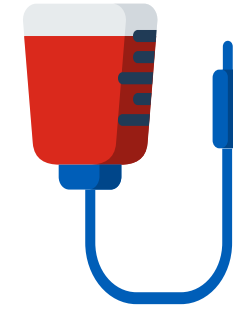
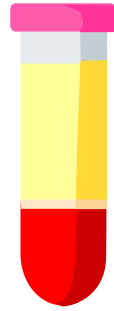


A close-up photograph of a woman with blonde hair, wearing a white lab coat with a green stripe, laughing heartily. She is looking towards a man whose profile is visible on the right side of the frame. The background is a bright, clinical setting.

Pre-Transfusion Testing

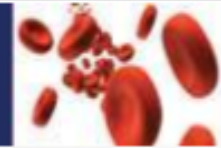
Session Outline



How do we get from a sample, to a bag of blood?

- Sample Requirements.
- Sample Testing:
 - ABO, RhD, Antibody ID etc.
- Crossmatching Red Cells.
- Issuing Blood Components and Products.
 - Platelets, Plasma, Drugs.

Guideline

TRANSFUSION
MEDICINEOfficial Journal of
the British Blood Transfusion Society

Transfusion Medicine | GUIDELINES

Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories*

British Committee for Standards in Haematology

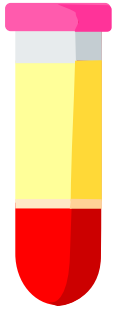
C. Milkins,¹ J. Berryman,² C. Cantwell,³ C. Elliott,⁴ R. Haggas,⁵ J. Jones,⁶ M. Rowley,^{3,7} M. Williams⁸ & N. Win⁹

¹UK NEQAS (BTLP), West Herts Hospitals NHS Trust, Watford, UK, ²Department of Blood Transfusion, University College London Hospitals, NHS Foundation Trust, London, UK, ³Department of Blood Transfusion, Imperial College Healthcare NHS Trust, London, UK, ⁴Department of Blood Transfusion, South Tees Healthcare Trust, Middlesbrough, UK, ⁵Department of Blood Transfusion, Leeds teaching Hospital NHS Trust, Leeds, UK, ⁶Welsh Blood Service, Cardiff, UK, ⁷Colindale Centre, NHSBT, London, UK, ⁸Leeds Centre, NHSBT, Leeds, UK, and ⁹Tooting Centre, NHSBT, Tooting, UK

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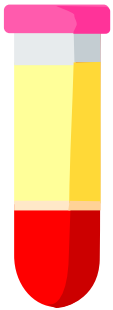
<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-3148.2012.01199.x>



Part 1: Sample Requirements



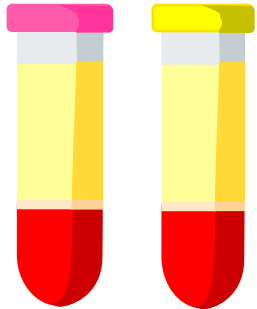
- EDTA Anti-coagulated Blood Samples (Pink Top)
- Following **ESSENTIAL** Information:
 - First Name and Surname (No Middle Name Required)
 - Date of Birth
 - NHS Number
 - Date of Collection
 - Time of Collection
 - Signature
- There can be **NO AMMENDMENTS** to the essential Information.

Part 1: Why is this important?



Essential Information	Reason
First Name, Surname and DOB.	Identifies the patient.
NHS Number	NHS numbers are unique. Other numbers get
<p>Incomplete/Amended Information = Increased risk of WBIT</p> <p> Increased risk of WBIT = Increased risk of DEATH! </p>	
Time of Collection	Ensures the lab can provide blood for the maximum amount of time.
Signature	Audit trail for the person providing the sample, in case of any errors discovered

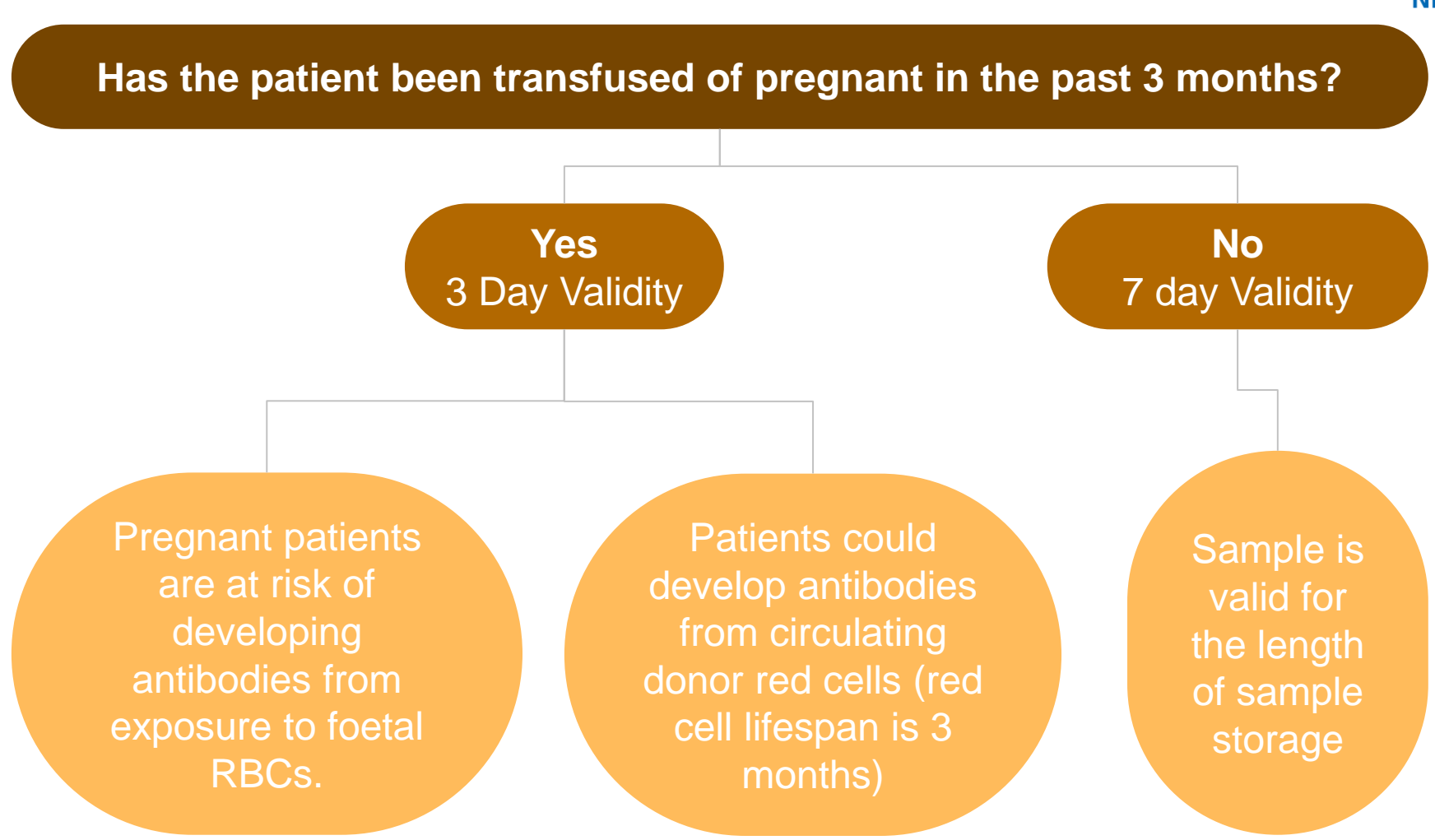
Part 1: Why 2 Samples?



1 in 2000
samples are
WBITs
Even when all
the information
is perfect!

- **2 samples protects patients!**
 - Confirms that the 1st sample wasn't a WBIT.
 - ABO matched blood is provided only after 2 samples.
 - ABO and Rh groups must match.
- **0-1 Samples**
 - Patients ONLY get group O.
 - Patients who can be pregnant get RhD-.
 - Other patients can receive RhD+ units.
- **Yellow Sample Rule**
 - Yellow top samples (provided by the lab) for patients on the same ward within 12 hours.
 - This ensures 2 samples taken separately!

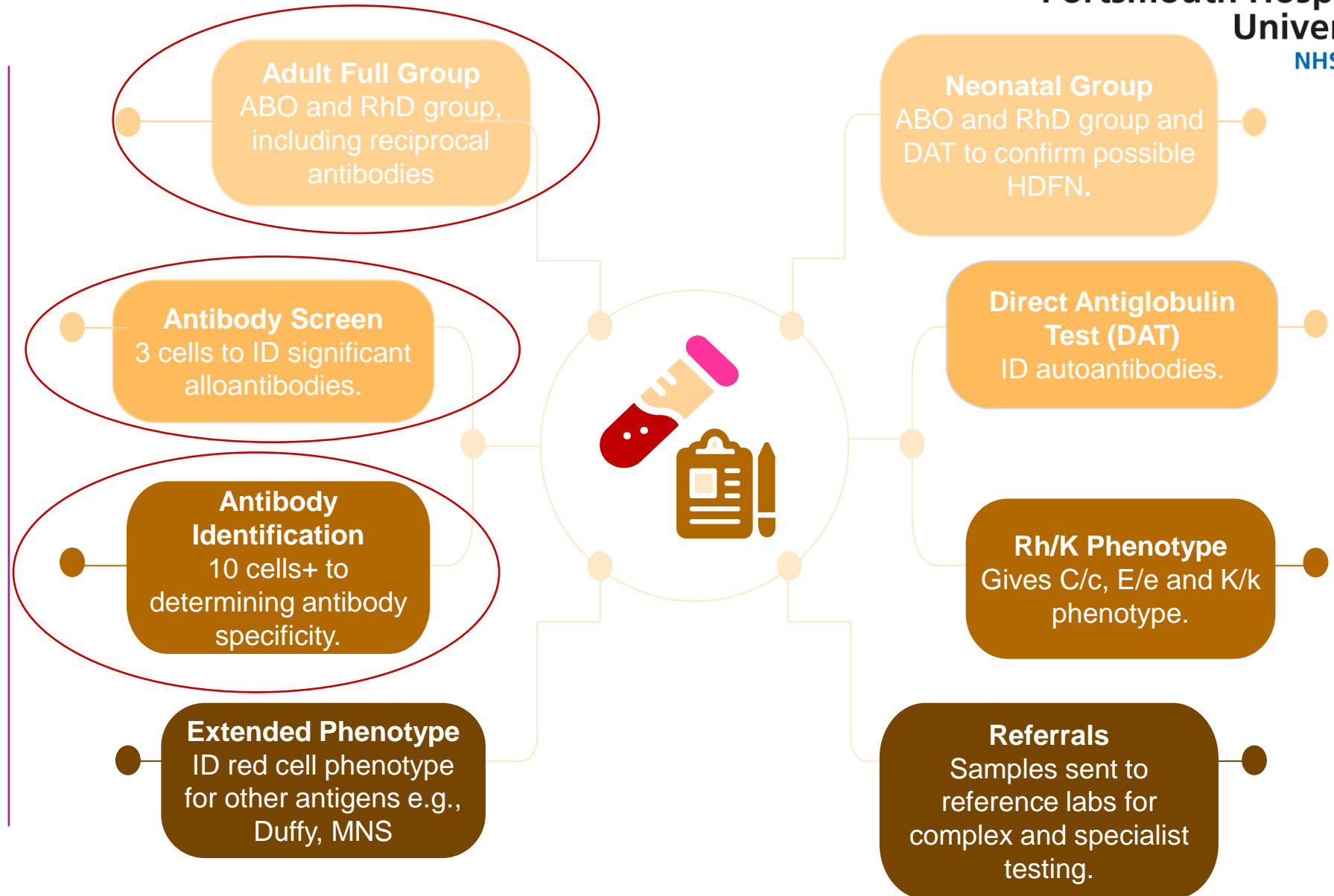
Part 1: Sample Validity.



Part 2: Types of Testing.



These are the most important tests for blood selection.



Part 2: Methods of Testing



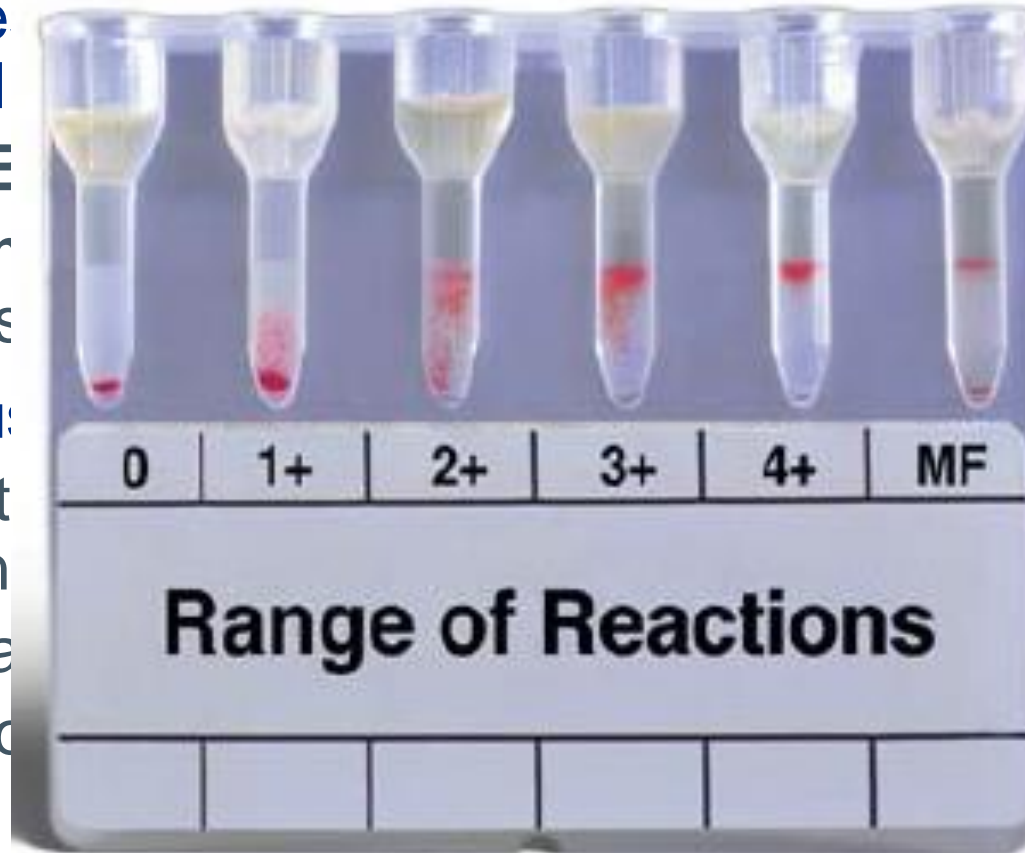
- Fully automated ABO/D group & antibody screen
 - Safer
 - Reduced Pipette errors
 - Automated Transcription of results
 - Difficult to mix up patient samples.
- Centrifugation ~ 6 mins
- ABO/D group ~ 8 mins
- Antibody screen ~ 20 mins



Part 2: Methods of Testing



- Sample needed
 - AE
 - Ar
 - tes
- Transfus
 - Int
 - an
 - Ca
 - Mo



ma are

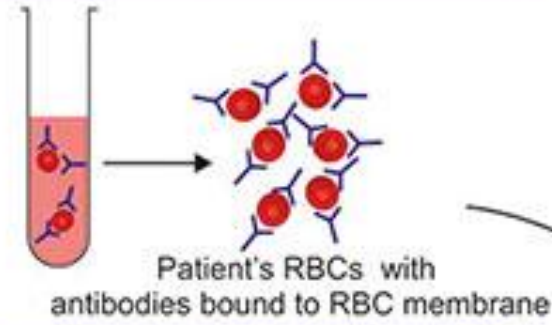
for the test.
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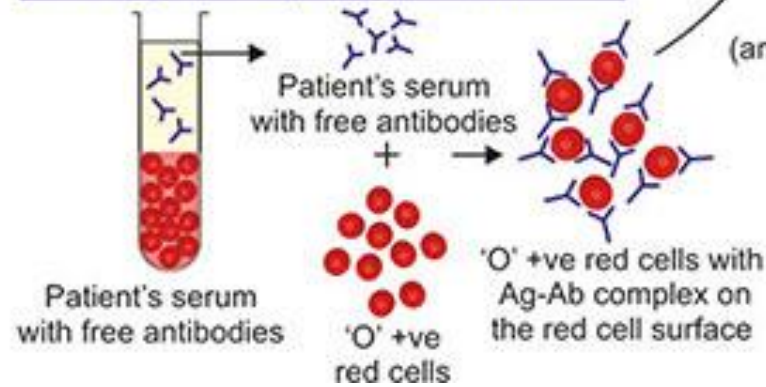
Part 2: Methods of Testing



Direct antiglobulin test (DAT) (Coombs test)



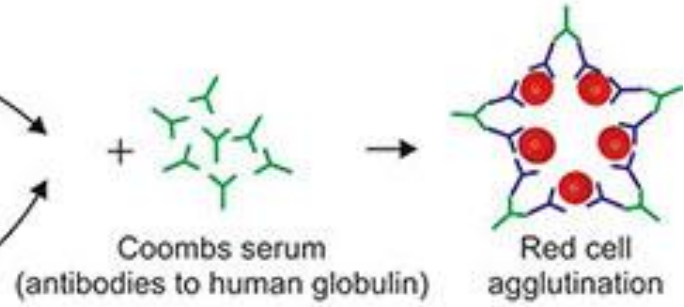
Indirect (Coombs) antiglobulin test-IAT



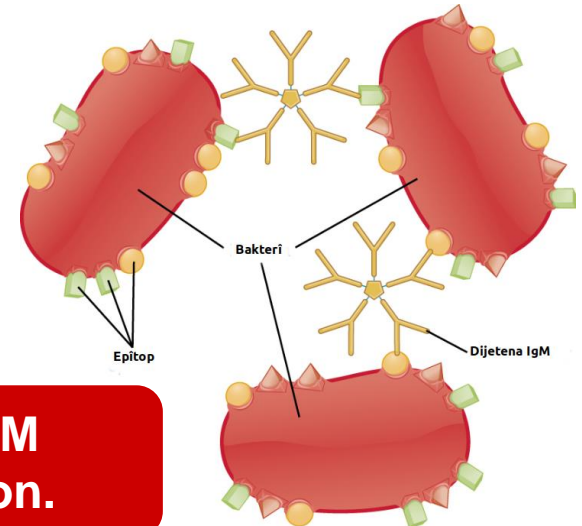
Autoimmune Antibodies are assessed using direct antiglobulin tests.

Antibody analysis uses indirect antiglobulin tests.

ABO Testing uses IgM mediated agglutination.



IgM Mediated Agglutination.



Part 2: ABO/RhD



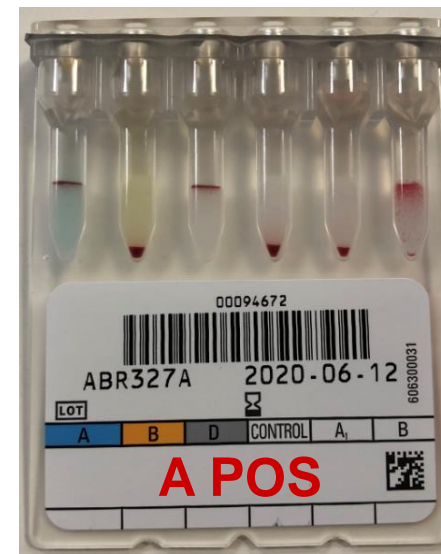
- Identifies the patients ABO and RhD antigens.
- Identifies the presence of innate Anti-A or Anti-B using cells.
 - **Should** correlate with the patient's Antigens.

PATIENT RED CELLS

PATIENT PLASMA



Part 2: ABO/RhD



Part 2: ABO/RhD



- **Abnormal Results:**
 - Transfusion with different ABO groups (Emergency units etc)
 - Transplant patients
 - Elderly/Very young (>4 months)
 - Strong autoantibodies
 - RhD and ABO Variants
- Abnormal results should be resolved before blood can be crossmatched.
 - If it can't be resolved, Group O will be given.
 - Most abnormal results excludes a patient from electronic issue.

Part 2: Antibody Screen



- 3 Cell Screen.
 - Uses to identify the **presence** of antibodies
- Uses IAT technique
- Reagent Cells are selected to ensure:
 - All clinically significant antigens are present
 - Homozygous expression of antigens for: Duffy, Kidd, S/s and k
 - All Group O (to avoid Anti-A and B interference)

Cell#	Rh-ir	Donor Number	Rh-ir										KELL				DUFFY		KIDD		Sex Linked		LEWIS		MNS		P		LUTHERAN		Special Antigen Typing		Test I
			D	C	E	c	e	f	C ^w	V	K	k	Kp ^a	Kp ^b	Js ^a	Js ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Xg ^a	Le ^a	Le ^b	S	s	M	N	P ₁	Lu ^a	Lu ^b			
1	R1wR1	324414	+	+	0	0	+	0	+	0	+	+	0	+	/	+	+	0	+	+	+	0	+	0	+	0	0	0	+			1	
2	R2R2	313967	+	0	+	+	0	0	0	0	+	+	0	+	/	+	+	+	0	+	+	0	+	+	+	+	+	+	0	+			2
3	rr	313301	0	0	0	+	+	+	0	0	0	+	+	+	/	+	0	+	+	0	+	0	+	0	+	+	+	+	0	+			3
	Patient Cells																																

Shaded columns indicate those antigens which are destroyed or depressed by enzyme treatment.

LOT NO.
8SS509

EXP. DATE
2020-03-17

CCYY-MM-DD

ANTIGRAM®

Antigen
Profile

635201161

* / * represents "Not T"

Ortho Clinical Diagnostics

Reagent Red Blood Cells
0.8% Surgiscreen®
©Ortho Clinical Diagnostics 2010

Part 2: Antibody Identification



- Uses 10+ cells with known phenotypes to identify the antibody/antibodies.
 - Also includes an “auto” cell.
- IAT Technique
- Reagent red cells have the same requirements as screening cells.
- Antibody specificity can be assigned IF:
 - The plasma is reactive with at least two examples of reagent red cells expressing the antigen
 - The plasma is non- reactive with at least two examples of reagent red cells lacking the antigen.

Part 2: Antibody Identification



- Antibodies can be hard to identify, especially if there's more than one present.
- In addition to the basic IAT, we also use enzyme treated cells.
 - Papain, Bromelain, Ficin digest extracellular proteins.

Enhanced	Decreased	Unaffected
ABO-related - ABO/H Systems - Lewis System - I System - P1PK/GLOB Rh System Kidd System	MNS System Duffy System	Kell System

Part 2: Antibody Identification



Patient's Name D.O.B.	<i>Patient 1</i>	Ref. No.	Sample No.	Conclusion Tested by	Date
--------------------------	------------------	----------	------------	-------------------------	------

Unless otherwise indicated, all cells are positive for Kp^b and Lu^b and negative for Wr^a and Co^b.

Instructions for use can be found at <http://www.blood.co.uk/reagents>

EC REP Quality First International OÜ, Laki 30, 12915 Tallinn, Estonia

	Rh	C	D	E	c	e	C ^w	M	N	S	s	P1	Lu ^a	K	k	Kp ^a	Le ^a	Le ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Other	IAT	Enz
1	R ₁ ^w R ₁	+	+	0	0	+	+	0	+	0	+	0	0	0	+	0	0	+	+	0	0	+		4	4
2	R ₁ R ₁	+	+	0	0	+	0	+	0	+	0	2	0	+	+	0	0	+	0	+	+	0		4	4
3	R ₂ R ₂	0	+	+	+	0	0	0	+	0	+	2	0	0	+	0	0	+	0	+	0	+		4	4
4	r'r	+	0	0	+	+	0	+	0	+	0	1	0	0	+	0	0	+	0	+	0	+		0	0
5	r''r	0	0	+	+	+	0	+	0	+	0	4	0	0	+	0	+	0	+	0	+	0	Cob+ HLA+	0	0
6	rr	0	0	0	+	+	0	+	+	0	+	2	0	+	0	0	0	0	+	0	0	+		0	0
7	rr	0	0	0	+	+	0	0	+	0	+	0	0	+	+	0	0	+	0	+	+	0		0	0
8	rr	0	0	0	+	+	0	0	+	0	+	3	0	0	+	+	+	0	+	0	+	0		0	0
9	rr	0	0	0	+	+	0	0	+	+	0	2	0	0	+	0	0	0	+	0	+	0	Cob+	0	0
10	rr	0	0	0	+	+	0	+	0	0	+	2	+	0	+	0	+	0	+	0	0	+		0	0
																							AVTO	0	/

Anti-D Detected in IAT and Enzyme.

Part 2: Antibody Identification



Patient's Name	2	Ref. No.	Sample No.	Conclusion
D.O.B.				Tested by
				Date

Unless otherwise indicated, all cells are positive for Kp^b and Lu^b and negative for Wr^a and Co^b.

Instructions for use can be found at <http://www.blood.co.uk/reagents>

EC REP Quality First International OÜ, Laki 30, 12915 Tallinn.

	Rh	C	D	E	c	e	C ^w	M	N	S	s	P1	Lu ^a	K	k	Kp ^a	Le ^a	Le ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Other	IAT	ENZ
1	R ₁ ^w R ₁	+	+	0	0	+	+	0	+	0	+	0	0	0	+	0	0	+	+	0	0	+		3	0
2	R ₁ R ₁	+	+	0	0	+	0	+	0	+	0	2	0	+	+	0	0	+	0	+	+	0		0	0
3	R ₂ R ₂	0	+	+	+	0	0	0	+	0	+	2	0	0	+	0	0	+	0	+	0	+		0	0
4	r'r	+	0	0	+	+	0	+	0	+	0	1	0	0	+	0	0	+	0	+	0	+		0	0
5	r''r	0	0	+	+	+	0	+	0	+	0	4	0	0	+	0	+	0	+	0	+	0	Cob+ HLA+	3	0
6	rr	0	0	0	+	+	0	+	+	0	+	2	0	+	0	0	0	0	+	0	0	+		3	0
7	rr	0	0	0	+	+	0	0	+	0	+	0	0	+	+	0	0	+	0	+	+	0		0	0
8	rr	0	0	0	+	+	0	0	+	0	+	3	0	0	+	+	+	0	+	0	+	0		3	0
9	rr	0	0	0	+	+	0	0	+	+	0	2	0	0	+	0	0	0	0	+	0	+	Cob+	0	0
10	rr	0	0	0	+	+	0	+	0	0	+	2	+	0	+	0	+	0	+	0	0	+		3	0
																							AUTO	0	/

Anti-Fy_a detected in IAT. No antibodies detected in Enzyme. This confirms the Anti-Fy_a, and excludes many other possible specificities e.g. Anti-Cw.

Part 2: Antibody Identification



Patient's Name	3	Ref. No.	Sample No.	Conclusion
D.O.B.				Tested by
				Date

Unless otherwise indicated, all cells are positive for Kp^b and Lu^b and negative for Wr^a and Co^b.

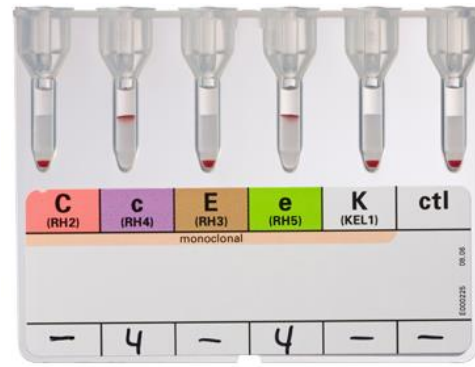
Instructions for use can be found at <http://www.blood.co.uk/reagents>

EC REP Quality First International OÜ, Laki 30, 12915 Tallinn, Est

	Rh	C	D	E	c	e	C*	M	N	S	s	P1	Lu ^a	K	k	Kp ^a	Le ^a	Le ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Other	IAT	EN ^a
1	R ₁ ^W R ₁	+	+	0	0	+	+	0	+	0	+	0	0	0	+	0	0	+	+	0	0	+		4	4
2	R ₁ R ₁	+	+	0	0	+	0	+	0	+	0	2	0	+	+	0	0	+	0	+	+	0		4	4
3	R ₂ R ₂	0	+	+	+	0	0	0	+	0	+	2	0	0	+	0	0	+	0	+	0	+		4	4
4	r'r	+	0	0	+	+	0	+	0	+	0	1	0	0	+	0	0	+	0	+	0	+		2	0
5	r''r	0	0	+	+	+	0	+	0	+	0	4	0	0	+	0	+	0	+	0	+	0	Cob+ HLA+	2	0
6	rr	0	0	0	+	+	0	+	+	0	+	2	0	+	0	0	0	0	+	0	0	+		2	0
7	rr	0	0	0	+	+	0	0	+	0	+	0	0	+	+	0	0	+	0	+	+	0		0	0
8	rr	0	0	0	+	+	0	0	+	0	+	3	0	0	+	+	+	0	+	0	+	0		0	0
9	rr	0	0	0	+	+	0	0	+	+	0	2	0	0	+	0	0	0	0	+	0	+	Cob+	0	0
10	rr	0	0	0	+	+	0	+	0	0	+	2	+	0	+	0	+	0	+	0	0	+		2	0
																							AUTO	0	1

Anti-D detected by IAT and Enzyme. Anti-M detected in IAT only.

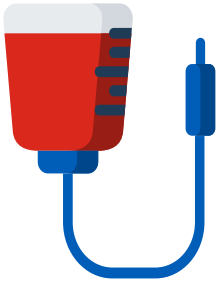
Part 2: Other Testing



	Rh/K Phenotype	Extended Phenotype	DAT
Principle	IAT	IAT	DAT
Value of Test	Provides phenotype for RhCE and K.	Phenotype for MNS, Kidd, Duffy etc.	Confirms autoimmune haemolytic anaemia and gives specificity.
Cause for atypical results.	<ul style="list-style-type: none"> Recent transfusions Stem cell transplants Variants 		IgM autoantibodies can cause pan-reactive agglutination

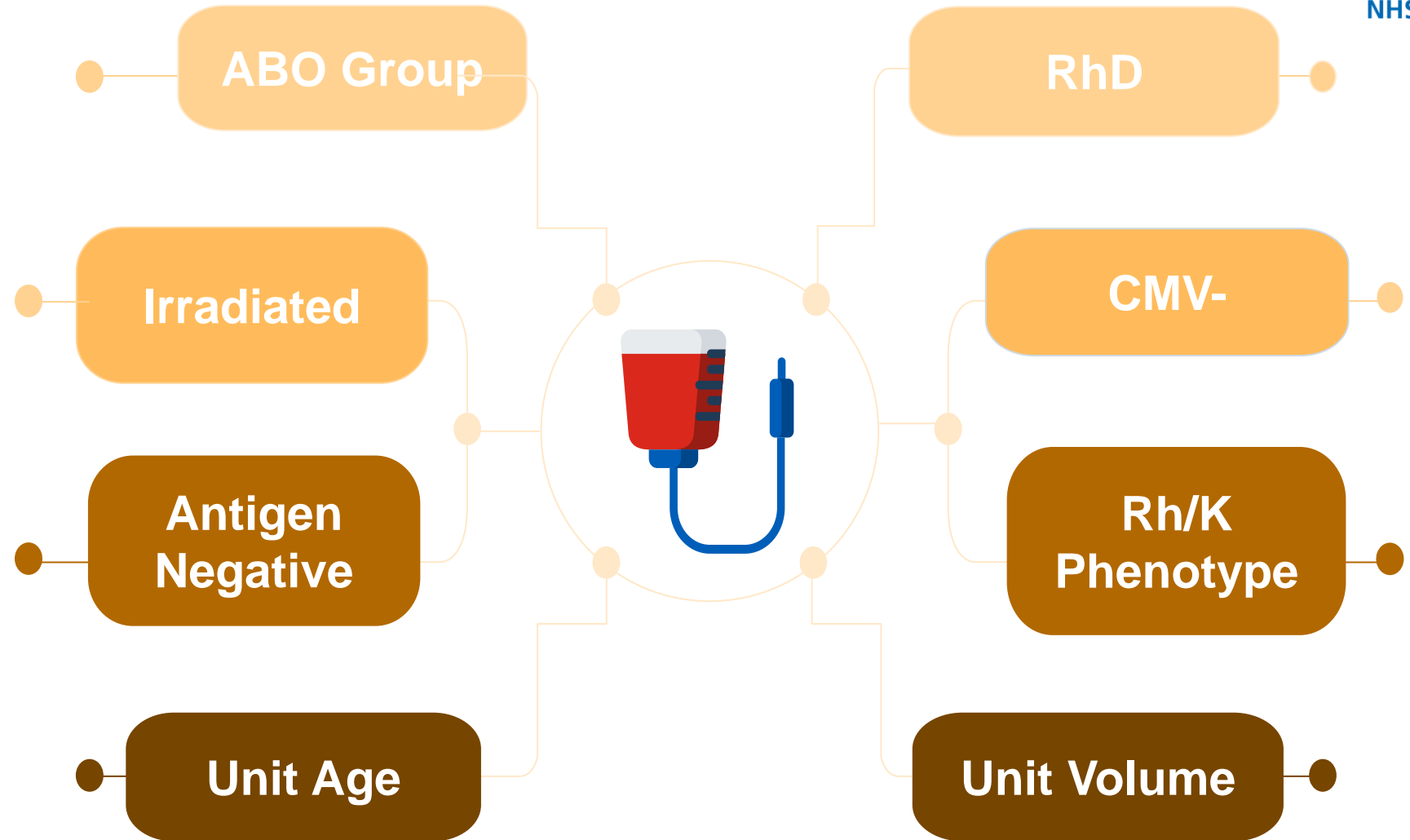
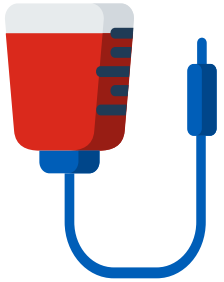


Part 3: Crossmatching

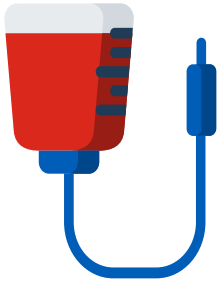


- Crossmatching refers to Red Cells ONLY.
 - All other components are “issued”
- Checking that donor red cells will not react with recipient plasma.
- Requests can be made via:
 - Initial Request (ICE)
 - Minestrone Add on System
 - Phone calls to the Lab
- Crossmatches can take 10mins to 24hours+
 - Emergency units are **always** available!

Part 3: Selecting Red Cells.



Part 3: Electronic Issue



- “Theoretical Crossmatch”
 - Assumption that units will be safe based patient info.
 - The lab still selects the units and perform ID checks etc.
- Patients and Units must meet very strict requirements:
 - Units booked into the lab using barcodes
 - Unaltered, automated tests results ONLY
 - Historical blood group required
 - NO ANTIBODIES!
- Units can be issued in 10 minutes.
 - **But is it safe?**

HTRs with EI are estimated at 1 in 500,000 to 1 in 1,000,000 transfusions (ISBT 2017)

Part 3: Serological Crossmatch

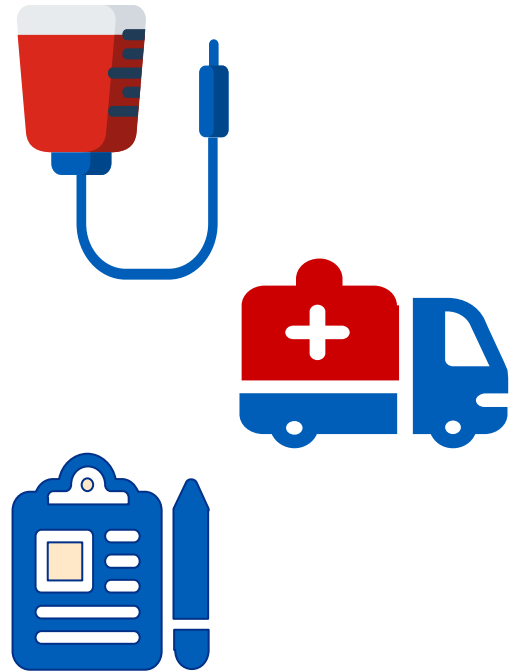
- IAT Test.
 - Physically mix patient plasma with aliquot of donor red cells.
- Only performed if patient is unsuitable for EI.

When?
Historical or current antibody
ABO incompatible solid organ transplant for 3 months.
HSCT transplant
Neonates with maternal antibody present
ABO/D grouping anomalies

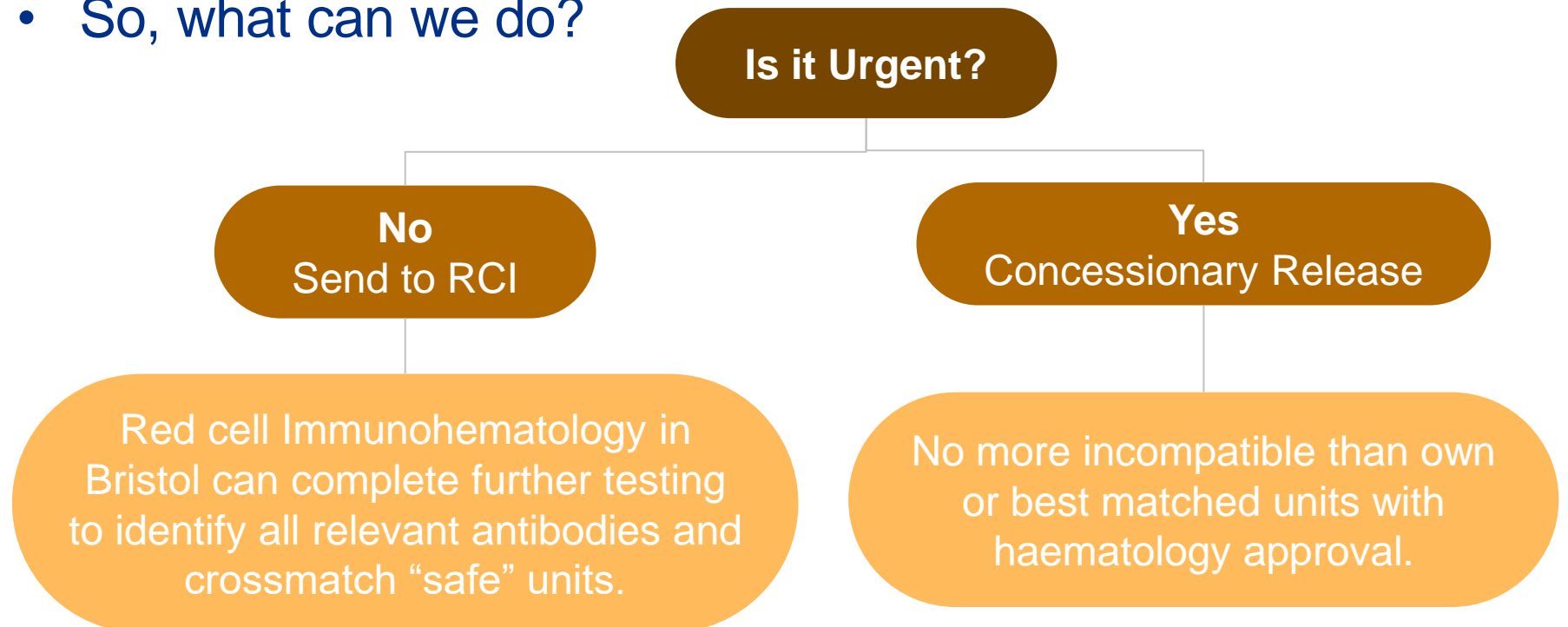
- Requires a negative and weak control to ensure accuracy.
- Takes 45 mins to 1 hour.



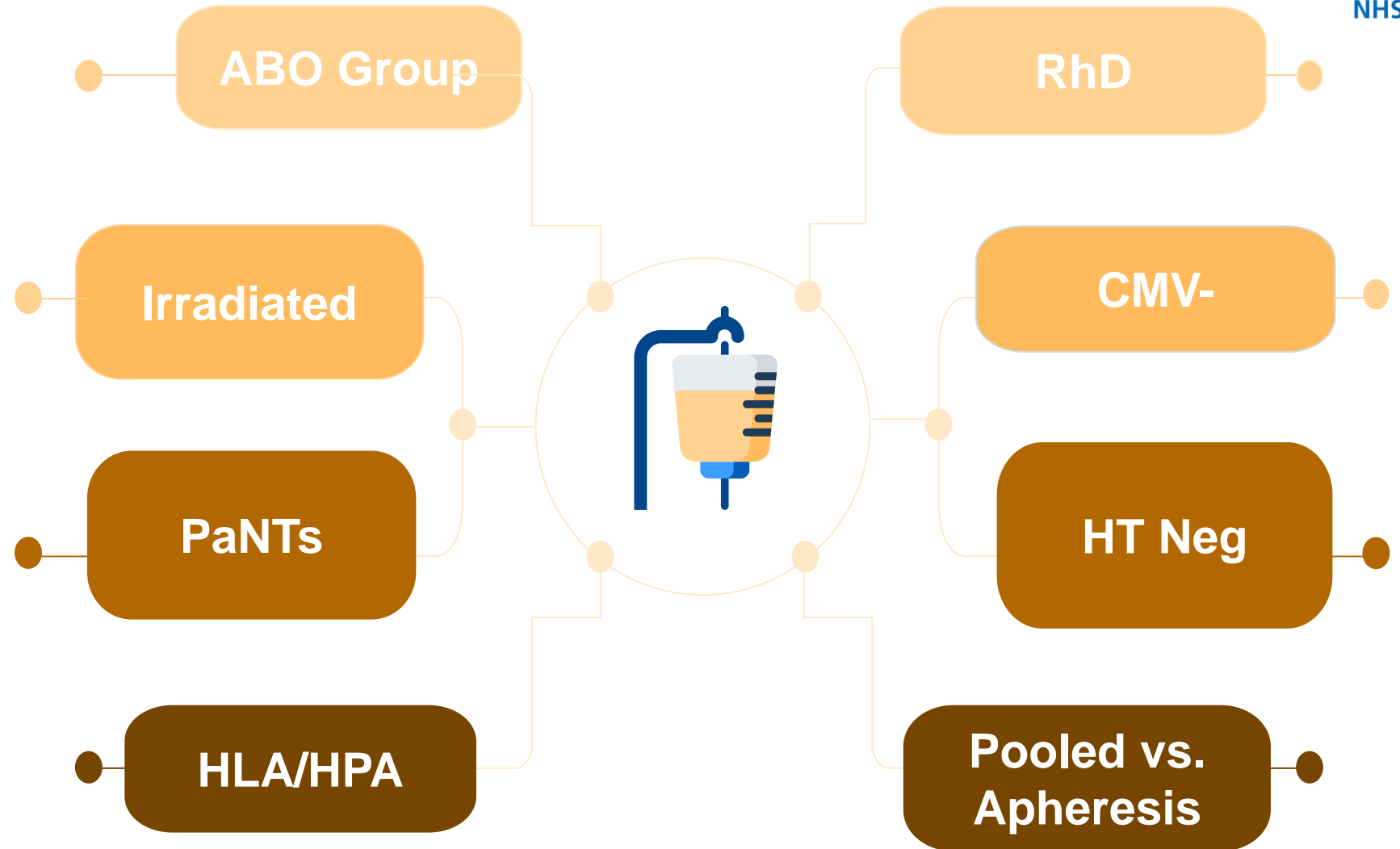
Part 3: Difficult Crossmatches



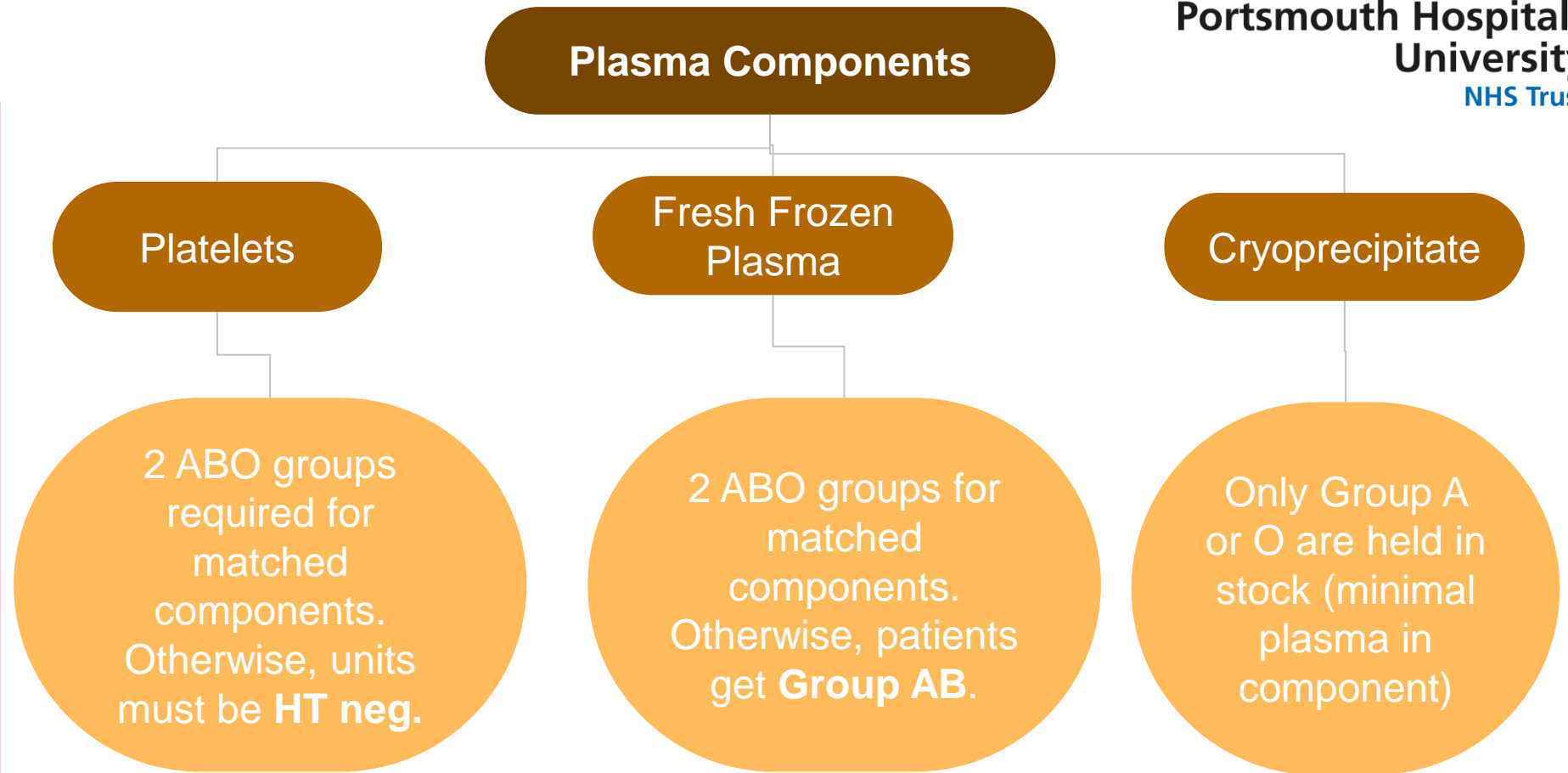
- Sometimes we can't crossmatch units in the lab.
 - Pan-reactive Antibodies.
 - Autoantibodies
 - Complex Antibody Profiles.
- So, what can we do?



Part 3: Selecting Other Components.

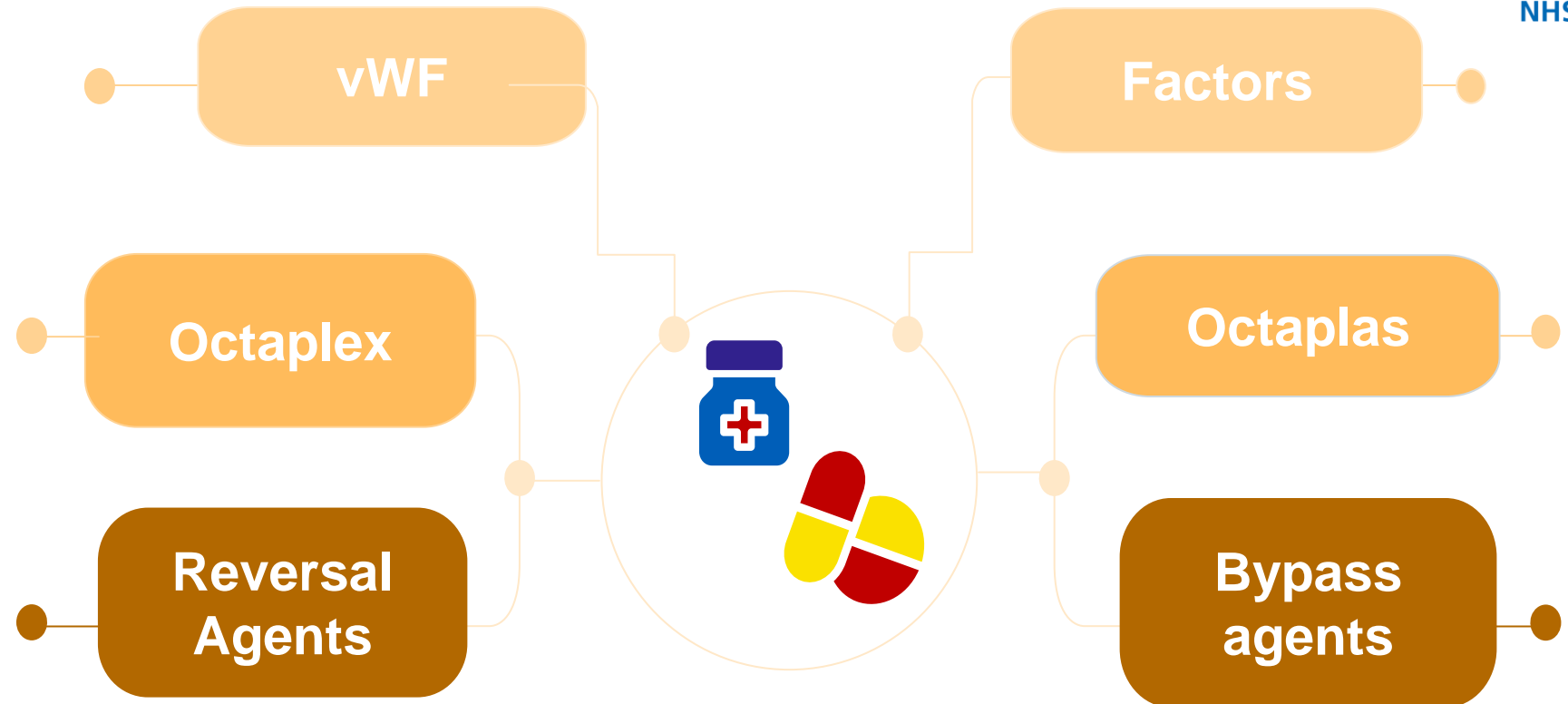
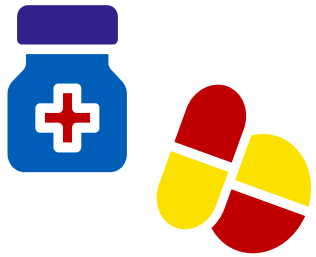


Part 4: Issuing Other Components



- Units are not crossmatched.
- Issuing takes 10-15 mins.
- Authorisation from Haematology required (with exceptions!)

Part 5: Issuing Blood Products.



- Blood derived products.
- Agreed by haematologists or haemostasis CNS'.
- Octaplex is also stored in Resus.

Key Points to Remember



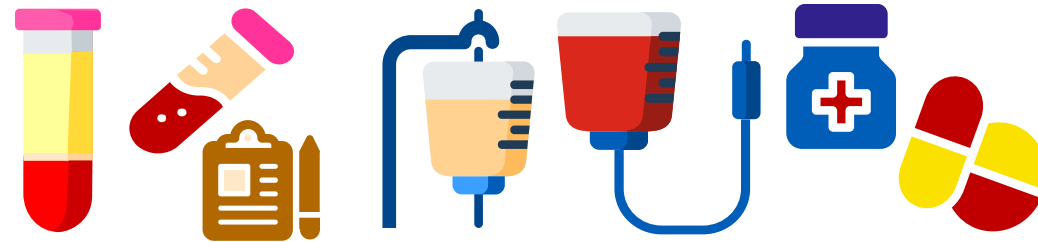
- The lab needs **two samples** to provide ABO matched units.
 - But Emergency group O is **always** available.
- Laboratory testing determines:
 - ABO and RhD
 - Antibody presence and specificity
 - Other red cell phenotypes needed for safe transfusion
- Biomedical Scientists are responsible for meeting patient requirements.
 - So, communicate if you think something is wrong!
- Red cell crossmatching can take up to 24 hours.
 - So, if your patient is complex- give us plenty of warning.

No one should die from a lack of blood!
We will always provide something for your patient!

The End!

Thank you for listening.

Any Questions?



Working together To drive excellence in care for
our patients and communities
