be helpful to a patient, there has to be a good match between the blood type of the donors and the patients.

People with blood group 0 are called “universal donors” and people with blood group AB are called “universal receivers.”
ABO Blood group distribution among Macao donor population
The Rh Blood Group System

Rh Blood Group System is
✓ One of the 29 known blood group systems.
✓ It consists of 48 different antigens.
✓ Clinical significant antigens: D, C, c, E, e.
✓ D antigen is the most important.
Inheritance

Mother: Rh +

Father: Rh +

D / d

Child

DD

Dd

dd

Rh-DD = Rh-positive
Rh-Dd = Rh-positive
Rh-dd = Rh-negative
Variations of % RhD negative between populations:

- Caucasians: 15%
- Asian: 0.3 to 0.5%
- Macao:
  - Chinese: 0.47%
  - Macanese: 2%

RhD blood group of Macao population

99.53% Rh Positive
0.47% Rh Negative
RhD negative blood recipients

Usually, RhD negative blood type patients will be given RhD negative blood.
Rh Negative Blood donors in Macao

- 總負型捐血者人數/Total negative donors
- 新負型捐血者/New negative donors
- 血液單位/Blood units

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<tr>
<th>Year</th>
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<th>New Negative Donors</th>
<th>Blood Units</th>
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Rh Negative Blood donors in Macao

- > 99% of the blood donation in Macao is from donors of Chinese descent who are the redominant ethnic group in Macao.

- 0.5% of the Chinese population and 2% of the Macanese in Macao are RhD negative as compared to 15% of the Caucasian population.

- Because of these rare variants, it’s very important for there to be diversity among blood donors. If a person with rare blood type needs blood and compatible donor cannot be found, the consequences can be fatal.
全血分離過程

Whole Blood separation process
There's no substitute for human blood

- It cannot be manufactured
- Animal blood cannot replace it
- Only 2.6% of eligible citizens in Macao donated blood
- The deferral rate of blood donation is 16%
- In Macao, more than 15,000 units of red cell needed annually
- 1 in 3 people will need blood transfusion in their lifetime
- The need in Macao is 50 blood donations per day.
Blood Transfusion Service
The function of CTS

- Voluntary blood donation education, promotion & donor recruitment.
- Donor service and donor management
- Blood collection
- Blood component preparation, storage
- Blood testing
- Quality assurance

- Adequate and timely provision of blood, components and derivatives.
- Provision of reference laboratory services
- Consultancy services
A small portion of each donation is removed for testing.

Using the information gathered, everyday of blood component is labeled, identifying the blood type and other special characteristics of the blood.
Mandatory tests on all units collected blood:

- ABO group and Rh type
- Screening for blood-group antibodies
- Serologic test for syphilis
- Serologic tests for human retroviruses including:
  - HIV-1/2 antibody
  - HTLV I/II antibodies
Testing

- Serologic tests for hepatitis including:
  - Hepatitis B surface antigen (HBsAg)
  - Hepatitis C antibody
- Nucleic Acid tests:
  HIV, HCV and HBV
## Safety of blood

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<td><strong>Nucleic acid testing</strong></td>
<td>11 days</td>
<td>23 days</td>
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There are only 20% of the blood centre in the world routinely perform Nucleic acid tests of every blood donations.
Tested and ready for transfusion, blood components are temporarily stored at the blood service until transported to the hospitals.
Distribution to Hospitals

Blood components are transported to hospitals, daily and on an emergency basis, so they are on hand when needed.
Ensure the supply of RhD negative blood

- Promotion & Education
- A list of RhD negative blood donors
- Blood transfusion guidelines for clinicians
- Frozen red cells
Recent decades, 600 other characteristics (blood groups) have been found in blood.

Laboratories test and identify exact type donated so that only right type is given to a particular patient.

The Macao BTS has a team to find the right blood for a particular patient.

**Blood, like milk, is perishable**

Red blood cells, can be stored for only 42 or 35 days. We make every effort to ensure as much blood as possible is used before its ‘shelf life’ date is up. But most importantly, a supply is always on hand and nobody’s life is threatened because donated blood wasn’t there when it was needed.
Statistics for 2010

17-69 yrs

Eligible Population ≈ 439,800

Blood Donors 11,562

2.63% 13,577 Blood units

Hospital transfusion 15,161 Units of components
I don't know your name, but thank you for your gift of life!