

Blood Group and Crossmatch: Issues and Troubleshoots

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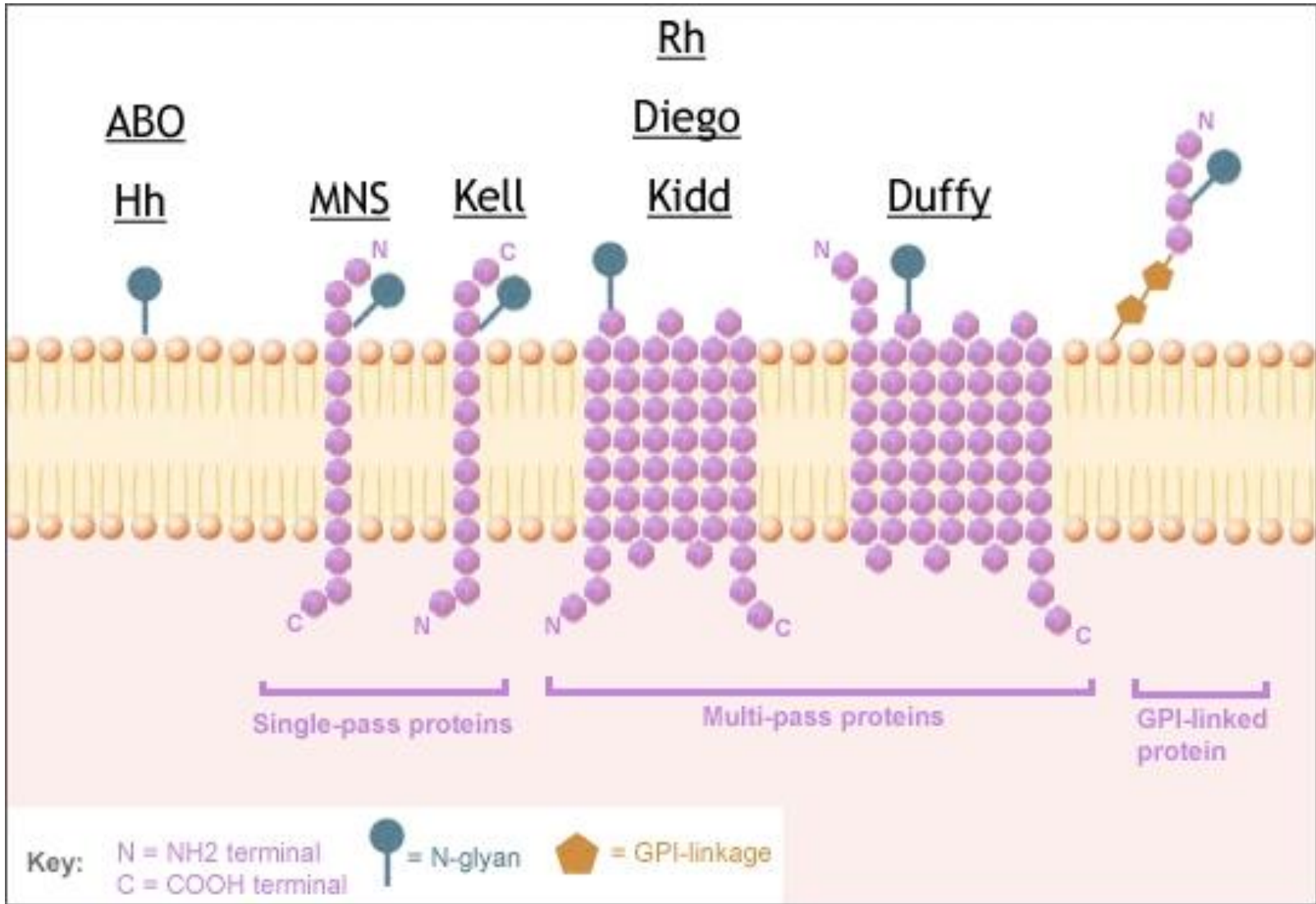
Introduction: Blood Group Systems

- Karl Landsteiner discovered ABO system - in 1900
- ABO system remains the most significant system till date
- Rh is 2nd most important system after ABO
 - Discovered in 1940

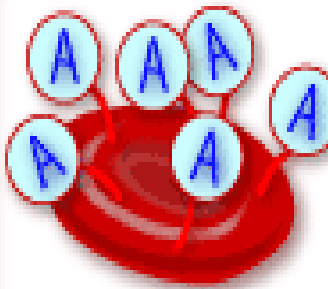
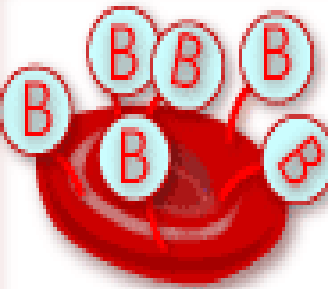
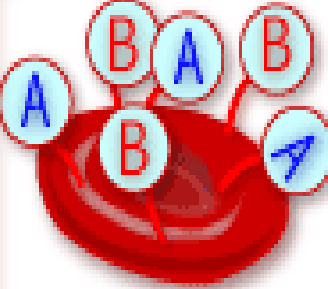
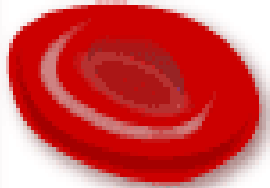


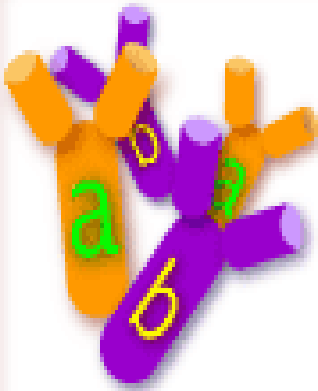


Introduction : Blood Group System

- Blood group antigens are on RBC
- 35 blood group system known
- ABO & Rh most important
- Others are
 - Kell,
 - Duffy,
 - Kidd,
 - P,
 - MNS etc



The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 <p>A agglutinogens only</p>	 <p>B agglutinogens only</p>	 <p>A and B agglutinogens</p>	 <p>No agglutinogens</p>
Plasma Antibodies (phenotype)	 <p>b agglutinin only</p>	 <p>a agglutinin only</p>	<p>NONE.</p> <p>No agglutinin</p>	 <p>a and b agglutinin</p>

Laboratory Determination of the ABO system

Laboratory testing for ABO

Detection of Antigen on Red cell surface

Cell grouping

Red cells with unknown antigen tested with known antisera

Using commercial reagents

- Anti-A
- Anti-B

Detection of Antibodies in plasma

Serum grouping

Serum with unknown antibodies tested with known antigens

Using reagent red cells

- A cells
- B cells



Reaction pattern of ABO group (Cell grouping & Serum grouping)

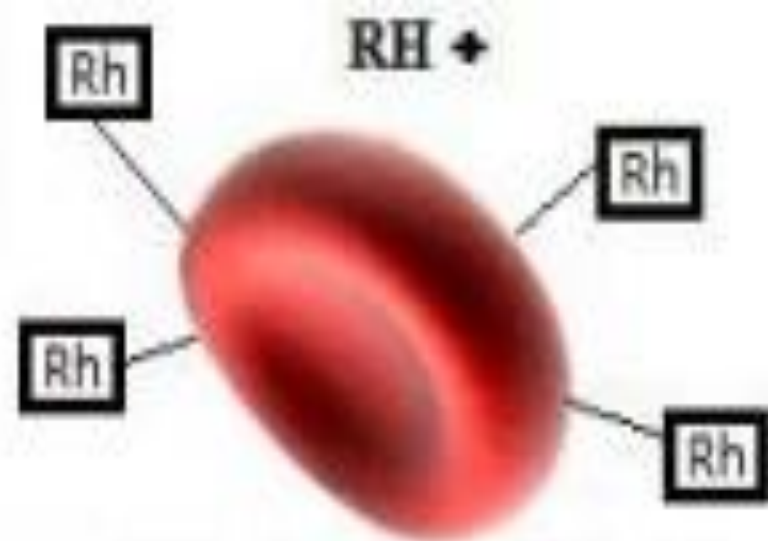
Red cells tested with		Serum tested with			Interpretation
Anti - A	Anti - B	A cells	B cells	O cells	
4 +	0	0	4 +	0	A
0	4 +	4 +	0	0	B
4 +	4 +	0	0	0	AB
0	0	4 +	4 +	0	O

Laboratory testing for Rh

- D antigen is most immunogenic
- Routine testing for D antigen
- Using commercial Antisera (Anti-D)
 - Rh Positive
 - Rh Negative



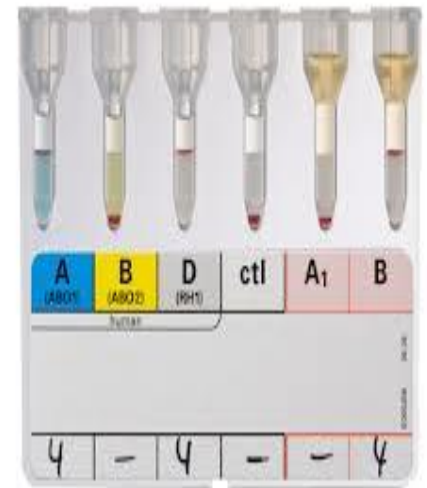
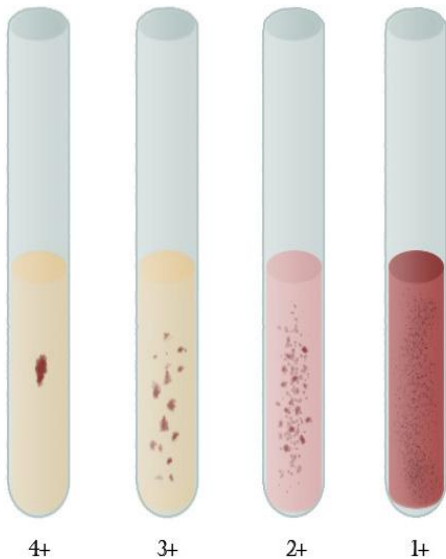
No RH Antigens in red blood cells



RH Antigens (Protein) in cells

Techniques

- Tube technique
- Microplate technique
- Column agglutination technique



Issues and Troubleshoots in Routine Blood Grouping

Identify the problem

Most of the time, the problem is technical

- Mislabeled tube
- Failure to add reagent
- Either repeat test on *same* sample, request a new sample, or wash cells

Other times, there is a *real discrepancy* due to problems with the patient's red cells or serum

Issues in Blood Grouping

ABO grouping problems

- Discrepancy in Cell and Serum Grouping

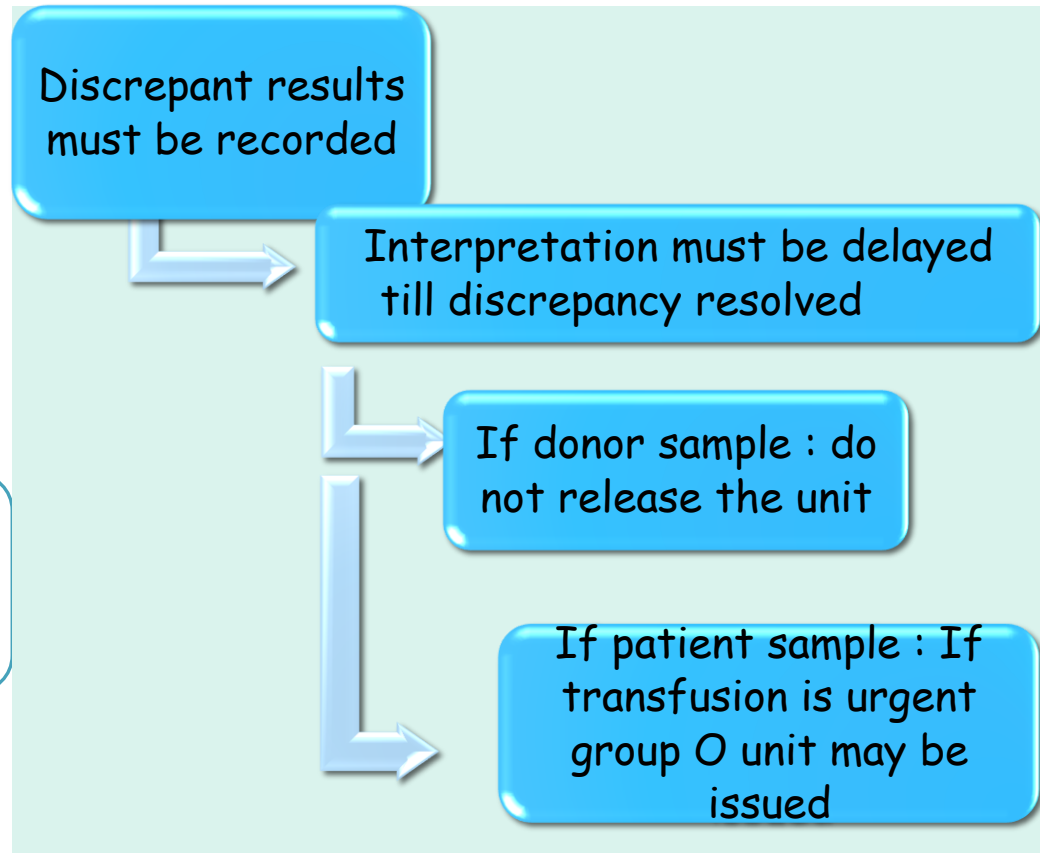
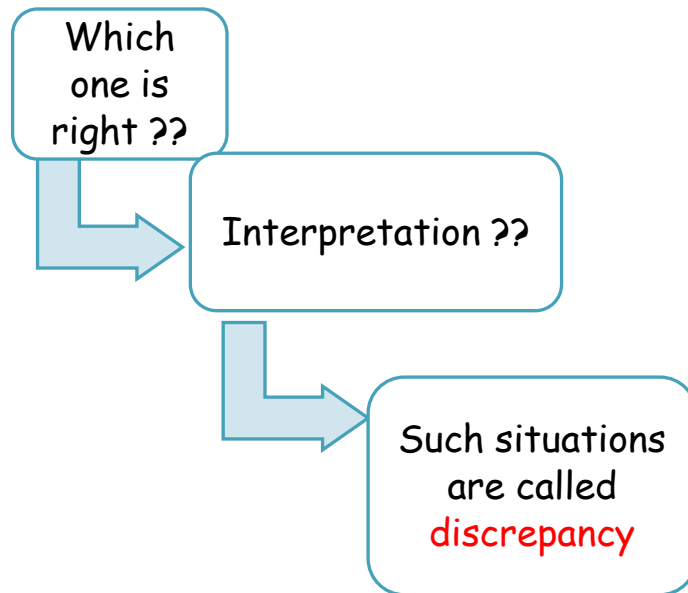
Rh grouping problems

- Weak D/Partial D

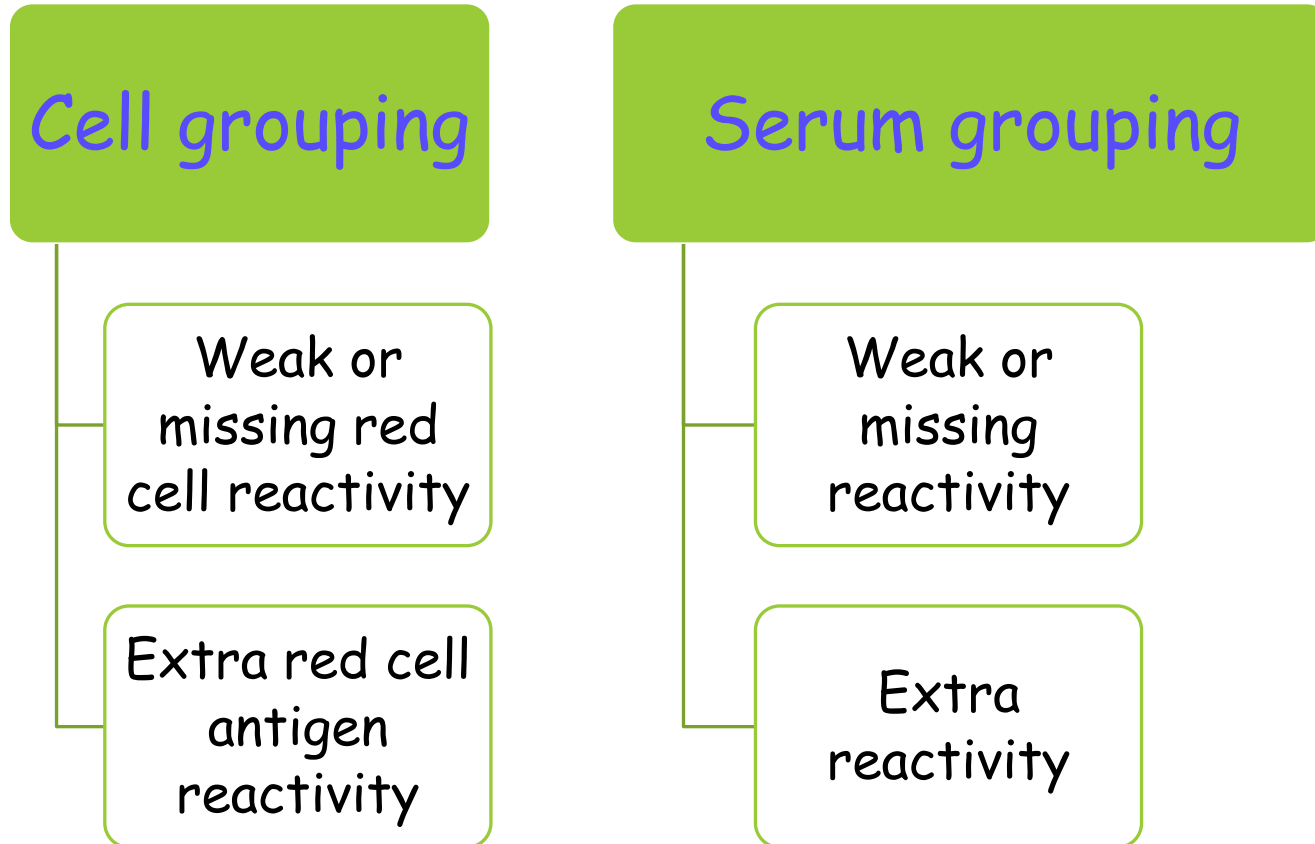
ABO Grouping problems

When cell and serum grouping do not match

Important to note :



Discrepancy in ABO grouping



To resolve

- Repeat the test with proper technical procedure
- Ask for fresh sample, repeat the test
- Check medical history, diagnosis, age, previous transfusion
- Perform additional tests
- Repeat after washing red cells, change cell:serum ratio, increase incubation time
- Adsorption Elution
- Secretary status

Interesting problem cases:

21 yr /F , Clinical diagnosis AML, M1, Blood group results

Anti-A	Anti-B	Ac	Bc	Interpretation
0 to 1+	0	0	4+	? A ? Subgroup of A

- Cell grp- weak reaction for A ag
- Serum grouping- A group
- Possibilities :
 - Subgroup of A
 - Weakening of A ag due to disease
- To resolve:
 - ✓ Previous bld grp report if kn
 - ✓ Detail clinical history
 - ✓ Special techniques

Interesting problem cases:

2 months /M, posted for Surgery on next day

Blood group results

Anti-A	Anti-B	Ac	Bc	Oc	Interpretation
0	4+	0	0	0	? B ?AB

- Cell grp- B
- Serum grouping- AB
- Possibilities:
 - Weak antibodies
 - ✓ Newborn:
 - ✓ Old age:
 - ✓ Hypogammaglobulemia

To resolve:

- ✓ Check age of the pt
- ✓ Clinical diagnosis
- ✓ Modification of techniques
-extended incubation, alter cell serum ratio etc

Interesting problem cases:

F/43, T cell lymphoma, Hb 5.6

Blood group results

Anti-A	Anti-B	Ac	Bc	Oc	Interpretation
0	3+	3+	3+	3 +	? Irregular Antibodies

- Alloantibodies
- Autoantibodies
- Others : abnormal proteins, fibrin clot, recent infusion of immunoglobulins etc

To resolve:

- ✓ Alloantibodies: identification by using reagent red cell panel
- ✓ Auto antibodies: test at different temperature, prewarm technique,
- ✓ Abnormal high proteins: alter cell to serum ratio

Interesting problem cases:

10 yr M, case of NHL, Hb 7.0, on chemotherapy

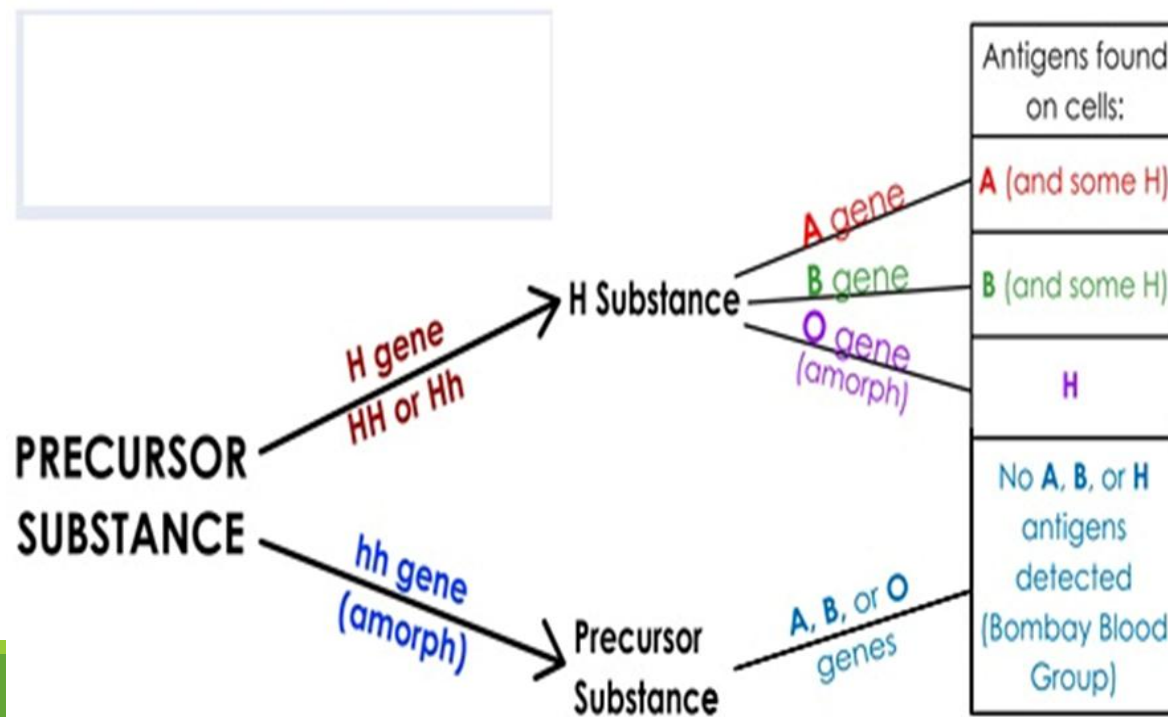
Anti-A	Anti-B	Ac	Bc	Oc	Interpretation
0	0	3+	3+	3+	? O with irregular Abs ? Bombay

To confirm:

1. Test with Anti-H
2. Test with various batches of anti-A, anti-B, anti-AB, anti-H
3. Family study
4. Secretor status

Bombay Phenotype (Oh)

- ✓ Discovered in Bombay by Bhende et al in 1952
- ✓ Absence of A, B and H antigen
- ✓ Presence of anti-A, anti-B & anti-H
- ✓ Should be transfused only with Bombay blood group



Rh typing problems

- All Rh negative samples are tested for weak D
 - Weak D :
 - extended incubation and test with AHG
 - Partial D
- Significance in donor and patient

Compatibility Testing

Compatibility testing

- Set of procedures required before blood can be issued
- To make sure that there are no antibodies present in patient serum which react with donor red cells
- This is the **final check** on compatibility between donor & recipient
- It includes:
 - ABO & Rh grouping of Patient & Donor
 - Screening for irregular antibodies
 - Cross-matching

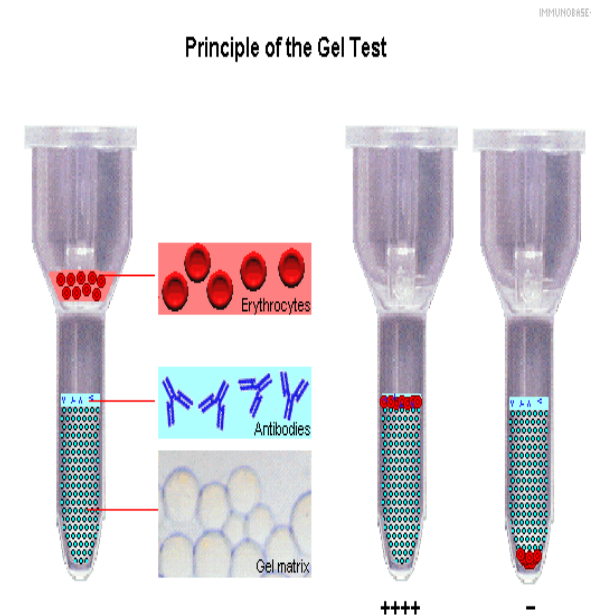
Techniques for compatibility

Routine procedure

- Saline RT & 37° C
- Antiglobulin test 37° C

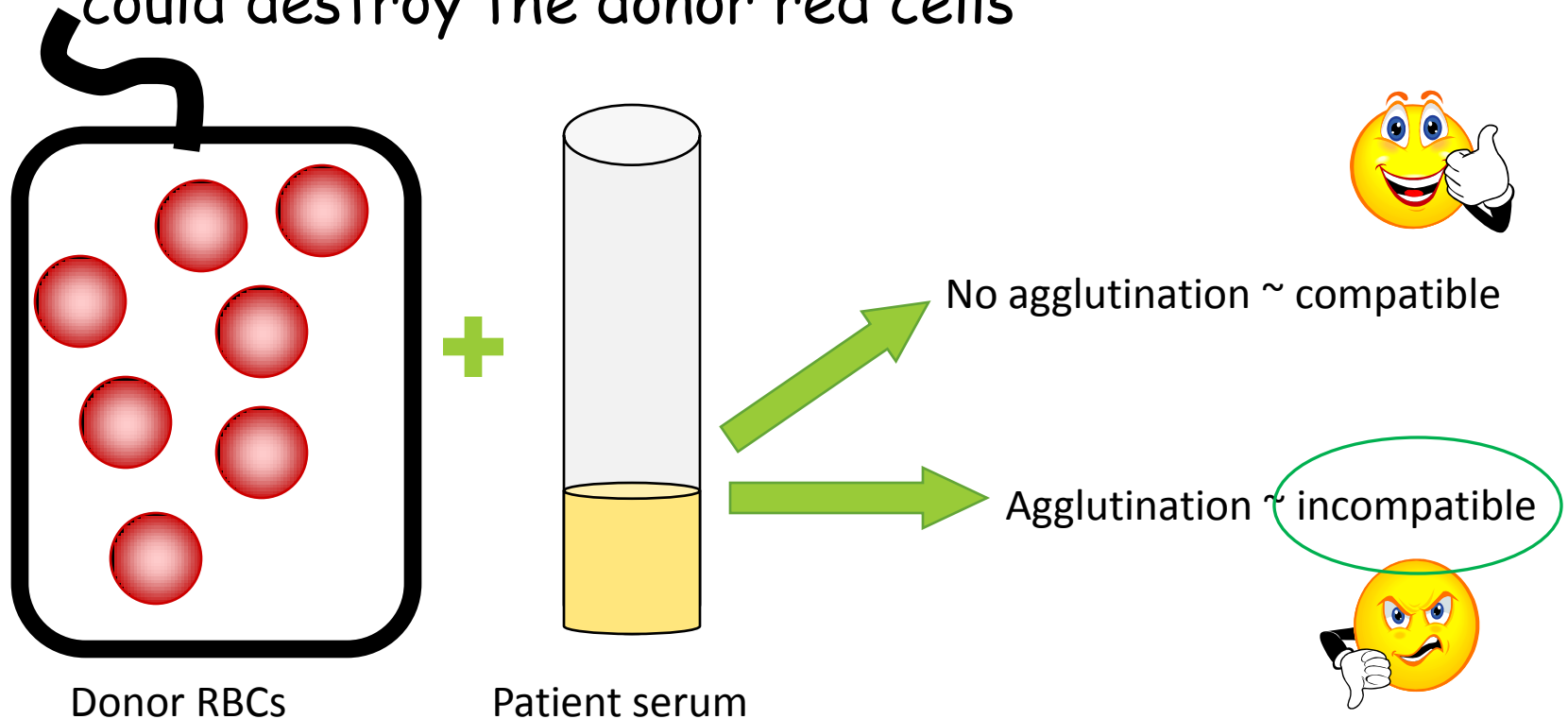
Method

- Test tube
- Column agglutination



Crossmatch

- Primary objective of crossmatch is to detect presence of antibodies in recipient's serum, which could destroy the donor red cells

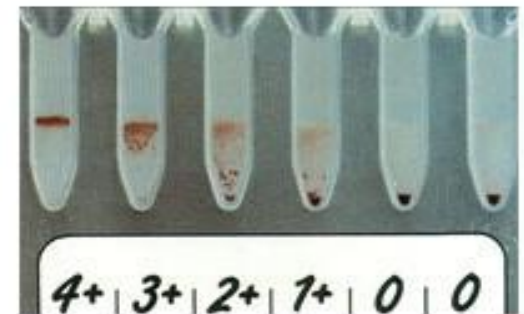


Issues related to Compatibility testing

Resolving incompatibilities

Causes of positive crossmatch results are

- ✓ Incorrect ABO grouping of patient or donor
- ✓ Presence of alloantibodies in patient's serum
- ✓ Presence of autoantibodies
- ✓ Abnormalities in patient serum



Incorrect grouping of patient or donor

- Due to procedural error
- Sampling error
- Repeat the blood grouping on patient and donor sample
- If require ask for new sample and also check blood group in previous record

Presence of Allo or autoantibodies

- Incompatible with many donor unit
- Detail clinical history
- DAT, IAT and autocontrol
- Antibody identification and issue antigen negative unit
-

Key points

- ✓ Follow standard procedures & manufacturer's instruction
- ✓ Use appropriate equipment and reagents
- ✓ If there is discrepancy, resolve it
- ✓ Repeat test on same sample
- ✓ If required perform additional tests
- ✓ Obtain clinical diagnosis, previous bld grp report, transfusion history, medication

Thank You !!!