

**Class 11:**

# Blood groups

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# Objectives for this lecture

- Discuss the Blood groups.
- understand the blood ABO and Rh system.

# Blood groups

- *Defined set of red blood cell antigens*, or blood group substances, controlled by a genetic locus having a variable number of alleles (3) (eg, A, B, and O in the ABO system).
- The *A and B alleles* catalyse addition of carbohydrate residues to a basic antigenic glycoprotein or glycolipid with a terminal sugar known as the H substance.

# Blood groups

- The *O allele* is non-functional and so does not modify the H substance.
- The A allele actually itself has two variants, A1 and A2.
- *A2 cells react more weakly than A1 cells with anti-A, and patients who are A2B can be wrongly grouped as B.*
- The A, B and H antigens are present on most body cells including WBC and platelets.

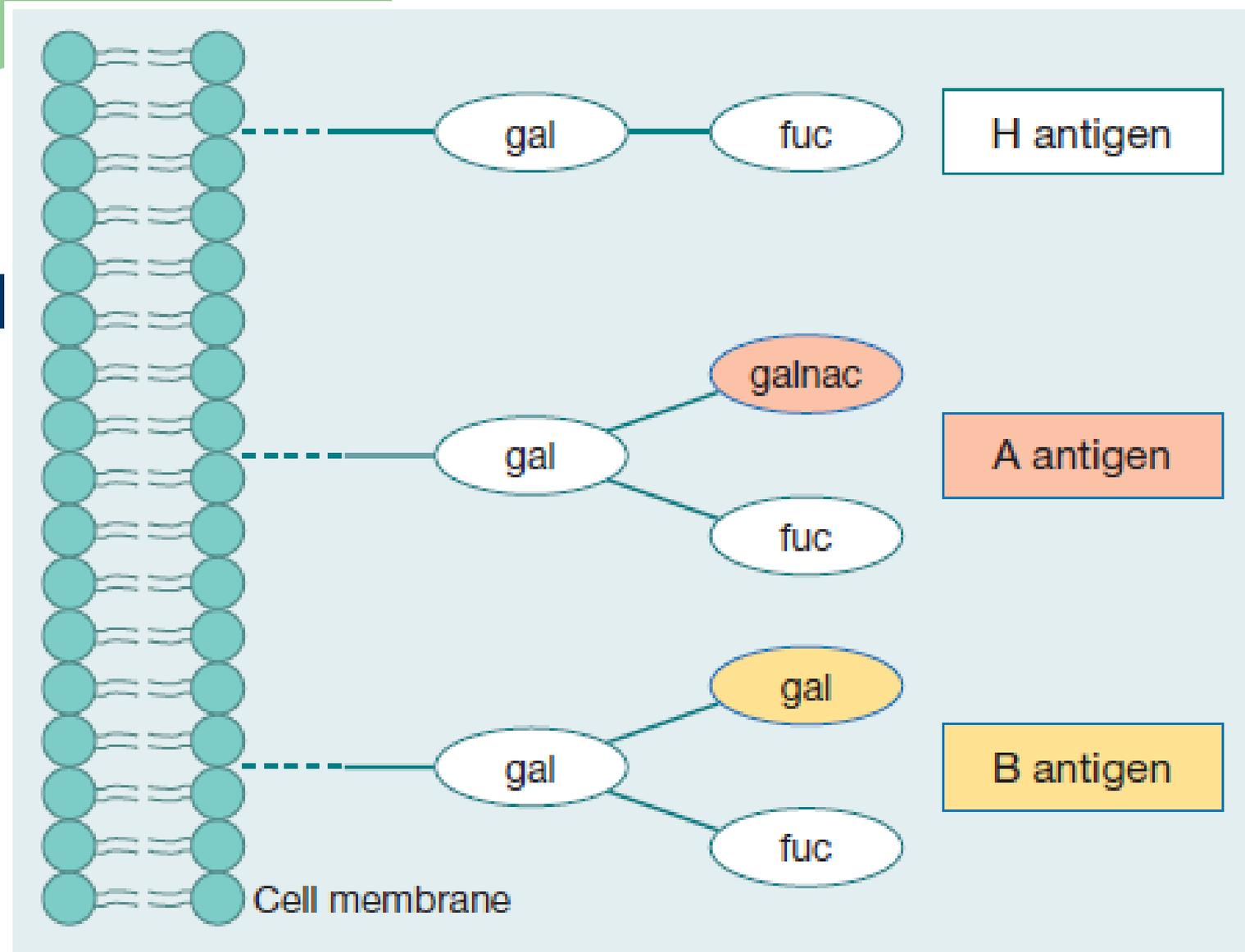


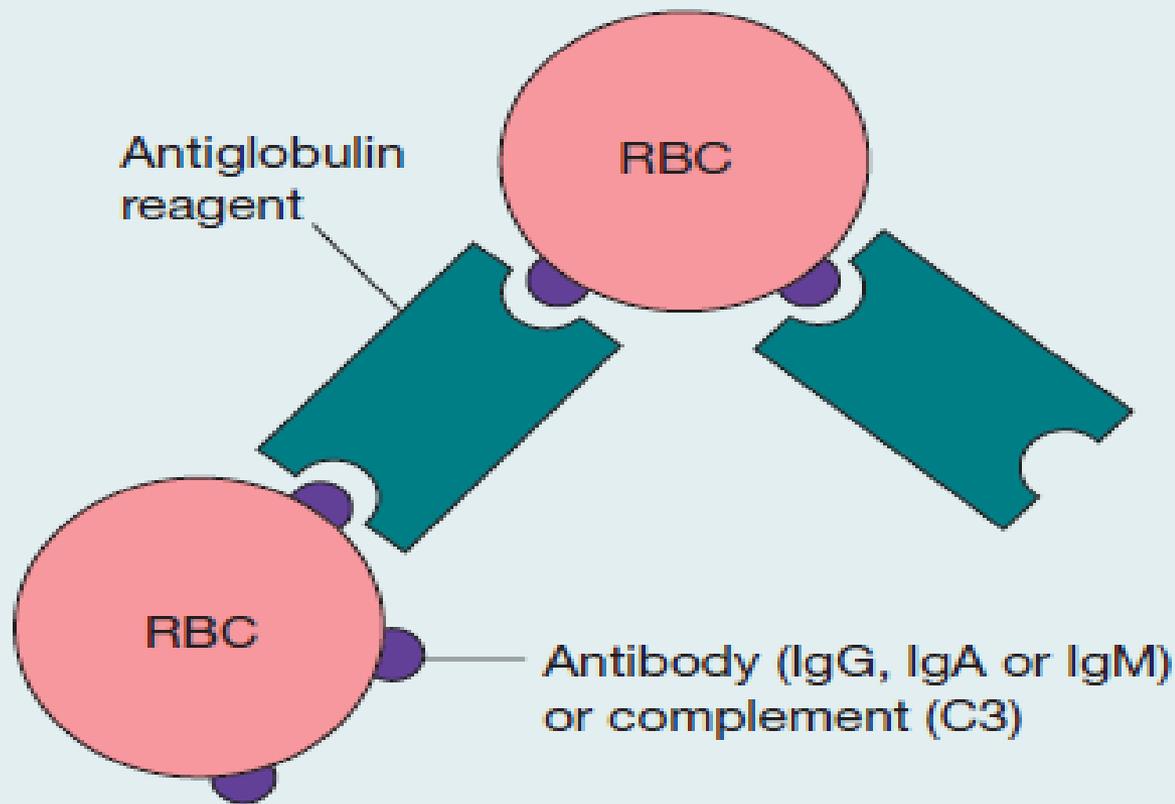
Figure 30.2 Structure of ABO blood group antigens. Each consists of a chain of sugars attached to lipids or proteins

**Table 30.4** The ABO blood group system.

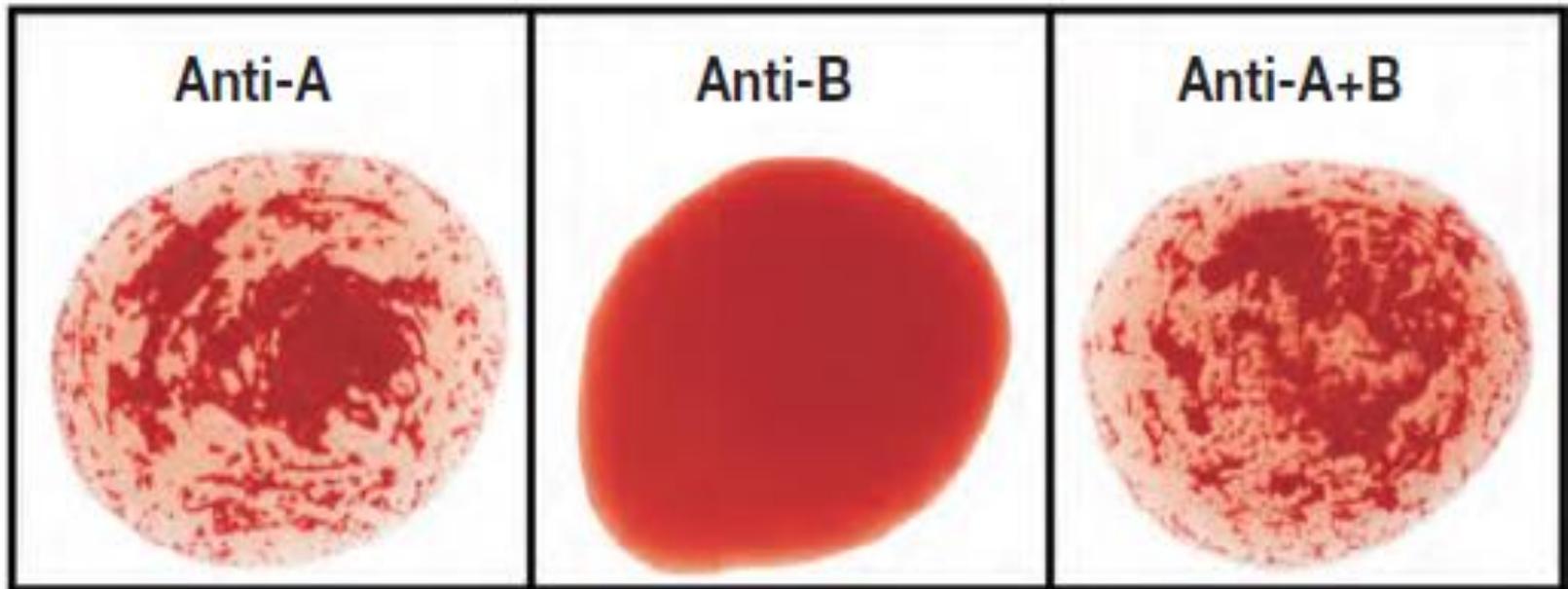
<b>Phenotype</b>	<b>Genotype</b>	<b>Antigens</b>	<b>Naturally occurring antibodies</b>
O	OO	O	Anti-A, anti-B
A	AA or AO	A	Anti-B
B	BB or BO	B	Anti-A
AB	AB	AB	None

## *Rh system*

- two structural genes, *RhD* and *RhCE*, encode membrane proteins that carry the D, Cc and Ee antigens.
- *RhD gene* may be either present or absent, giving the Rh D+ or Rh D– phenotype.

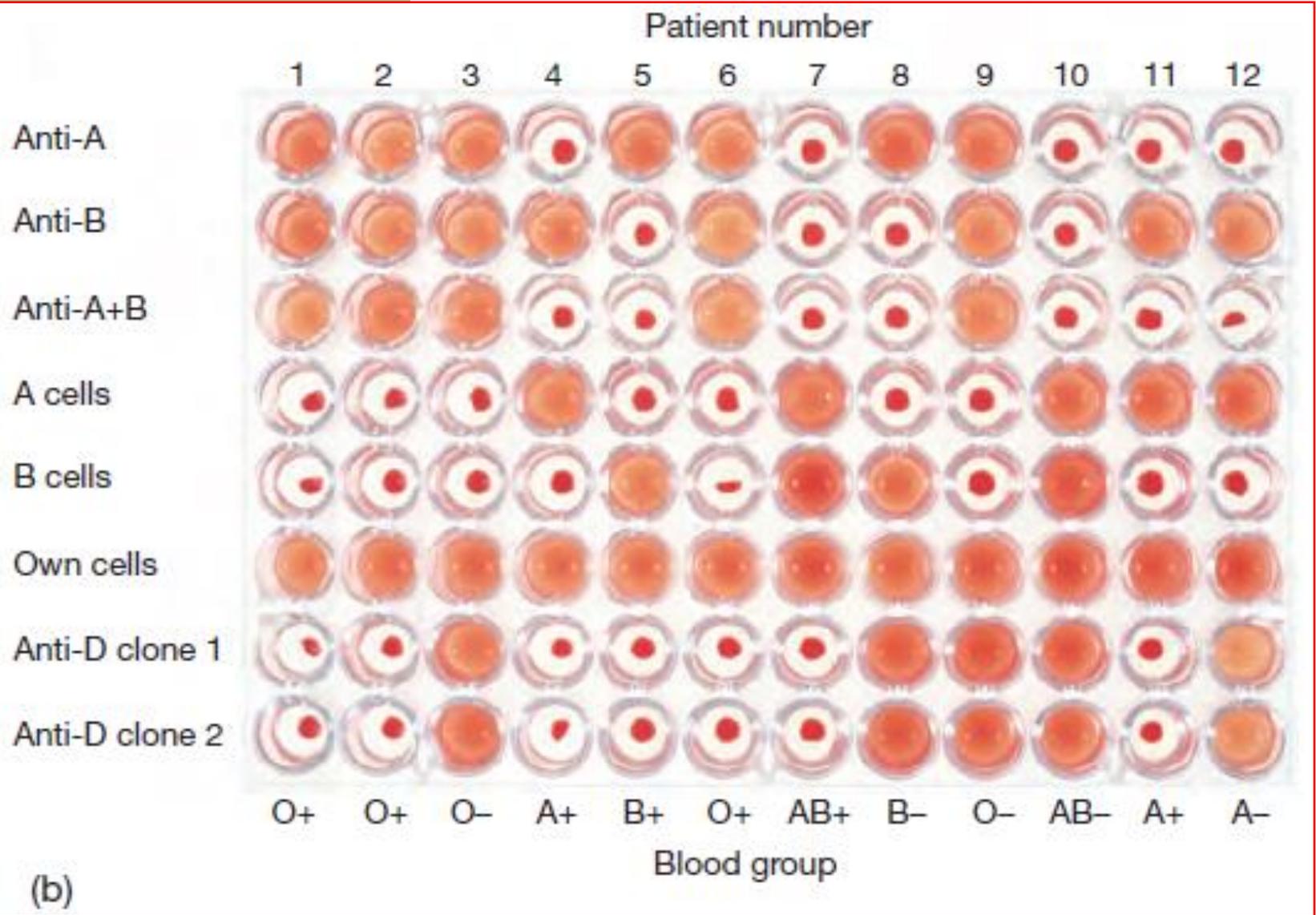


**Figure 30.5** The antiglobulin test for antibody or complement on the surface of red blood cells (RBC). The antihuman globulin (Coombs') reagent may be broad spectrum or specific for immunoglobulin G (IgG), IgM, IgA or complement (C3).



(a)

**Figure 30.3 (a)** The ABO grouping in a group A patient.



(b)

(b) Routine grouping in a 96-well microplate. Positive reactions show as sharp agglutinates;

- Individuals of *type A* have anti-B antibodies in their plasma that will agglutinate the erythrocytes in type B or type AB blood.
  - **universal donor:** **Type O** blood has neither A nor B antigens.
  - **universal recipient:** **Type AB** blood has neither anti-A nor anti-B antibodies

# *haemolytic transfusion reaction*

- ***Haemolytic shock phase :***
  - after transfusing a few millilitres of blood or up to 1–2 hours after the end of the transfusion.
  - Patient will show urticaria, pain in the lumbar region, flushing, headache, precordial pain, shortness of breath, vomiting, fall in blood pressure.
  - There is red cell destruction, and jaundice, haemoglobinuria.

# *haemolytic transfusion reaction*

- ***The oliguric phase :***
  - In some patients with a haemolytic reaction there is renal tubular necrosis with acute renal failure.
- ***Diuretic phase :***
  - Fluid and electrolyte imbalance may occur during the recovery from acute renal failure.

# References

- Victor A Hoffbrand, Paul Moss, J Pettit; ***Essential Haematology***. Essentials Series Blackwell Science, New York; 2008.
- Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil. ***Harper's Illustrated Biochemistry***. McGraw-Hill Ed, 31 ed, 2018.