

Blood Groups and Antibodies, Transfusion and Pregnancy

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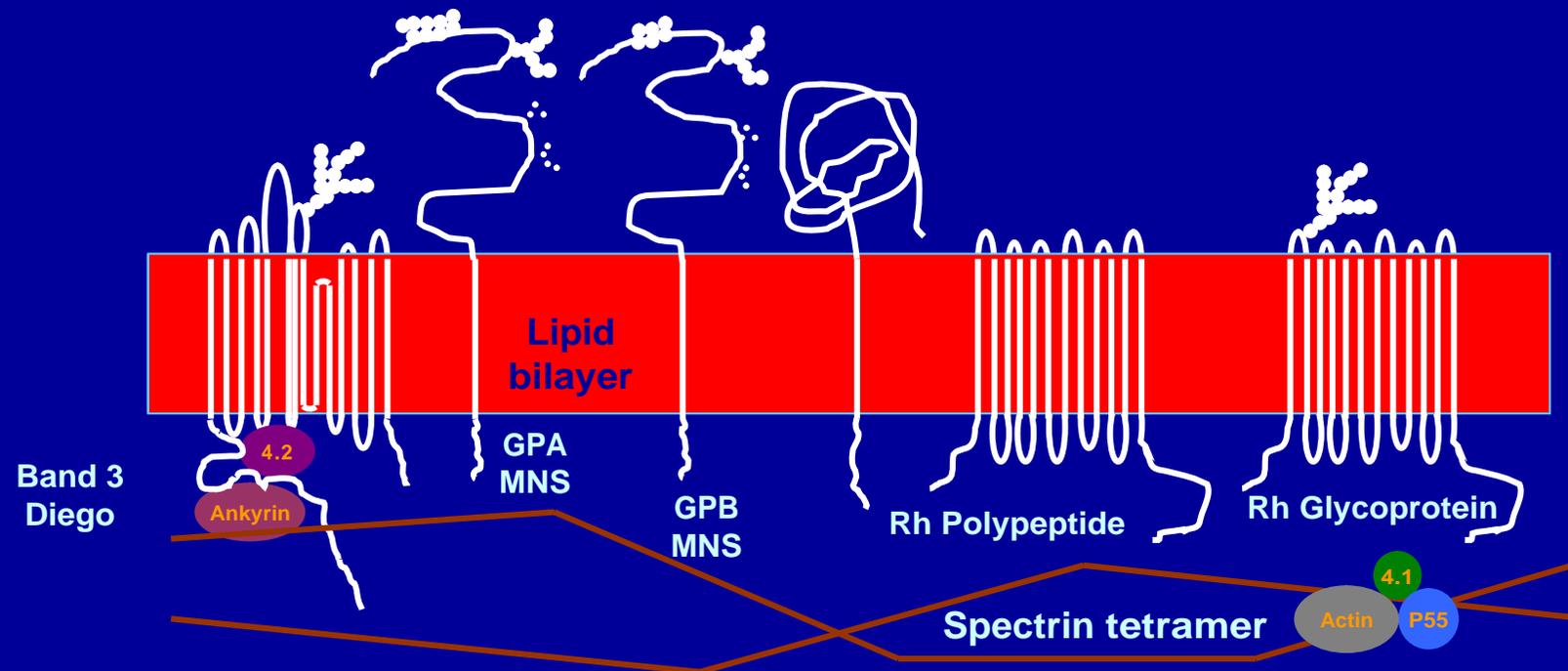
To cover:

- What is a red cell antigen?
- What is a red cell antibody?
- Haemolytic Disease of the Newborn
 - Monitoring pregnancies
 - Preventing HDN, particularly through antenatal anti-D prophylaxis
 - Predicting outcomes
 - Difficult interpretations and working together
- The Direct Antiglobulin Test (DAT/DCT)

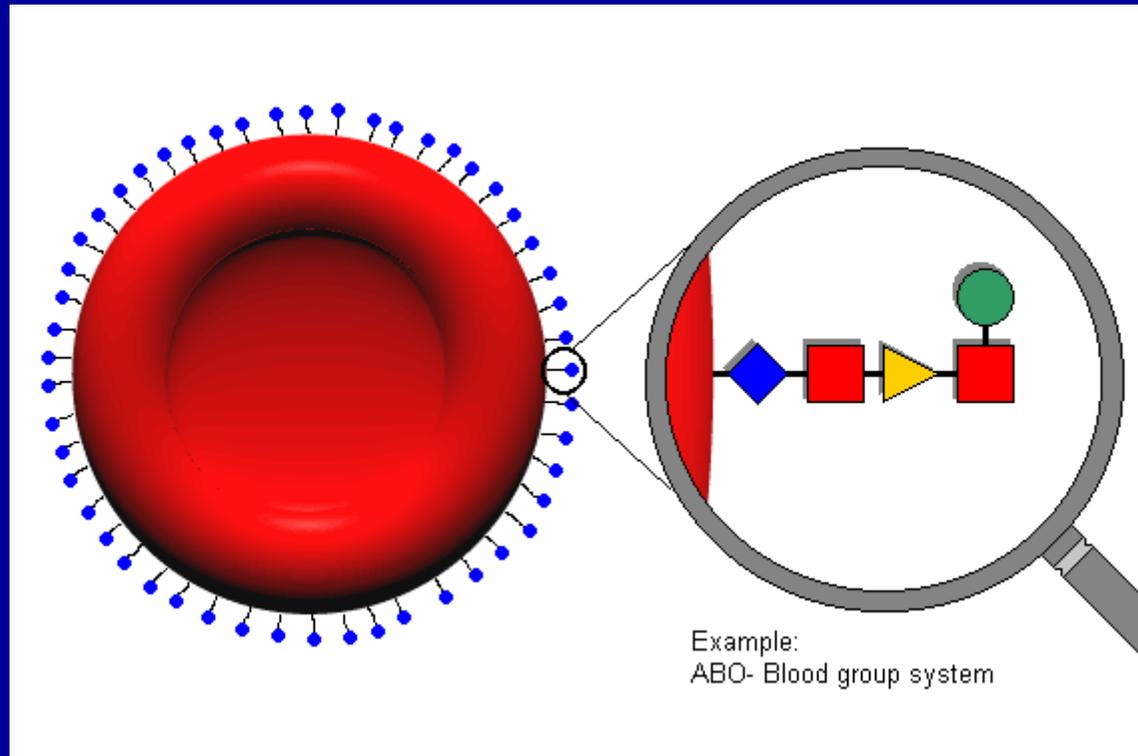
An Antigen

- An antigen can be defined as a substance that, when introduced into the circulation of an individual lacking that antigen, can stimulate the production of a specific antibody.
- Red cell antigens

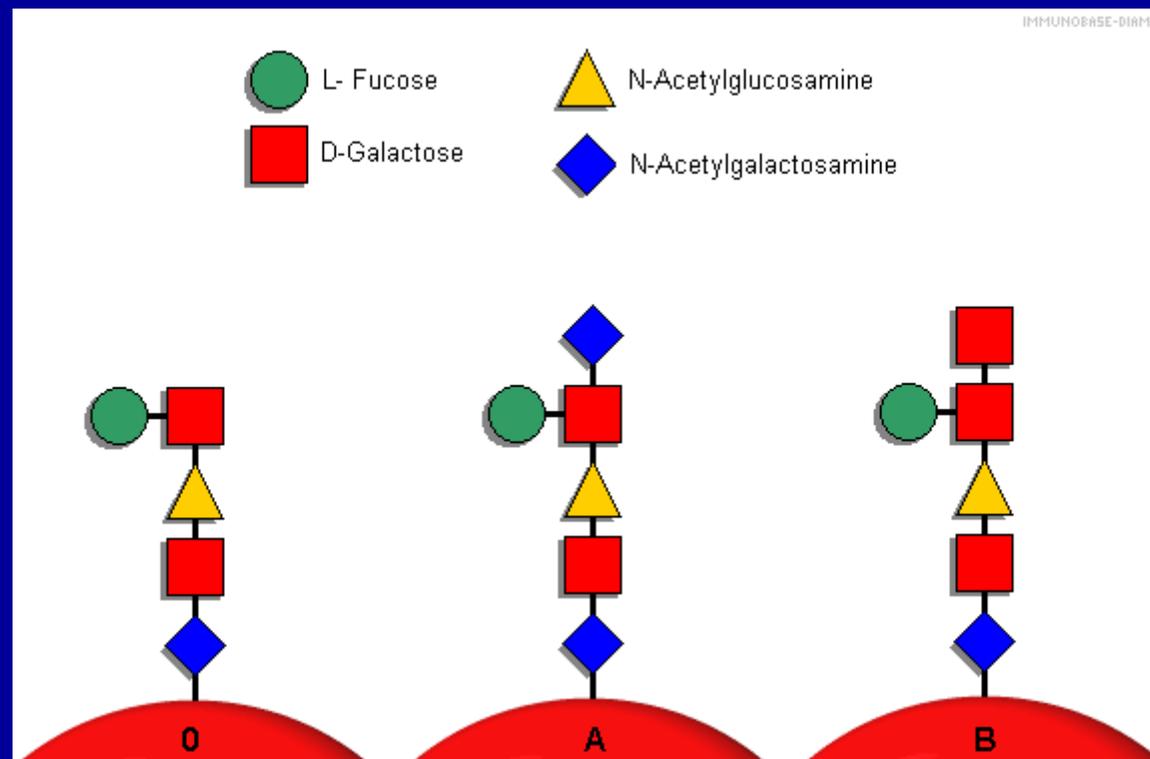
Blood Group Antigens



ABO Antigens



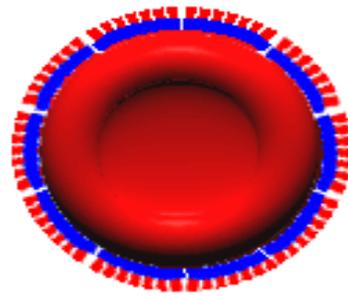
A Close Up



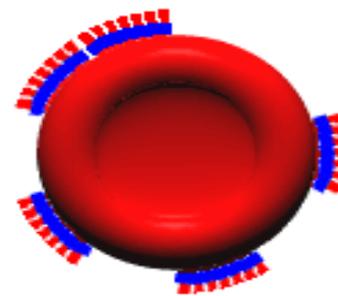
The D Antigen

- Most individuals are D positive or D negative
- An individual may have a weak D antigen (previously known as D^u).
- An individual may have a partial D antigen (previously known as a D^{variant}).

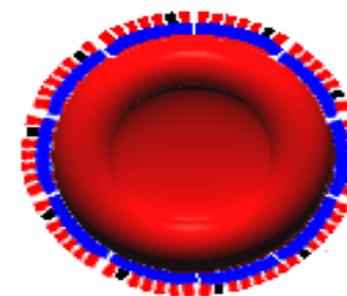
RhD



Normal D-Antigen



D-weak



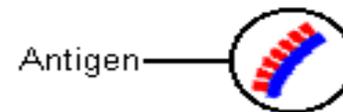
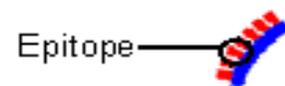
D-Variant

Epitope: Normal
Antigen frequency: Normal

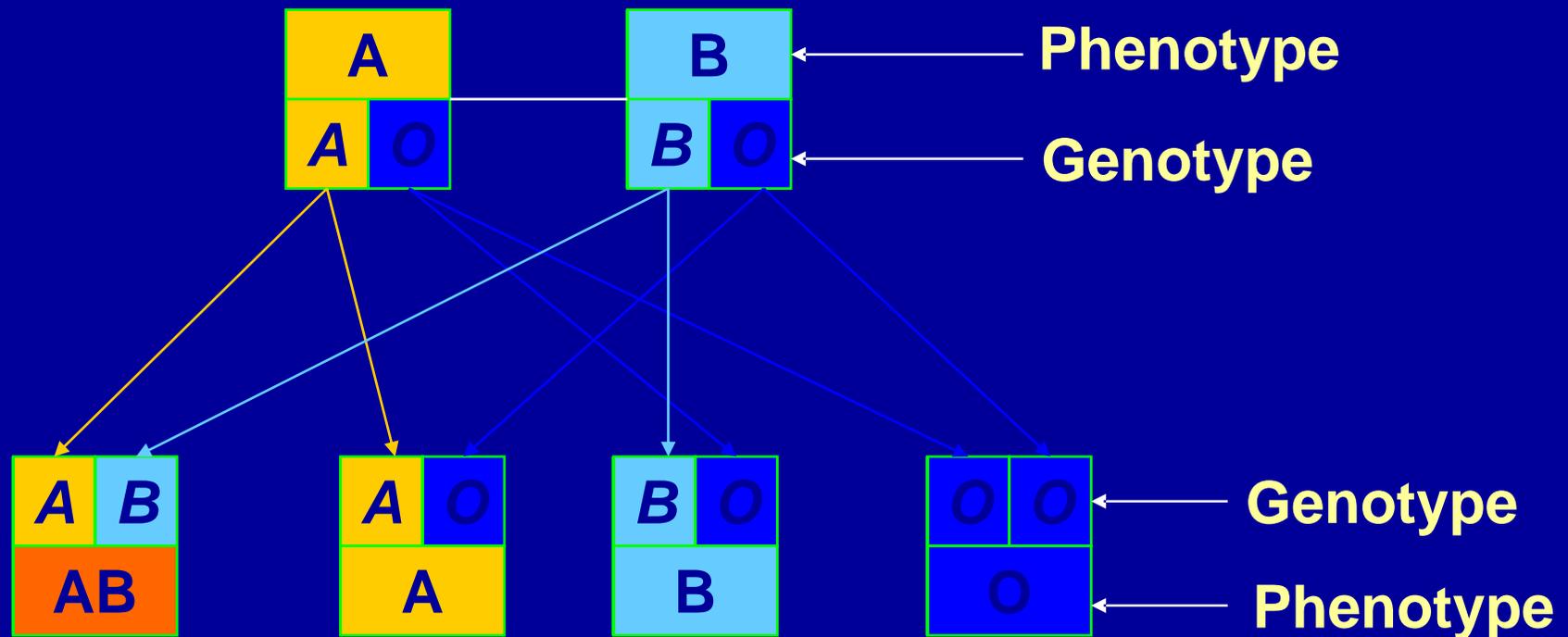
Normal
Reduced

Mutated
Normal or reduced

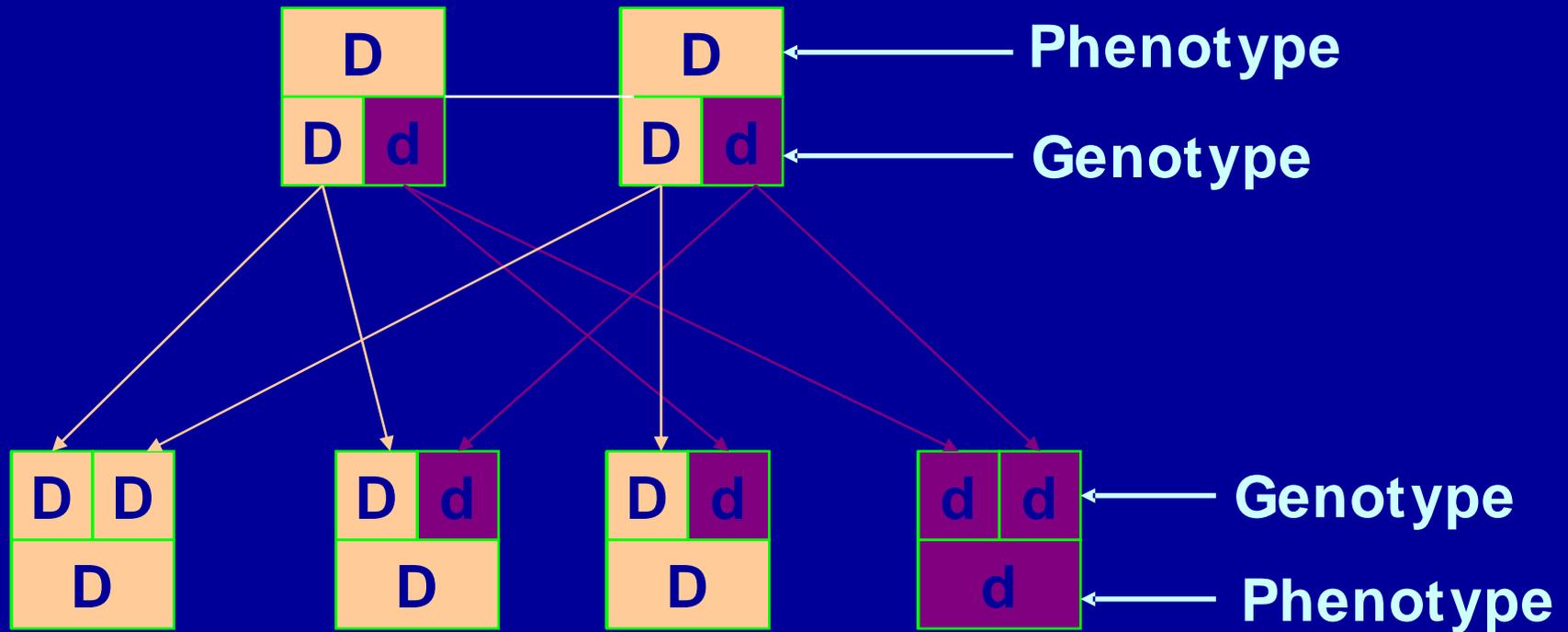
Legend:



Inheritance



Genetics

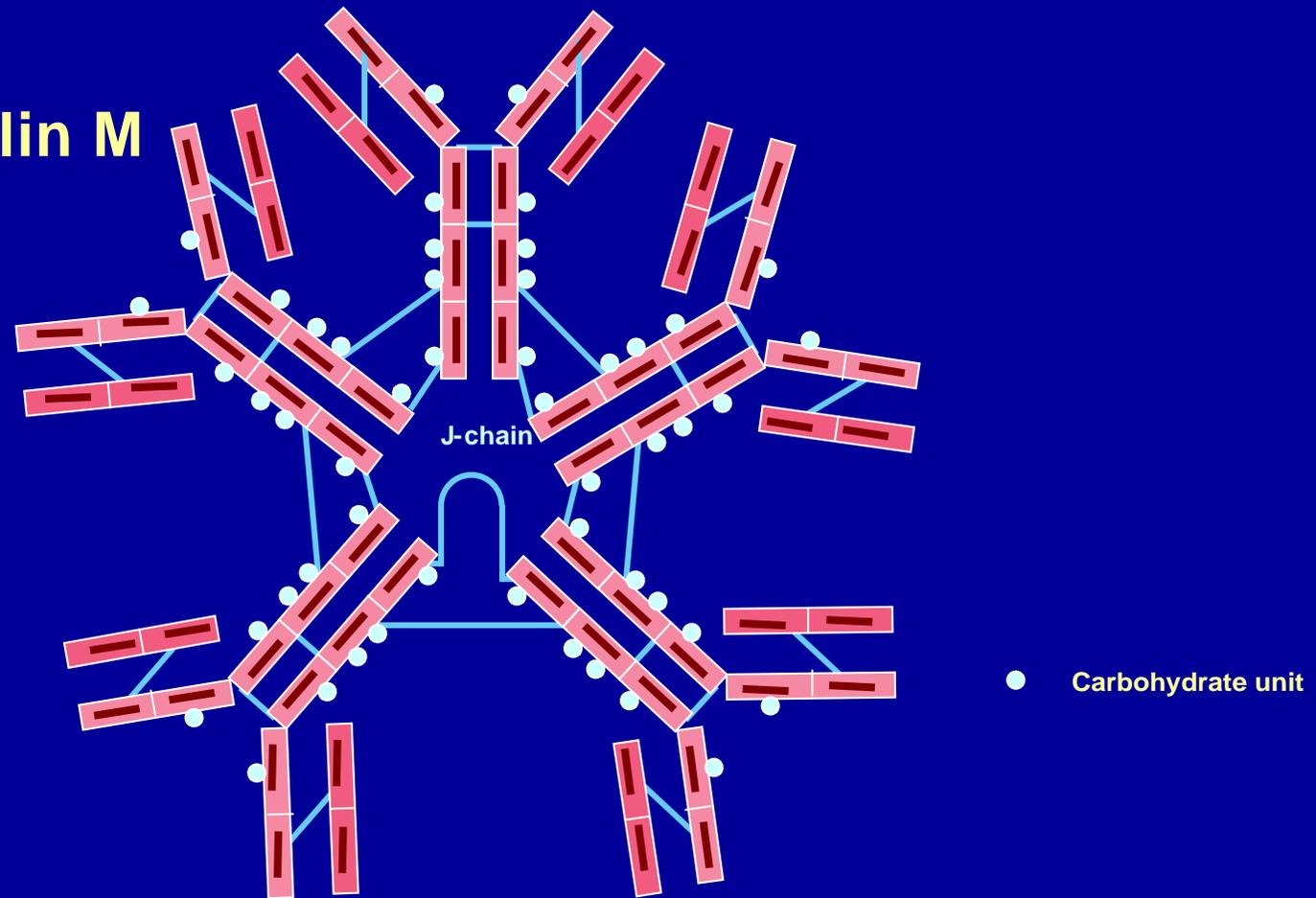


An Antibody

- An antibody can be defined as a serum protein (*i.e.* an immunoglobulin with specific antigen binding sites) produced as a result of the introduction of a foreign antigen, that has the ability to combine with (and, in many cases, destroy) the cells carrying the antigen that stimulated its production

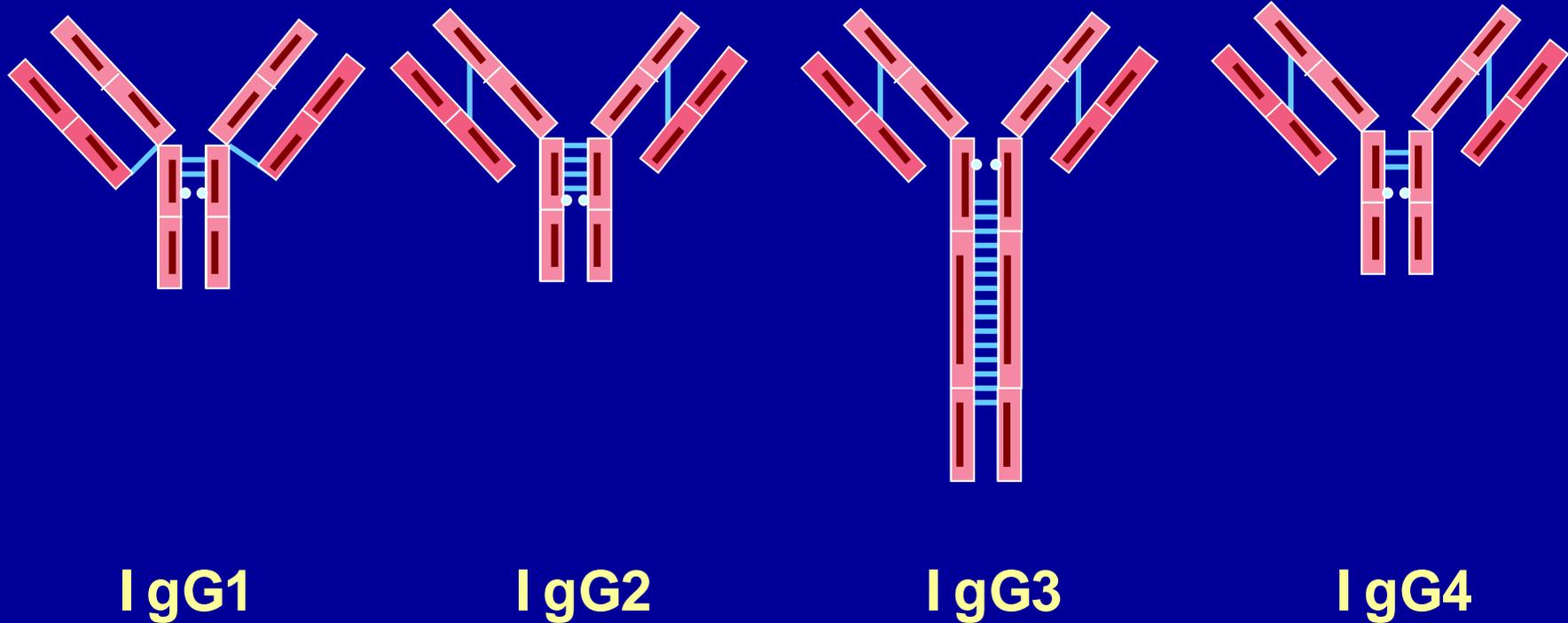
Antibodies - IgM

Immunoglobulin M



Antibodies - IgG

Immunoglobulin IgG subclasses



Red Cell Antibodies

Produced when exposed to foreign blood:

- Previous transfusion of blood/components
- Fetal maternal haemorrhage

ABO System

Red Cells
(Antigens)

- A
- B
- O
- AB

Plasma
(Antibodies)

- Anti-B
- Anti-A
- Anti-A,B
- None

Haemolytic Disease of the Fetus and Newborn

- Is a condition in which the lifespan of the infant's red cells is shortened by the action of specific antibodies derived from the mother by placental transfer.
- Anaemia, jaundice, liver damage, kernicterus, IUD

Serological Testing During Pregnancy

Purpose:

- Identify RhD negative individuals so that appropriate anti-D prophylaxis can be given to prevent HDN due to anti-D
- To identify those at risk of HDN
- To predict the severity of the HDN to plan treatment

Maternal Monitoring

- Booking bloods
 - ABO, D type and antibody screen
- Repeat test at 28 weeks
 - Confirm ABO and D type, repeat antibody screen
- If antibodies detected
 - Identify and monitor, regime dependent upon antibody

The Big Three

- Anti-D, anti-c and anti-K
- Test monthly up to 28 weeks
- Test every 2 weeks up to delivery
- Anti-D and anti-c are quantitated against a National Standard with results in IU/mL
- Anti-K is titrated
- Current sample is tested in parallel with previous sample to accurately identify changes in antibody level

Sample NHSBT Report 1

National Blood Service – Red Cell Immunohaematology



Blood and Transplant

HOSPITAL TRANSFUSION LABORATORY
NORFOLK & NORWICH UNIVERSITY
HOSPITAL
COLNEY LANE
COLNEY
NORWICH
NORFOLK
NR4 7UY

Patient:
DoB:
NHS No:
Hospital No:
Address:

Sample No:
NHSBT No:
Taken: 17-May-2012
Received: 21-May-2012 09:02:19
Reported: 23-May-2012
Hosp Sample ID:

Primary Requesting Clinician:
X0000001 HEAD OF BLOOD TRANSFUSION

EDD: 21-Nov-2012
Gestation 14 weeks

O RhD negative

Red Cell Antibody Results

Type	Specificity	Technique	Quantification IU/mL or Titre		Sample Type
Allo	Anti-D	IAT	Quant	4.2	Plasma

This is a clinically significant antibody.
No additional alloantibodies were detected.
Select ABO compatible, D-, C-, E-, K- red cell units for crossmatching by IAT.
There has been no significant change in antibody level.
There is a moderate risk of HDN when the maternal anti-D level is between 4 and 15 IU/mL.
This woman should be in the care of a hospital obstetric unit.
Guidelines recommend repeat testing at 4 weekly intervals to 26 weeks gestation then every 2 weeks to delivery.
At delivery a cord DAT should be performed and, if positive, the baby's Hb and bilirubin monitored.
The risk of HDN may increase if gestation proceeds beyond term.

The Others

- Tested at booking and 28 weeks
- In general a titre of >32 may possibly cause HDN
- A steep increase in titre between the two samples is worrying and may lead to further monitoring

Paternal Testing

- Determining paternal phenotype and likelihood of fetal genotype may be useful particularly when anti-D, anti-c or anti-K have been detected
- Misidentification of the father needs to be acknowledged

Fetal Genotyping

- Historically fetal DNA obtained by amniocentesis – invasive
- Fetal DNA can now be extracted from maternal peripheral plasma

Preventing HDN

- Prevent production of red cell antibodies in females of child-bearing potential
 - conservative transfusion regimes
 - transfuse D negative blood to D negative females of child bearing potential
 - and K negative blood to females of child bearing potential
- Give anti-D prophylaxis

Prophylaxis Regime

Following an event:

- <20 weeks gestation 250iu
- >20 weeks gestation at least 500iu followed by a test to measure the size of the FMH

Routine antenatal anti-D prophylaxis:

- 1500iu at 28 weeks or
- 2x500iu at 28 and 34 weeks

Following delivery of a D positive baby:

- At least 500iu followed by a test to measure the size of the FMH

Difficult Interpretations

Midwives:

- Maintain a clear record of prophylactic anti-D given: dose and date.
- Inform laboratory
- Vital to take 28 week samples for group and antibody screen BEFORE giving routine prophylaxis

Laboratory:

- Identify and quantitate antibody
- Give advice on anti-D prophylaxis based on history provided and results obtained
- Request further samples at stated times to monitor the level of antibody

Sample NHSBT Report 2

National Blood Service – Red Cell Immunohaematology



Blood and Transplant

HOSPITAL TRANSFUSION LABORATORY NORFOLK & NORWICH UNIVERSITY HOSPITAL COLNEY LANE COLNEY NORWICH NORFOLK NR4 7UY		Patient: DoB: NHS No: Hospital No: Address:	Sample No: NHSBT No: Taken: 27-Jun-2012 Received: 02-Jul-2012 06:58:42 Reported: 03-Jul-2012 Hosp Sample ID:
Primary Requesting Clinician: X0000001 HEAD OF BLOOD TRANSFUSION	EDD: 05-Sep-2012 Gestation 31 weeks		

A RhD negative C-c+E-e+K-

Red Cell Antibody Results

Type	Specificity	Technique	Quantification IU/mL or Titre		Sample Type
Not specified	Anti-D	IAT	Quant	<0.1	Plasma

No additional alloantibodies were detected.
 Select ABO compatible, D-, C-, E-, K- red cell units for crossmatching by IAT.
 From information provided the anti-D detected is probably due to recent anti-D prophylaxis.
 No further routine screening samples are required in this pregnancy.
 An antibody card has not been supplied.
 Continue antenatal and post-natal anti-D prophylaxis.

Sample NHSBT Report 3

National Blood Service – Red Cell Immunohaematology



Blood and Transplant

HOSPITAL TRANSFUSION LABORATORY THE QUEEN ELIZABETH HOSPITAL GAYTON ROAD KING'S LYNN NORFOLK PE30 4ET	Patient: DoB: NHS No: Hospital No: Address:	Sample No: NHSBT No: Taken: 22-May-2012 Received: 25-May-2012 08:25:48 Reported: 29-May-2012 Hosp Sample ID:
Primary Requesting Clinician: X0000001 HEAD OF BLOOD TRANSFUSION	EDD: 14-Aug-2012 Gestation 29 weeks	

O RhD negative C-c+E-e+K-

Red Cell Antibody Results

Type	Specificity	Technique	Quantification IU/mL or Titre		Sample Type
Not specified	Anti-D	IAT	Quant	<0.1	Plasma

No additional alloantibodies were detected.
 Select ABO compatible, D-, C-, E-, K- red cell units for crossmatching by IAT.

Passive and immune anti-D cannot be differentiated at this level.

If anti-D prophylaxis has NOT been given during the past 8 weeks, repeat tests at 4 weekly intervals to 28 weeks' gestation then every 2 weeks until delivery.

If this woman has been given routine antenatal anti-D prophylaxis, no antibody screening tests are required by NHSBT after 28 weeks and continue to offer anti-D prophylaxis in accordance with national guidelines.

Please review the case and take appropriate action.

Actions

Midwives:

- If immune (allo) anti-D is present do NOT give prophylactic/passive anti-D
 - failed to prevent anti-D formation
 - must not give an unnecessary blood product
- If interpretation of results is in doubt give anti-D as
 - may prevent HDN
 - anti-D is a blood product with a good safety record
- If further samples are requested send them
 - could miss catching an immune anti-D that is increasing to a dangerous level.

Direct Antiglobulin Test (Direct Coombs Test)

- A test performed on the cord/baby's sample soon after birth
- The test to see whether an antibody is attached to an antigen on red cells (in HDN that is maternal antibody on baby's red cells)
- Under what circumstances should a DAT be tested?