Shine
SCIENTIFIC AND
CLINICAL DEVELOPMENT

What are Blood Group Antigens and antibodies

Introduction to Blood Groups

Aim

To provide an introduction to:-

- Antigens and antibodies in blood transfusion
- Clinically significant Blood Group Systems

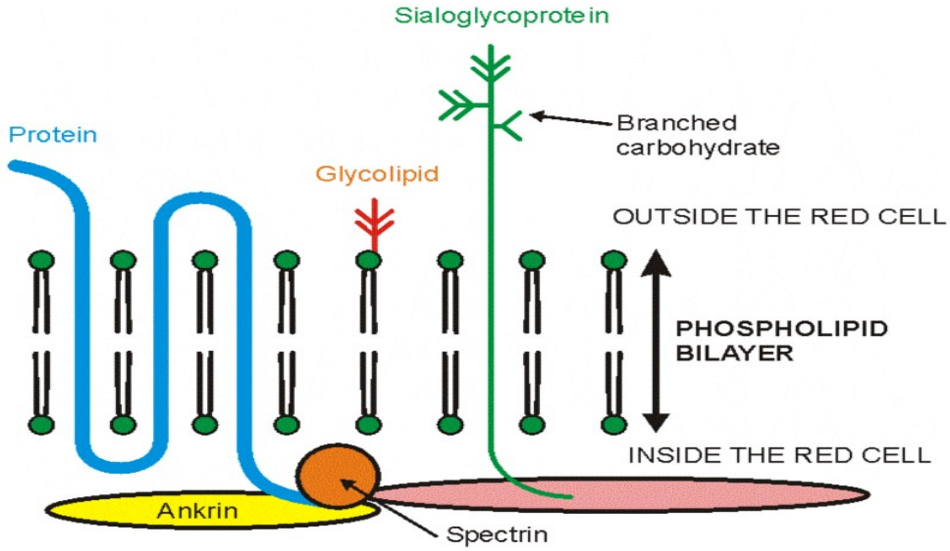
By the end of the session:-

- Use some Basic Terminology

- List the main clinically significant blood group systems

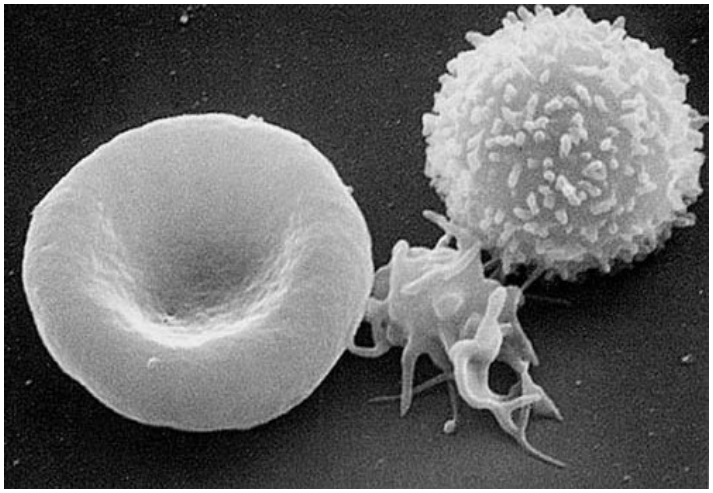
What Are Blood Group Antigens?

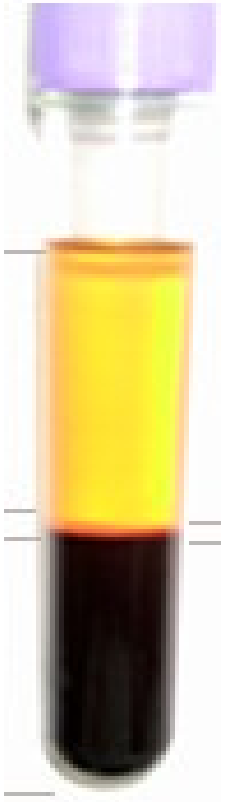
- Part of the membrane structure
- Complex structures of protein and carbohydrate
- Variety of functions
  - Maintain membrane and cell shape
  - Transport nutrients
- Differences recognised in different people
  Produced by inheritance
  of specific genes
- Genes produce different
  antigen options within
  one blood group system



Antigens

- White cells and Platelets have HLA antigens
- Platelets also have HPA antigens
- Red Cells have "Blood group antigens"





Reactions usually occur when the antigen on the_____reacts with an antibody in the _____

Antigens

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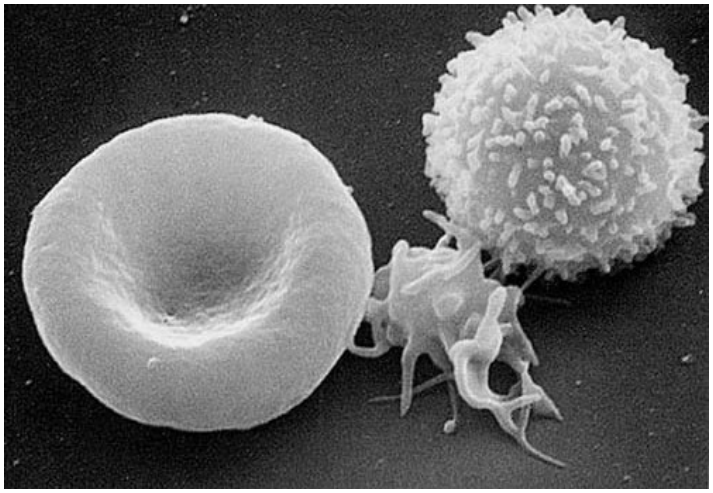
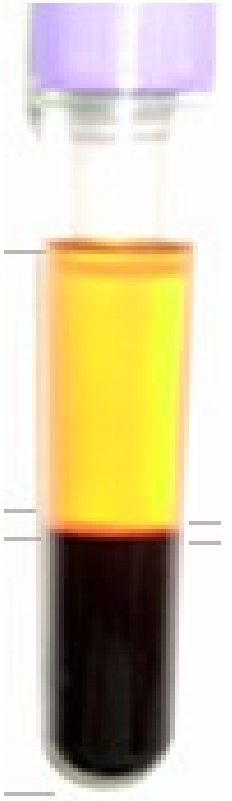




Reactions usually occur when the antigen on the donor cells reacts with an antibody in the patient plasma

Unfortunately.....

In appropriate biological circumstances antigens can stimulate an immune response;

So when introduced into the circulation it may stimulate the production of a specific antibody if the person lacks that antigen

Antibodies

Protein molecules (immunoglobulins) occurring in body fluids, produced in response to the introduction of a foreign antigen:-

- The antibody formed is for a particular antigen

- Any other foreign antigen entering the body may result in the production of a different specific antibody

Antibody - Antigen Reactions

IN VIVO (*in the body)*

Destruction of the cell

Either:

- directly when cells break up in the blood stream

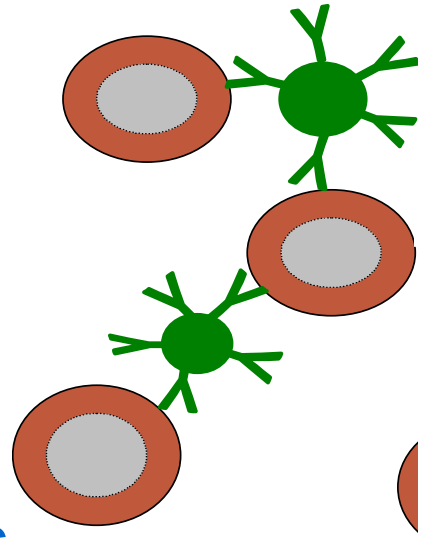
Or

- indirectly where liver and spleen remove antibody coated cells

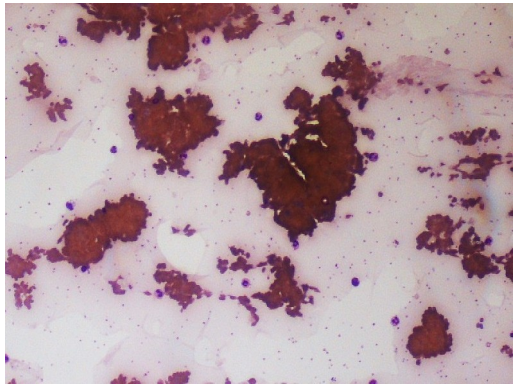
IN VITRO *(in the lab)*

- normally seen as agglutination
- the specific reaction is used in testing

Agglutination



- Clumping together of red cells into visible agglutinates by antigen-antibody reactions
- Antibody cross-links with the antigens
- The reaction is specific, so agglutination can be used to identify either:-
  - The presence of a red cell antigen, i.e. ‘blood grouping’
  - The presence of an antibody in the plasma, i.e. ‘antibody screening’



Agglutination Tests used in Blood Transfusion

- Cell typing

e.g. of blood donors:

– testing for various red cell antigens on the red cell surface using known antibody reagents

Anti-A

Anti-B

Anti-D

X

Red Cells

Agglutination Tests used in Blood Transfusion

- Antibody screening and Identification

e.g. of patients prior to transfusion:

  - looking for unknown red cell antibodies in patient / donor plasma using cells with known antigens
  - 2 cells (screening) or 8-12 cells (identification)

Known Red Cells

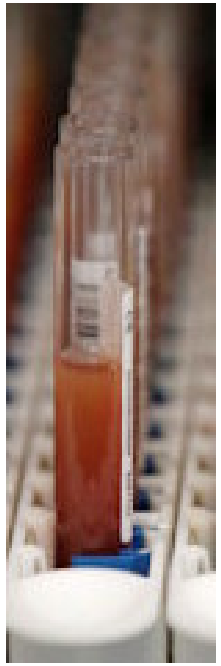
X

Unknown plasma

Agglutination Tests used in Blood Transfusion

- Serological Crossmatching
  - reacting red cells from the proposed donor with the plasma of the patient

X

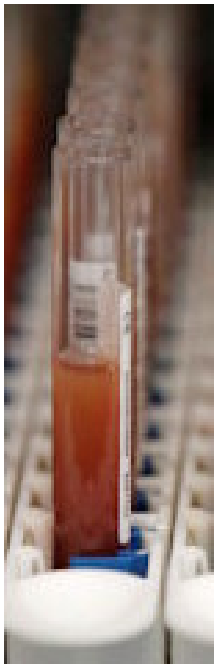


Agglutination Tests used in Blood Transfusion

X

positive result

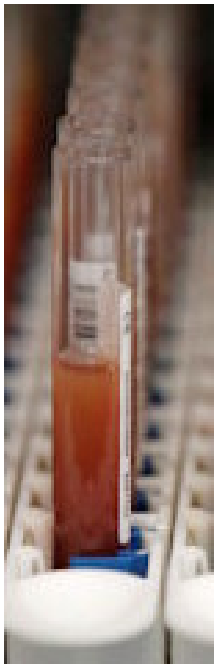
or



Incompatible unit - **DO NOT TRANSFUSE**

Agglutination Tests used in Blood Transfusion

X



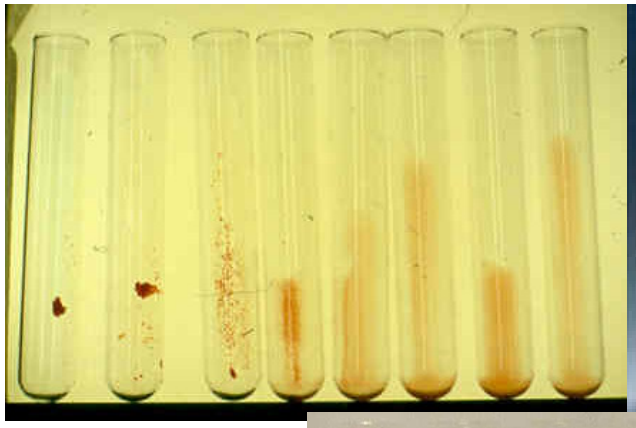
negative result

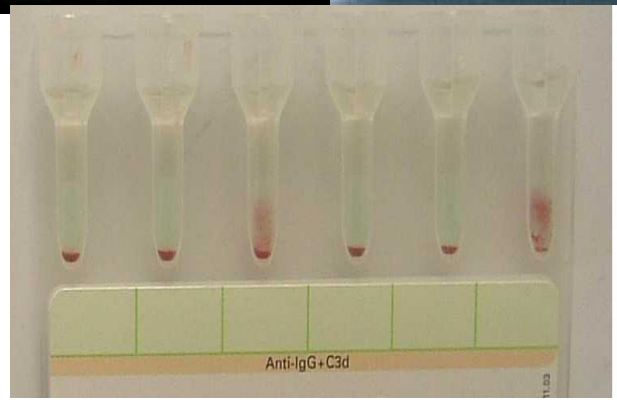
Compatible unit

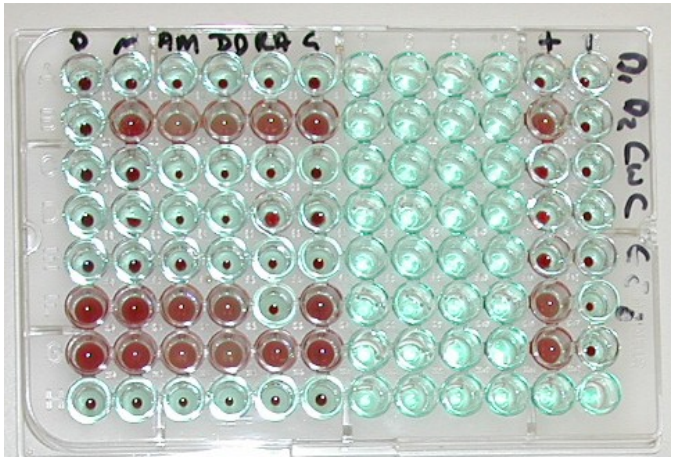
Safe to transfuse

Techniques Used in Blood Group Serology

- Agglutination
- IAT:-
  Indirect Antiglobulin Test
- Enzyme tests: -
  used in identification
- Perform tests in Tubes,
  Microplates and Gels







Blood group systems

Alternative genes produce different antigen options within one blood group system :-

- 33 known blood group systems
  - In excess of 300 different antigens
- Antibodies usually produced in absence of antigen
- Some are more clinically significant than others i.e. do more harm to the patient

Production of Blood Group Antibodies

- Alloantibodies can be found in 0.3%-38% of the population - variation dependant upon:
  - The people tested (e.g. patients, donors, etc.)
  - The sensitivity / type of the test method(s) used
- Immunisation may occur following:
  - Pregnancy
  - Transfusion
  - Transplantation
- In some instances no obvious immunising event can be identified (? infection)

How many blood group systems can you name?

System Name
1.
2.
3.
4.
5.
6.
7.
8.
9.

How many can you name?

System Name
1. ABO
2. Rh
3. MNS
4. P_1
5. Lutheran
6. Kell
7. Lewis
8. Duffy
9. Kidd

Which ones are most clinically significant?

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Which ones are most clinically significant?

ABO and Rh most clinically significant

Next most clinically significant?

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Which ones are most clinically significant?

ABO and Rh most clinically significant

Next most clinically significant?

Kell
Ss, Duffy and Kidd

MN, P1, Lutheran and Lewis less so

Remember anti-A and anti-B are the most dangerous of all!

What does ‘clinically significant’ mean?’

- Clinical (*in vivo*)
  - ‘Antibodies that are capable of causing patient morbidity due to the accelerated destruction of a significant proportion of transfused red cells’
  - One that shortens the survival of transfused red cells
  - One that causes haemolytic Disease of the Fetus and Newborn (HDFN)
- Serological (in vitro)
  - Alloantibodies which react at 37^{o}C by IAT

Antibodies of the same specificity have different degrees of significance!

- Transfusion
  - ‘Immediate’ destruction of (some of) the transfused red cells (within hours or even minutes)
  - Reduction of expected red cell survival
  - No discernable red cell destruction
- Pregnancy
  - Fetal death due to HDFN
  - Positive Direct Antiglobulin Test (DAT) and clinical evidence of HDFN
  - Positive DAT without clinical evidence of HDFN

Blood Group antibodies in transfusion recipients*

(IN DECREASING ORDER OF INCIDENCE)

- Anti-D / anti-C+D
- Anti-E
- Anti-K
- Anti-c
- Anti-Fy^a / anti-Fy^b
- Anti-Jk^a / anti-Jk^b
- Anti-e
- Anti-S / anti-s

* Pooled data from 4 studies (Petz et al)

Blood Group Alloantibodies in Allo-immunised Mothers

(DENMARK 1998 - 2005)

	Number	%
Anti-D	212	46.6
Anti-K	70	15.4
Anti-E	50	11
Anti-M	30	6.6
Anti-c	28	6.2
Patients with more than one antibody	122	27

Nordvall (Oct 2009)

Aim

By the end of the session:-

- Use some Basic Terminology

- List the main clinically significant blood group systems

- Your opportunity to ask questions!