

TML Basics: ABO Rh(D) Compatibility; Group & Screen; Crossmatch



where science and innovation
meet Compassionate Care

Name: Melanie Tokessy
Date: November 25 2020



Objectives

- Overview of basic immunology
- ABO typing and compatibility
- Review Rh(D) typing
- Describe antibody screening and investigation
- Review crossmatching methods





Pretransfusion Testing

- Requires upmost attention when collecting specimens
- Repeated every 96-hours
- Must have 2 ABO groups on record prior to issuing RBC
- If no historical ABO on record:
 - Need confirmatory specimen
 - May repeat ABO on current sample if collect by PPI





Human Blood Group Systems

- 33 different blood group systems
 - ABO
 - Rh
 - Kell
- Pretransfusion testing will ensure best compatibility with the various blood group systems





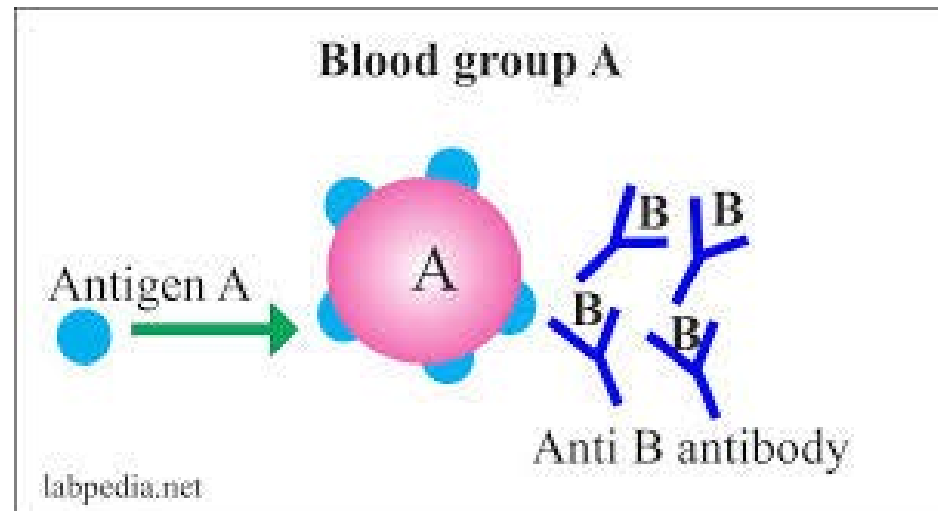
Pretransfusion Testing

- Group and Screen
 - ABO group
 - Rh(D) group
 - Antibody screen
 - Crossmatch



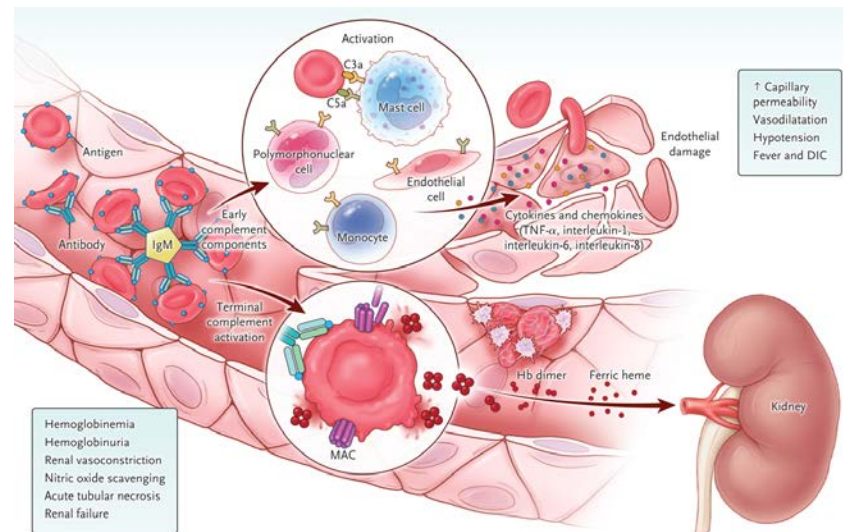
ABO Blood Group

- Antigen: the glycoprotein present on the surface of the red blood cell (RBC)
- Antibodies: the protein that binds with foreign substances


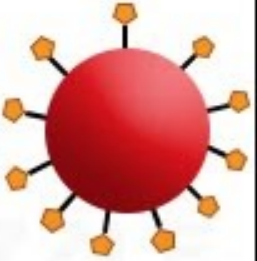
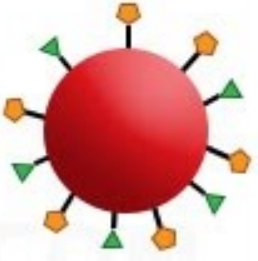
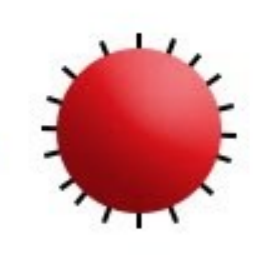








ABO Blood group

- Most important blood group system
- Binding of antibodies with antigens causes clumping/agglutination
- Transfusion of ABO incompatible blood is often fatal
- Most incompatible transfusion are caused by clerical error



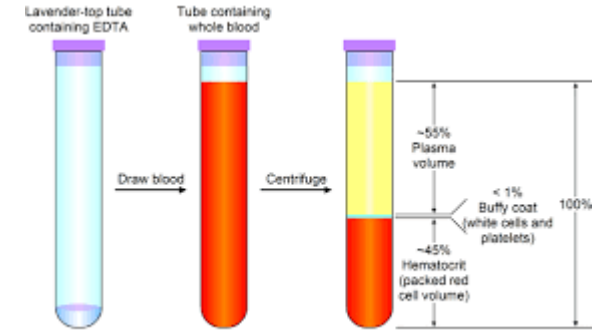
Four ABO Phenotypes and Their Antibodies

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-B and Anti-A
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

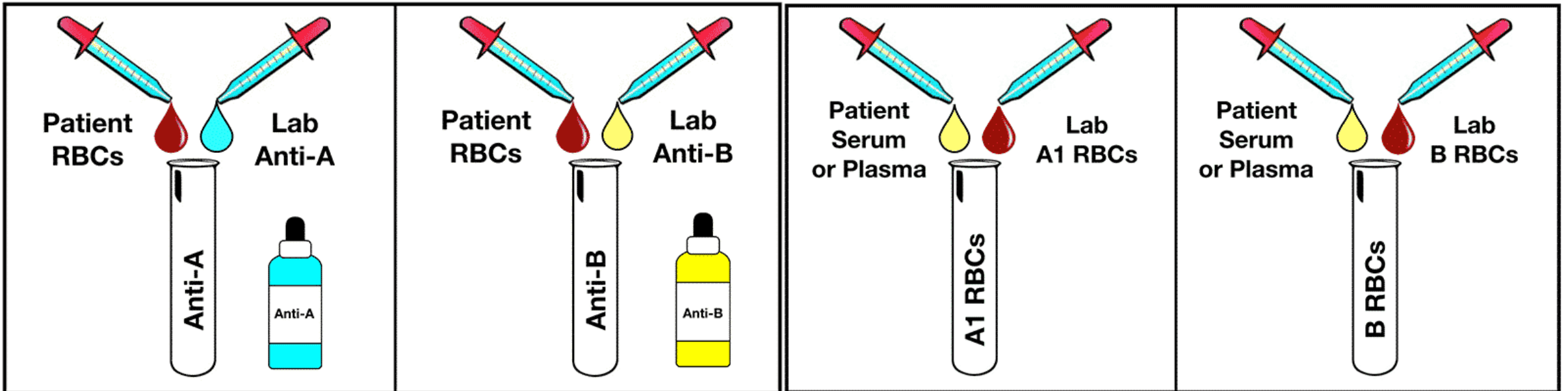
© Buzzle.com



ABO Blood Group Testing

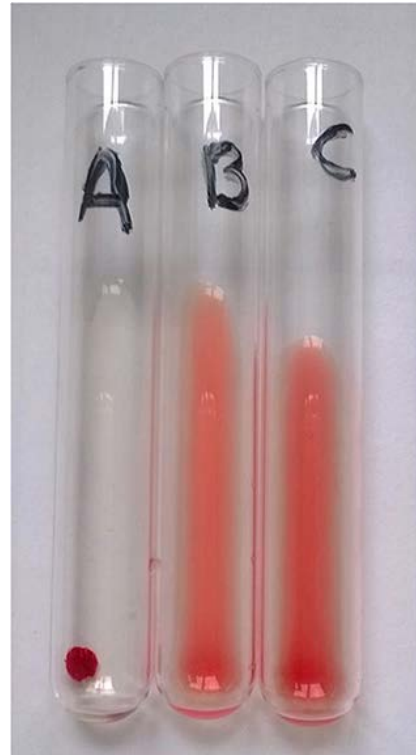


© PhysiologyWeb at www.physiologyweb.com



















ABO Blood Group Testing

- Testing is based on antigen-antibody binding in test tube: agglutination



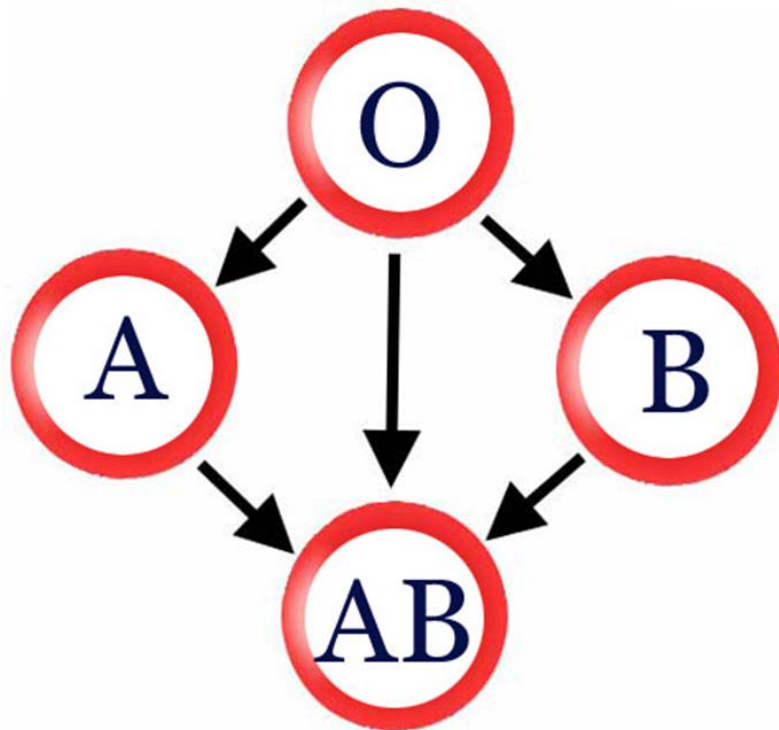
ABO Interpretations

	Patient RBCs	Patient RBCs	Patient Plasma	Patient Plasma
	Anti-A Antibody	Anti-B Antibody	Type A RBCs	Type B RBCs
O				
A				
B				
AB				

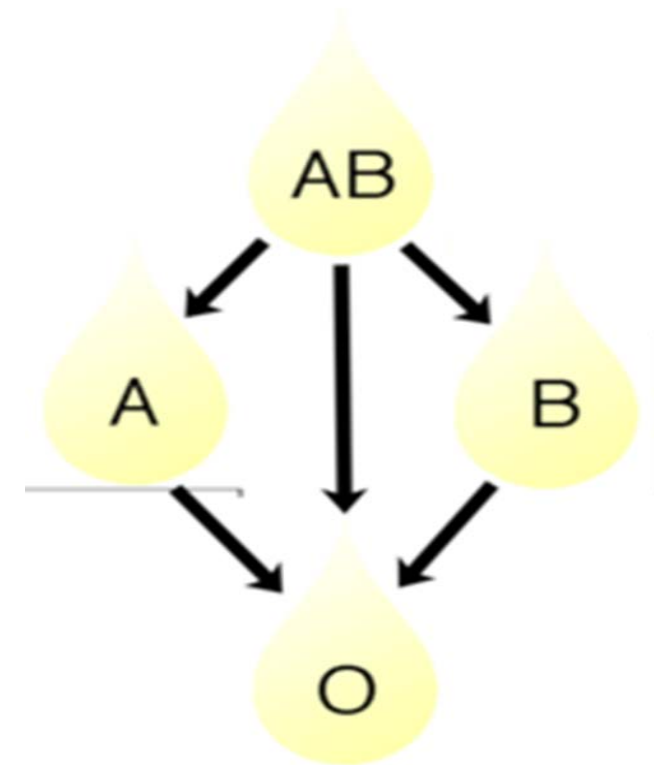


ABO Blood Product Compatibilities

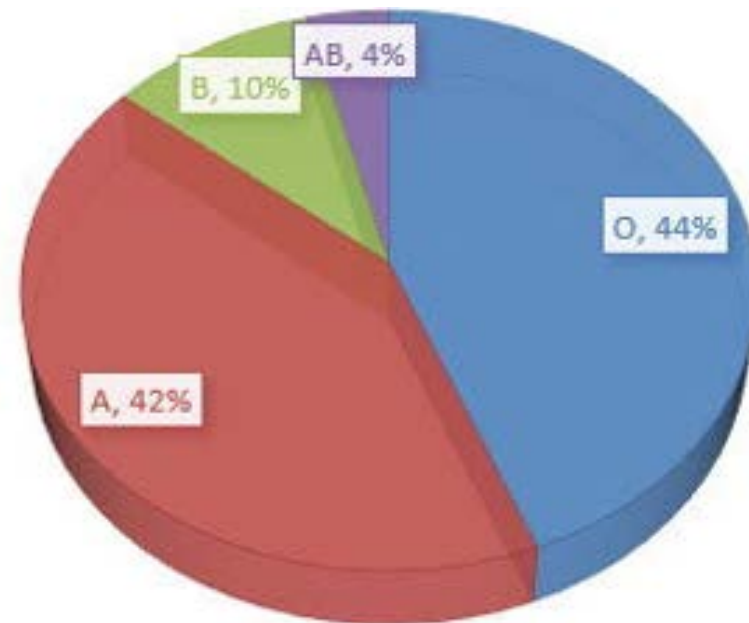
RBC Compatibility



Plasma Compatibility



ABO Blood Type Frequencies





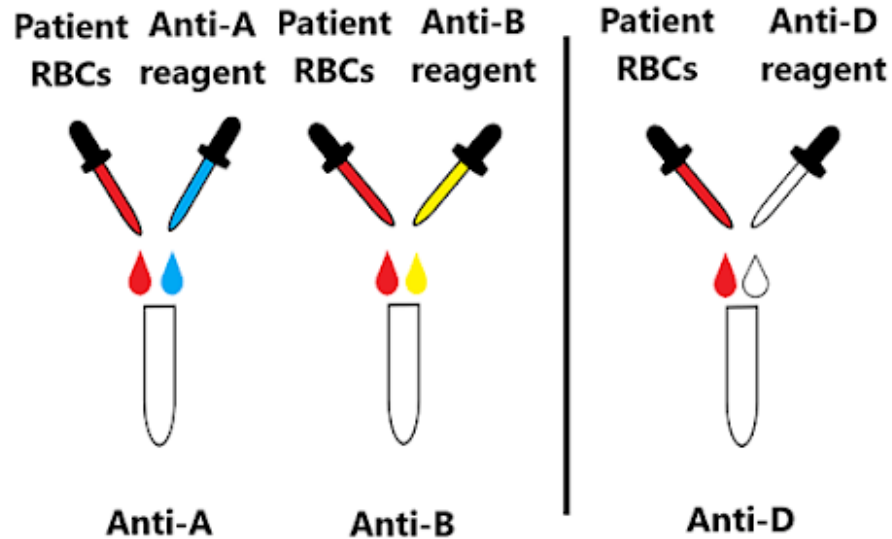
Rh Blood Typing

- 50 antigens in the Rh system
 - D, C, c, E, e.....
- Rh(D) is the antigen to determine Rh blood typing
 - Having the D antigen: Rh(D) positive
 - Lacking the D antigen: Rh(D) negative
- No naturally occurring anti-Rh antibodies
 - Rh(D) negative patients must be stimulated to produce Rh antibodies by receiving Rh(D)+ blood or pregnancy with Rh(D)+ baby

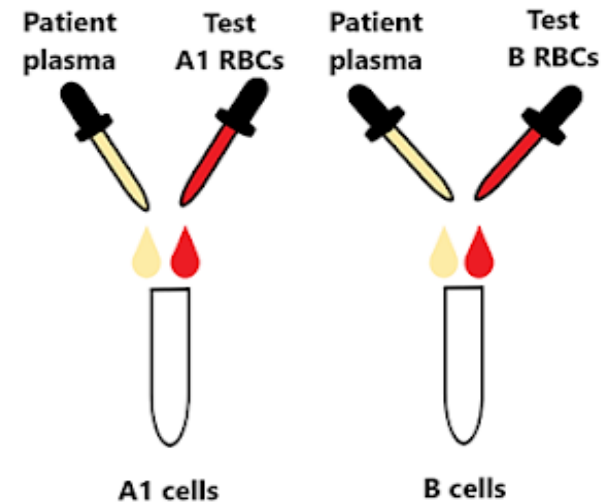


ABO and Rh(D) Typing

Forward Typing



Reverse Typing

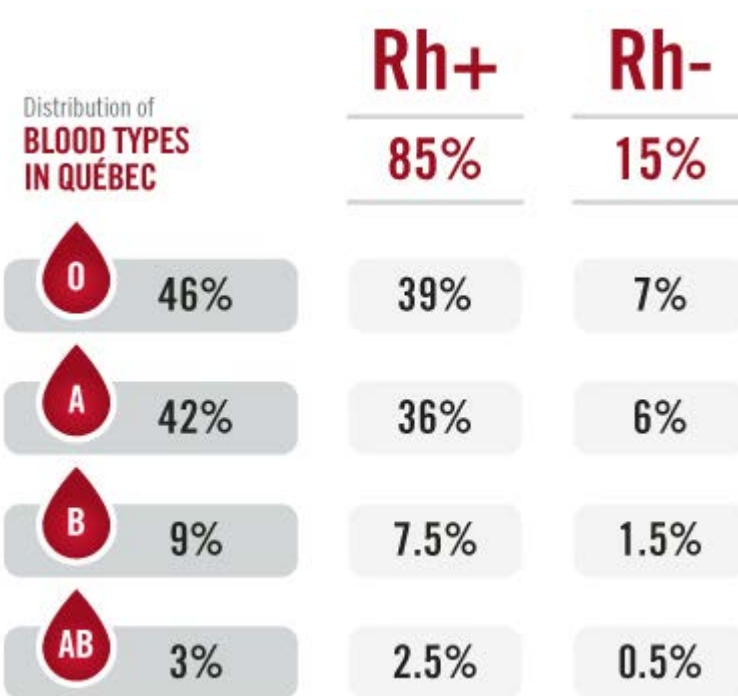


ABORh(D) Interpretations

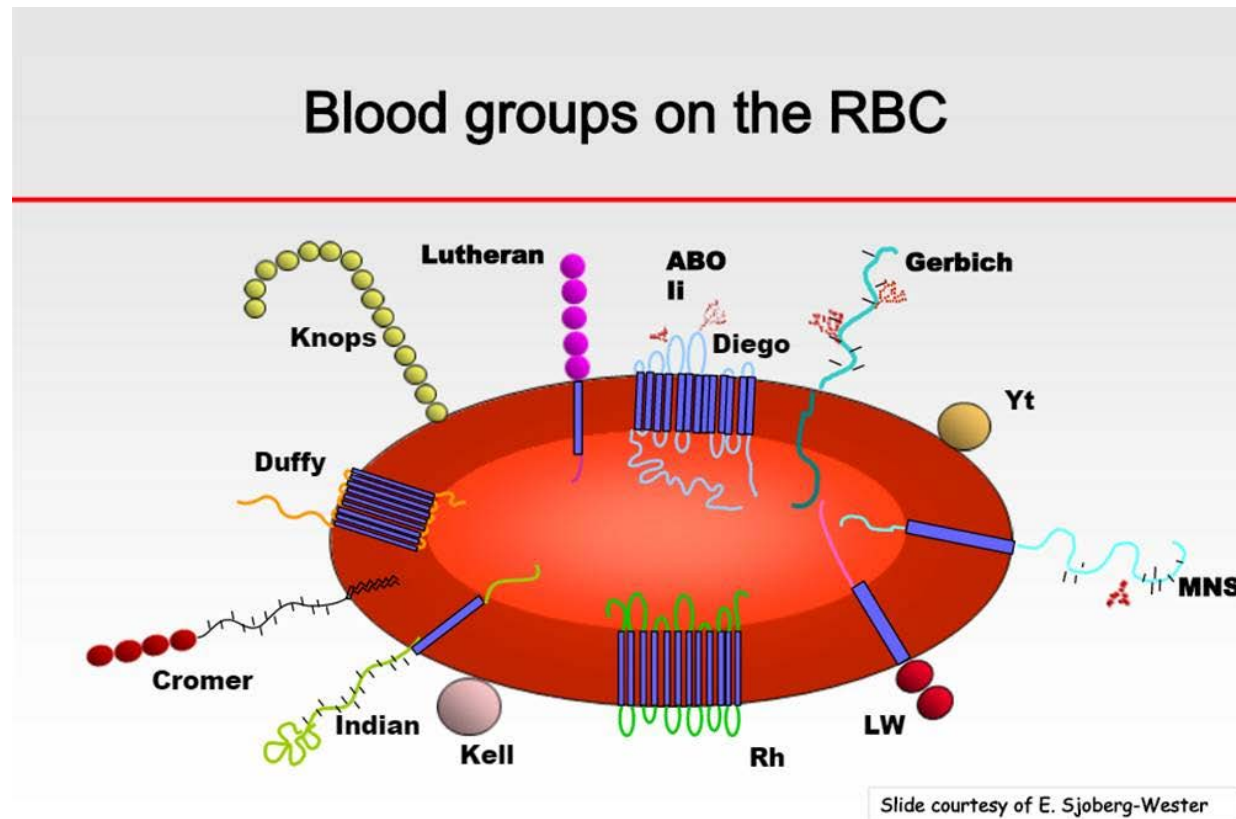
ABO/Rh group	Forward Typing			Reverse Typing	
	Anti-A	Anti-B	Anti-D	A1 cells	B cells
O neg	0	0	0	4+	4+
O pos	0	0	4+	4+	4+
A neg	4+	0	0	0	4+
A pos	4+	0	4+	0	4+
B neg	0	4+	0	4+	0
B pos	0	4+	4+	4+	0
AB neg	4+	4+	0	0	0
AB pos	4+	4+	4+	0	0



ABORh(D) Frequencies



More than just ABORh(D)



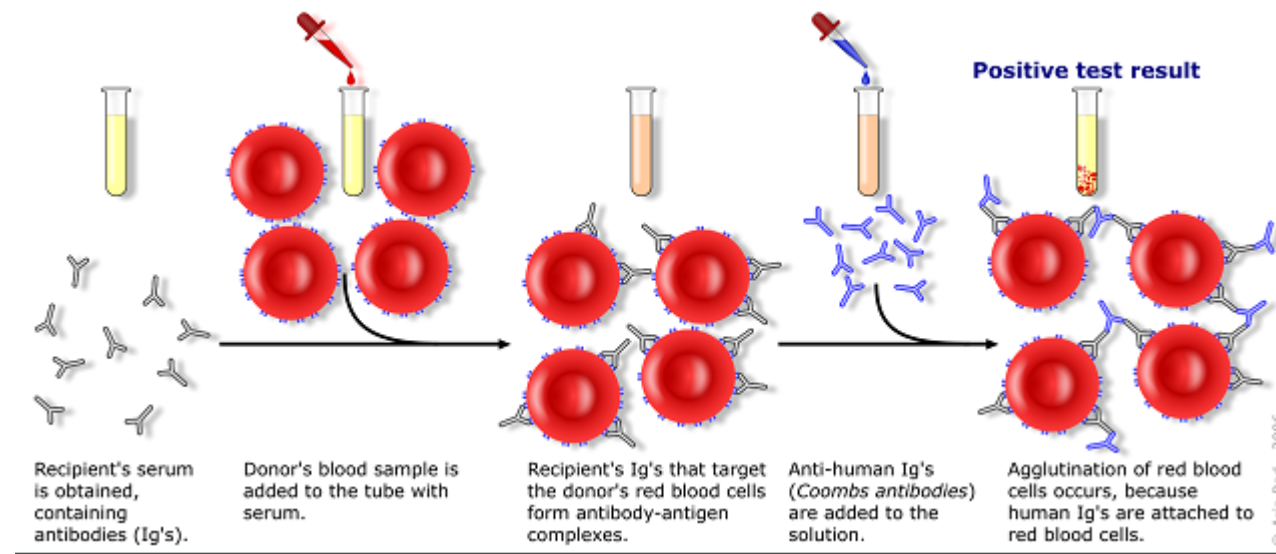


Antibody Screen Test

- Indirect antiglobulin test
- Uses recipient plasma against reagent RBC
- Detects unexpected blood group antibodies to non-ABO/Rh(D) antigens
- Ensures a safe transfusion
- Detects/monitors for HDFN



Antibody Screen Test



Antibody Screen Test



IMMUCOR, INC. Norcross, GA 30071 USA
 US LICENSE NO: 886
 LOT NO: 40380
 EXPIRES: 2020/12/11

PANOSCREEN VIAL	Donor			Rh - Hr					Kell					Duffy		Kidd		Lewis		P	MN			Lutheran		Xg	Patient A				
	Barcode #	Add'l Typings	Rh Donor ID	D	C	c	E	e	C*	K	k	Kp ^a	Kp ^b	Js ^{a*}	Js ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s		Lu ^a	Lu ^b	Xg ^a	
				+	0	+	0	+	0	+	0	+	0	+	0	+	0	+	0	+	0	+	0	+	0	+		0	+	0	+
I	198380		R1R1 B10311	+	+	0	0	+	0	+	0	0	+	0	+	0	+	0	0	0	0	+	+	+	+	+	0	+	+	+	
II	298380		R2R2 C6690	+	0	+	+	0	0	0	+	0	+	0	+	+	0	+	+	+	0	+	0	+	0	+	0	+	0	+	0
III	398380	Yt(b+)	rr G1266	0	0	+	0	+	0	+	+	0	+	0	+	+	0	+	0	0	+	0	+	0	+	0	+	0	+	0	

PANOSCREEN

* Indicates those antigens whose presence or absence may have been determined using only a single example of a specific antibody.
 An antigen designated with a 'w' represents a weakened expression of the antigen that may or may not react with all examples of the corresponding antibody.





Antibody Screen Test - positive

- Positive result: presence of unexpected antibodies
- Unexpected RBC antibodies are found in 1-2% of population
- Must perform antibody investigation to determine specificity
- Antigen negative RBC is required prior to transfusion
- May need additional sample from the patient to complete work
- Can be time consuming and result in delay of getting blood to patient



Antibody Investigation

PANUCELL-20
Master List

INMUCOR, INC. Norcross, GA 30071 USA
U.S. License No. 846 Lot No. 41489 Exp. Date: 2020/12/18

INSTITUTION _____
BLOOD GROUP _____ ANTIBODY IDENTITY _____
TECH _____ DATE _____

SYSTEM	Rh - Hr	C	E	K	Kp	Kp2	Jk ^a	Jk ^b	Fy ^a	Fy ^b	Jk ^x	Le ^a	Le ^b	P	MN	Lutheran	Xg	Special Antigen Type	PATIENT'S TEST RESU	
1 R1wR1 B10314	+	+	0	0	+	0	+	0	+	+	+	+	+	0	+	0	+	+		1
2 R1R1 B6895	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	2
3 R1R1 B10317	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	3
4 R1R1 B10031	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	4
5 R2R1 A4499	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	5
6 R2R2 C9995	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	6
7 R2R2 C6464	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	7
8 R2R2 C1299	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	8
9 R2R2 C9994	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	9
10 R1R1 B6897	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	10
11 F1E780	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	11
12 F1F15	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	12
13 W1541	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	13
14 F1D1563	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	14
15 F1N554	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	15
16 F1H1522	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	16
17 F1G1756	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	17
18 F1H4822	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	18
19 F1N3119	0	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	19
20 R1wC476	+	+	0	0	+	0	+	0	+	+	+	+	+	0	0	+	0	+	0	20

PATIENT'S CELLS

In those instances where a patient's serum is known to contain anti-B, it may be desirable to perform antibody screening tests with D-red cells. The panel cells 3,11,12 and 13 also be used together to screen for negative antibody screening reagents.

*Indicates those antigens whose presence or absence may have been determined using only a single example of a specific antibody. An antigen designated with a "w" represents a weakened expression of the antigen that may or may not react with all examples of the corresponding antibody.

REVERSE GROUPING CELLS

PANUCORREN LOT

MADE IN USA



Antibody Investigation

PANOCELL-20 Master List

IMMUCOR, INC. Norcross, GA 30071 USA
U.S. License No: 886 Lot No: 41489

Exp. Date: 2020/12/18

NAME Patient A NO. _____
INSTITUTION _____
BLOOD GROUP _____ ANTIBODY IDENTITY _____
TECH _____ DATE _____

SYSTEM	Rh - Hr						Kell				Duffy		Kidd		Lewis		P	MN				Lutheran		Xg	Special Antigen Type	PATIENT'S TEST RESULTS									
	Donor	D	C	c	E	e	C _v	K	k	Kp ^a	Kp ^b	Js ^{a*}	Js ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s		Lu ^a	Lu ^b	Xg ^{a*}							
1	R1wR1 B10314	+	+	0	0	+	+	0	+	0	+	0	+	0	+	+	+	0	+	+	0	+	0	0	+	+	+					1			
2	R1R1 B6885	+	+	0	0	+	0	+	0	+	0	+	+	+	0	0	0	+	0	+	0	+	0	+	0	+	0					2			
3	R1R1 B10317	+	+	0	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	0	+	0	+	+	0	+	+					3			
4	R1R1 B10031	+	+	0	0	+	0	0	+	0	+	+	+	+	0	0	+	0	+	+	+	+	0	0	+	+	Bg(a+)*					4			
5	RzR1 A4469	+	+	0	+	+	0	0	+	0	+	+	+	+	0	0	+	0	+	+	+	+	+	0	+	0						5			
6	R2R2 C6696	+	0	+	+	0	0	0	+	0	+	+	+	+	0	0	+	+	+	+	+	0	+	+	0	+						6			
7	R2R2 C6404	+	0	+	+	0	0	0	+	0	+	+	+	+	0	0	+	+	+	+	+	0	+	0	+	+						7			
8	R2R2 C1286	+	0	+	+	0	0	0	+	0	+	+	+	+	0	0	+	+	+	+	+	0	+	0	+	+						8			
9	R2R2 C6694	+	0	+	+	0	0	0	+	0	+	+	+	+	0	0	+	+	+	+	+	0	+	0	+	+	Bg(a+)*						9		
10	R1R1 B8897	+	+	0	0	+	0	0	+	0	+	+	+	+	0	0	+	+	+	+	+	0	+	0	+	0	M(a+), GP.Mur						10		
		D	C	c	E	e	C _v	K	k	Kp ^a	Kp ^b	Js ^{a*}	Js ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s	Lu ^a	Lu ^b	Xg ^{a*}								
11	r'r E780	0	+	+	0	+	0	0	+	0	+	0	+	+	+	+	0	+	+	+	+	+	0	+	0	+							11		
12	r'r F918	0	0	+	+	+	0	0	+	0	+	0	+	+	0	0	+	0	+	0	+	+	+	0	0	+							12		
13	rr G1641	0	0	+	0	+	0	+	+	0	+	0	+	0	+	+	+	0	+	+	0	0	+	0	+	0							13		
14	rr G1563	0	0	+	0	+	0	+	+	0	+	0	+	+	0	0	+	0	+	+	0	+	0	+	0	+							14		
15	rr N3054	0	0	+	0	+	0	0	+	0	+	0	+	0	+	0	+	0	+	0	0	+	+	0	0	+							15		
16	rr H1922	0	0	+	0	+	0	0	+	0	+	0	+	+	0	0	+	+	0	0	+	0	+	+	+	+							16		
17	rr G1768	0	0	+	0	+	0	+	0	0	+	0	+	+	W	+	+	+	0	+	+	+	0	+	0	+							17		
18	rr N4822	0	0	+	0	+	0	0	+	0	+	0	+	+	+	0	+	0	+	0	0	+	+	+	0	+	0							18	
19	rr N3110	0	0	+	0	+	0	0	+	0	+	0	+	+	+	0	+	0	0	0	0	+	0	+	0	+							19		
20	Ror D2478	+	0	+	0	+	0	0	+	0	+	0	+	0	0	+	+	0	+	+	+	0	0	+	0	+	V ⁺ , VS ⁺							20	
	PATIENT'S CELLS																																		





Antibody Investigation

- Anti-K
- Must crossmatch K- RBC
- The K antigen occurs in 8% of the donor population
- Crossmatch compatibility is 92%
- If patient requires 4 RBC; need to crossmatch 4 RBC





Antibody Investigation

- Some patients have multiple antibodies:
 - Anti-E and anti-Jka
 - Compatibility is 16%
- May need special order blood from Canadian Blood Services
- Rarely patient may have antibodies to common blood group antigens:
 - Bombay
 - Anti-k





Crossmatching

- Type and screen testing leads the technologist to select the most appropriate type of crossmatch and RBC unit
- 3 types of crossmatches:
 - Immediate spin crossmatch
 - Electronic/Computer crossmatch
 - Indirect antiglobulin crossmatch





Immediate Spin Crossmatch

- Most commonly used type of crossmatch
- Antibody screen test must be negative
- Recipient plasma is mixed with donor RBC, centrifuged and examined for agglutination
- Will only detect ABO incompatibility
- Takes about 5-10 minutes





Electronic/Computer Crossmatch

- Becoming more common crossmatch
- Will only ensure ABO compatibility
- No mixing of recipient plasma with donor RBC
- Requires:
 - Negative antibody screen test with no history of antibodies
 - Must have validated blood bank computer system
 - Results of at least 2 ABO types on record
- Takes about 2 minutes





Indirect Antiglobulin Crossmatch

- Performed when patient has antibodies
- Ensures full compatibility of donor RBC
- Patient plasma is mixed with donors RBC, incubated and antihuman globulin added, centrifuged and examined for agglutination
- Takes 20-45 minutes



Timing for testing:

Action	Time
Booking in the sample	3 min
Centrifuging	5 min
ABORh(D)	10 min
Antibody screen test	20-45 min
Crossmatching (IS or XME)	5 min
Labelling of RBC	5 min
Issuing	2 min
Antibody investigation	>60 min
Crossmatching (IAT)	20-45 min



Questions?

