To C, or not to C?

Rh nomenclature

American Red Cross
Missouri and Arkansas Region

For reference

RHD gene present	*RHCE* gene present	Fisher-Race haplotype	Wiener haplotype	Antigens present				
				D	C	E	c	e
RHD	*RHce*	Dce	R_0	+	0	0	+	+
RHD	*RHCe*	DCe	R_1	+	+	0	0	+
RHD	*RHcE*	DcE	R_2	+	0	+	+	0
RHD	*RHCE*	DCE	R_z	+	+	+	0	0
-	*RHce*	dce	r	0	0	0	+	+
-	*RHCe*	dCe	r'	0	+	0	0	+
-	*RHcE*	dcE	r''	0	0	+	+	0
-	*RHCE*	dCE	r^y	0	+	+	0	0

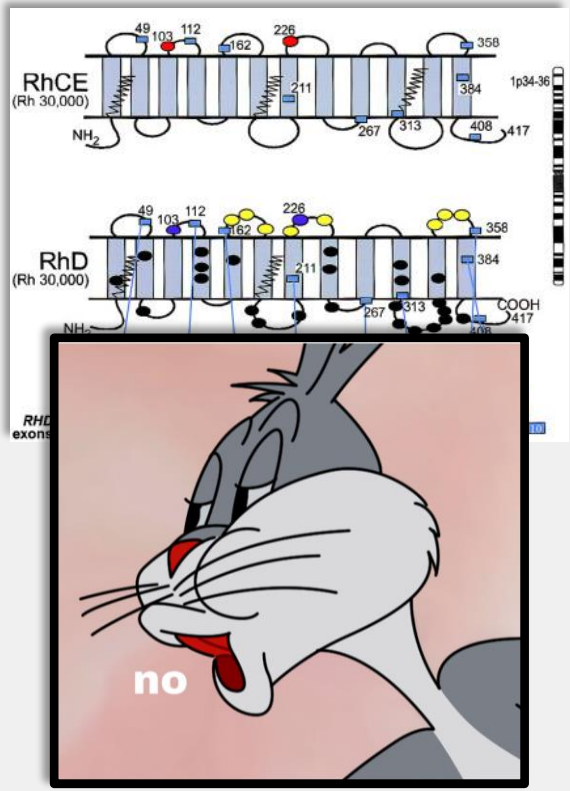
The Rh system

Bafflingly complex

- *RHD* gene: D antigen
- *RHCE* gene: C, c, E, e antigens

- Required or common to see on panels [1]
  - D, C, c, E, e, C^w, V/VS

- **So many** others, both high and low prevalence
  - Not today, Satan



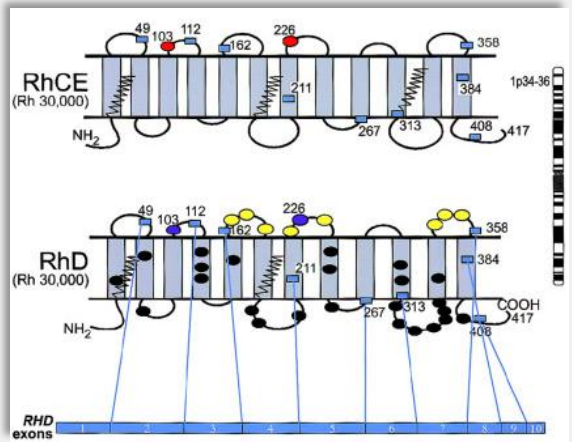
Neil D. Avent, Marion E. Reid, The Rh blood group system: a review. Blood, Volume 95, Issue 2, 2000, Pages 375-387, ISSN 0006-4971, https://doi.org/10.1182/blood.V95.2.375.

The Rh system

Even common antigens can get complicated

- *RHCE* gene generally one of four common alleles [2]
  - *RHCE, RHCe, RHcE, RHce*
  - Produces RHCE polypeptide

- ‘Compound’ antigens
  - Present as an additional gene product of a given *RHCE* allele [2]
    - Example: *RHce* encodes protein carrying
      - c
      - e
      - ce
    - Note, ce only present when c and e antigens produced by same allele [2]
      - *R¹R²* (*RHcE / RHCe*)
        - c
        - e
        - NOT ce



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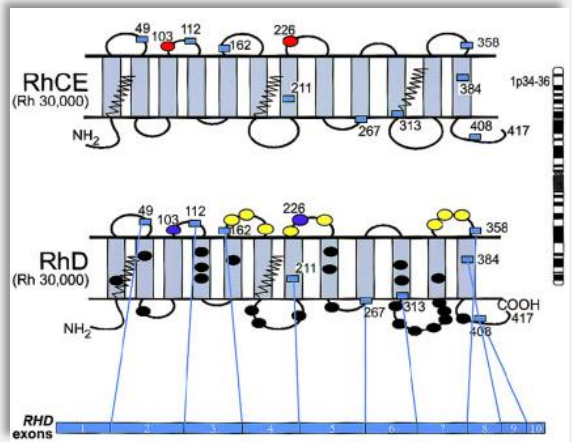
The Rh system

Compound antigens

RHCE allele	Rh haplotype producing antigen	Compound antigen	Other names
RHce	R_0 , r	ce	f , Rh6
RHCe	R_1 , r'	Ce	rh_i , Rh7
RHcE	R_2 , r''	cE	Rh27
RHCE	R_z , r^y	CE	Rh22



- Important note- antibodies to compound antigens are not separable mixtures [3]
- Demonstrate with adsorptions, and/or testing known genotypes [3]
- Product of conformational changes resulting from amino acid substitutions [4]

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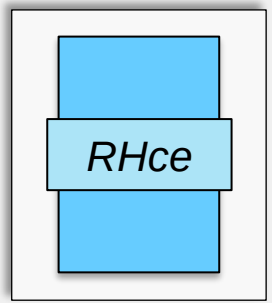
The Rh system

Antibodies to compound antigens

- Anti-ce (anti-f, -Rh6)
  - Relatively common part of sera containing anti-e or anti-c [3]
  - Uncommonly found alone [3]
    - Tend to ID in R_1R_2 (DCe/DcE) individuals [5]
      - If present with anti-e or anti-c, unable to see underlying anti-ce without adsorbing
      - R_1R_2 not typically at risk for anti-c or anti-e, can *only* make anti-ce
      - R_Zr (DCE/d**ce**) not at risk for anti-c, anti-e, *or* anti-ce

RHCE allele	Rh haplotype producing antigen	Compound antigen	Other names
RHce	R_0 , r	ce	f , Rh6

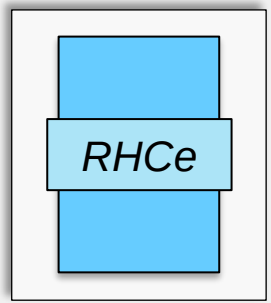


The Rh system

Antibodies to compound antigens

- Anti-Ce (anti-Rh7, -rh_i)
  - Frequently present in sera containing anti-e, or anti-C [3]
    - If present with anti-e or anti-C, unable to see underlying anti-Ce without adsorbing
  - Unlikely to be identified on its own [3]
    - Easy to mistake for anti-C, even if seen alone

RHCE allele	Rh haplotype producing antigen	Compound antigen	Other names
RHCe	R_1 , r'	Ce	rh_i , Rh7



The Rh system

Anti-e + anti-Ce (anti-Rh7, -rh$_i$)

- Anti-e and anti-Ce
  - Looks like straightforward anti-e

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	+		3+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		2+		
4	r'r dCe / dce	0	+	0	+	+	+		3+		
5	r''r dcE / dce	0	0	+	+	+	0		2+		
6	rr dce / dce	0	0	0	+	+	0		2+		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		3+		
8	R_Zr DCE / dce	+	+	+	+	+	0		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	0		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-e + anti-Ce (anti-Rh7, -rh$_i$)

- Anti-e and anti-Ce
  - Looks like straightforward anti-e
    - Anti-Ce only visible if adsorb with e+, Ce- cell

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R_1R_1** D**Ce** / D**Ce**	+	+	0	0	+	+		3+		
2	R_2R_2 DcE / DcE	+	0	+	+	**0**	**0**		0 √		
3	R_0r Dce / dce	+	0	0	+	+	**0**		2+		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		3+		
5	r''r dcE / dce	0	0	+	+	+	**0**		2+		
6	rr dce / dce	0	0	0	+	+	**0**		2+		
7	**R_1**R_Z D**Ce** / DCE	+	+	+	0	+	+		3+		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	**0**	**0**		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	**0**	**0**		0 √		
11	**R_1**R_2 D**Ce** / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-C + anti-Ce (anti-Rh7, -rh$_i$)

- Anti-e and anti-Ce
  - Looks like straightforward anti-e
    - Anti-Ce only visible if adsorb with e+, Ce- cell
- Anti-C and anti-Ce
  - Looks like straightforward anti-C
    - Anti-Ce only visible if adsorb with C+, Ce- cell
- Transfuse C- or e- units as appropriate, avoid Ce antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R$_1$R$_1$** D**Ce** / D**Ce**	+	+	0	0	+	+		3+		
2	R$_2$R$_2$ DcE / DcE	+	**0**	+	+	0	**0**		0 √		
3	R$_0$r Dce / dce	+	**0**	0	+	+	**0**		0 √		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		3+		
5	r''r dcE / dce	0	**0**	+	+	+	**0**		0 √		
6	rr dce / dce	0	**0**	0	+	+	**0**		0 √		
7	**R$_1$**R$_Z$ D**Ce** / DCE	+	+	+	0	+	+		3+		
8	R$_Z$r DCE / dce	+	+	+	+	+	**0**		2+		
9	R$_Z$R$_Z$ DCE / DCE	+	+	+	0	0	**0**		2+		
10	R$_2$R$_Z$ DcE / DCE	+	+	+	+	0	**0**		2+		
11	**R$_1$**R$_2$ D**Ce** / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R$_1$R$_1$** D**Ce** / D**Ce**	+	+	0	0	+	+		2+		
2	R$_2$R$_2$ DcE / DcE	+	0	+	+	0	**0**		0 √		
3	R$_0$r Dce / dce	+	0	0	+	+	**0**		0 √		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	**0**		0 √		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	**R$_1$**R$_Z$ D**Ce** / DCE	+	+	+	0	+	+		2+		
8	R$_Z$r DCE / dce	+	+	+	+	+	**0**		0 √		
9	R$_Z$R$_Z$ DCE / DCE	+	+	+	0	0	**0**		0 √		
10	R$_2$R$_Z$ DcE / DCE	+	+	+	+	0	**0**		0 √		
11	**R$_1$**R$_2$ D**Ce** / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C
  - Panels usually lack rarer Rh haplotype combinations

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R$_1$R$_1$** D**Ce** / D**Ce**	+	+	0	0	+	+		2+		
2	R$_2$R$_2$ DcE / DcE	+	0	+	+	0	**0**		0 √		
3	R$_0$r Dce / dce	+	0	0	+	+	**0**		0 √		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	**0**		0 √		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	**R$_1$**R$_Z$ D**Ce** / DCE	+	+	+	0	+	+		2+		
8	R$_Z$r DCE / dce	+	+	+	+	+	**0**		0 √		
9	R$_Z$R$_Z$ DCE / DCE	+	+	+	0	0	**0**		0 √		
10	R$_2$R$_Z$ DcE / DCE	+	+	+	+	0	**0**		0 √		
11	**R$_1$**R$_2$ D**Ce** / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh_i)

- Anti-Ce alone easily mistaken for anti-C
  - Panels usually lack rarer Rh haplotype combinations
  - No specific reason to test R_2R_Z cell
    - If tested, easy to mistake for dosage

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	+		2+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		0 √		
4	r'r dCe / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	0		0 √		
6	rr dce / dce	0	0	0	+	+	0		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		2+		
8	R_Zr DCE / dce	+	+	+	+	+	0		0 √		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	0		0 √		
10	**R_2R_Z DcE / DCE**	+	±	+	±	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C
  - Panels usually lack rarer Rh haplotype combinations
  - No specific reason to test R_2R_Z cell
    - If tested, easy to mistake for dosage
  - Very unlikely to have R_ZR_Z cells available
- As misidentifications go, unlikely to cause problems
  - C- units lack Ce antigen

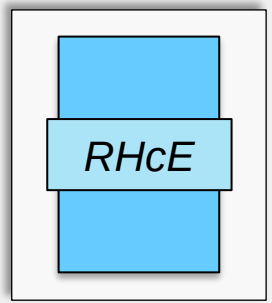
	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	+		2+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		0 √		
4	r'r dCe / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	0		0 √		
6	rr dce / dce	0	0	0	+	+	0		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		2+		
8	R_Zr DCE / dce	+	+	+	+	+	0		0 √		
9	**R_ZR_Z DCE / DCE**	+	**+**	+	**0**	0	0		**0 √**		
10	R_2R_Z DcE / DCE	+	+	+	+	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Antibodies to compound antigens

- Anti-cE (anti-Rh27)
  - Rarely identified, originally found with anti-E in R_1R_1 (DCe / DCe) woman [4]
  - Unlikely to be identified in general [3]
    - If present with anti-E or anti-c, unable to see underlying anti-cE without adsorbing
    - Alone, easily mistaken for anti-E
  - Minimal literature on antibody

RHCE allele	Rh haplotype producing antigen	Compound antigen	Other names
RHcE	R_2 , r''	cE	Rh27

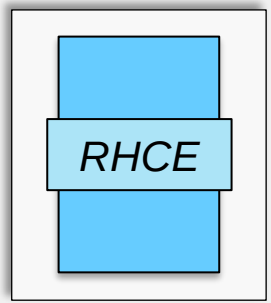


The Rh system

Antibodies to compound antigens

- Anti-CE (anti-Rh22)
  - Very rare [4]
    - Has been identified along with anti-C [4]
  - If present with anti-C or anti-E, unable to see underlying anti-CE without adsorbing
  - Minimal literature on antibody

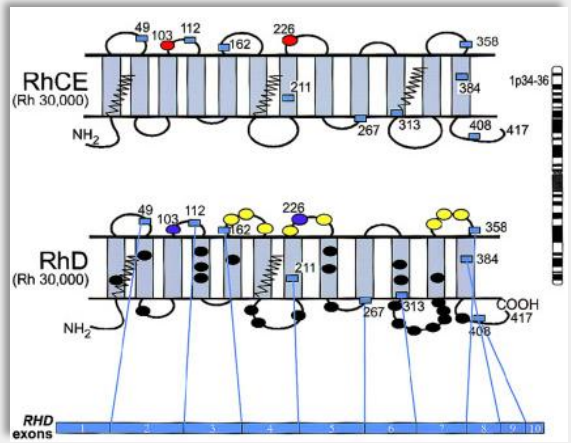
RHCE allele	Rh haplotype producing antigen	Compound antigen	Other names
RHCE	R_z , r^y	CE	Rh22



The Rh system

Antibodies to compound antigens

- Generally behave like other Rh antibodies [3]
  - Clinically significant
  - Can cause HTR, HDFN
  - One naturally occurring anti-cE found that activated complement [7]



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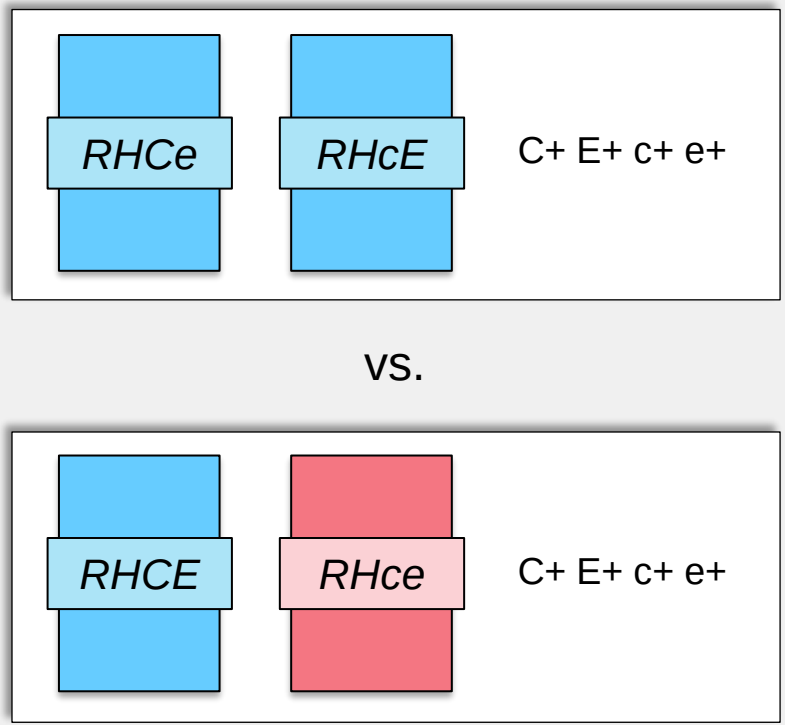
The Rh system

How to transfuse?

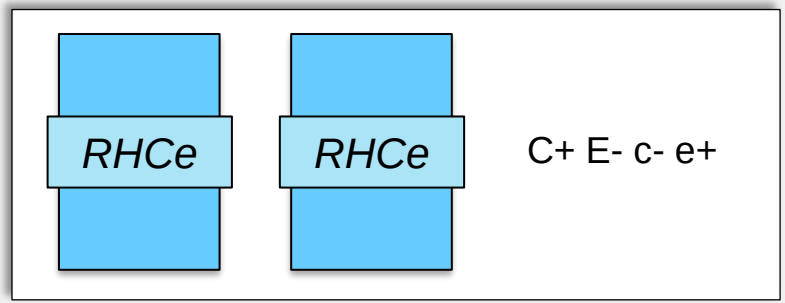
- No commercially available antisera
- O pos patient, anti-ce:
  - Phenotype D+ C+ E+ c+ e+
    - Presumed R_1R_2 (DCe / DcE)
  - Able to transfuse R_1R_2 (DCe / DcE) units
  - <u>Not</u> able to transfuse R_Zr (DCE/d**ce**)



The Rh system

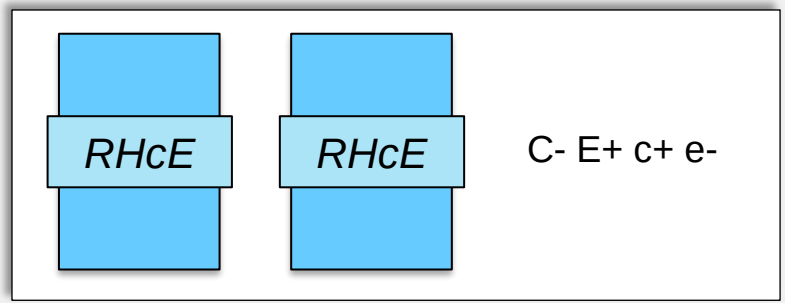
How to transfuse?

- Solution, transfuse c- or e- blood
  - c *and* e must be present on same gene for antigen to be present
  - Without one or the other, no ce antigen



or

- R_1R_1 (DCe / DCe) preferred due to rarity of R_2R_2 (DcE / DcE)



Case study

Initial presentation

American Red Cross
Missouri and Arkansas Region

- Caucasian male, in his late 90s
- Stat request
- Hgb: 6.5g/dL
- Never transfused
- No known RBC antibodies
- Complaint: Respiratory failure, vomiting
- Plasma notably icteric
- Transfusion planned once workup complete
- Limited specimen sent

Blood type

American Red Cross
Missouri and Arkansas Region

Anti-A	Anti-B	Anti-A,B	Anti-D	Rh control	A_1 cells	A_2 cells	B cells

Blood type

Starting off strong

American Red Cross
Missouri and Arkansas Region

Anti-A	Anti-B	Anti-A,B	Anti-D	Rh control	A_1 cells	A_2 cells	B cells
4+mf	0	4+mf	4+	0	0	0	4+

Type: NTD Positive

Blood type

Starting off strong

Anti-A	Ant	cells	B cells
4+mf	0	0	4+

O Positive

History needs investigation

American Red Cross
Missouri and Arkansas Region

Several phone calls later…

- Nine days ago, at Our Lady Of Perpetual Healthcare
  - Hgb 6.6 g/dL, specimen not noted as icteric
  - IRL ID'd warm autoantibody, auto-anti-C
  - 1 unit O pos least incompatible C- pRBC transfused uneventfully
- Four days ago, at St Elsewhere
  - Hgb 6.3 g/dL, specimen noted "slightly icteric"
  - IRL ID'd warm autoantibody, auto-anti-C
  - 2 units A pos least incompatible, C untested pRBC transfused uneventfully
- Today, at Sacred Heart
  - Hgb 6.5 g/dL, specimen noted "grossly icteric"
  - Per ICU, patient appears to be hemolyzing, cause unclear
    - AIHA vs transfusion reaction vs ??

More history

HEA molecular results

- Nothing unusual noted
- Patient likely R_1R_z (DCe/DCE, ~0.2% prevalence [4])

Blood Group	Antigen	Result
Rh	c	0
	C	+
	e	+
	E	+
	V	0
	VS	0
Kell	K	0
	k	+
	Kp^a	0
	Kp^b	+
	Js^a	0
	Js^b	+
Duffy	Fy^a	+
	Fy^b	+
Kidd	Jk^a	+
	Jk^b	+
MNS	M	+
	N	+
	S	0
	s	+
	U	+

Blood Group	Antigen	Result
Lutheran	Lu^a	0
	Lu^b	+
Diego	Di^a	0
	Di^b	+
Colton	Co^a	+
	Co^b	0
Dombrock	Do^a	0
	Do^b	+
	Hy	+
	Jo^a	+
Landsteiner-Wiener	LW^a	+
	LW^b	0
Scianna	Sc1	+
	Sc2	0
Hemoglobin S	HgbS	0

Blood type

Back to the type discrepancy

American Red Cross
Missouri and Arkansas Region

Anti-A	Anti-B	Anti-A,B	Anti-D	Rh control	A_1 cells	A_2 cells	B cells
4+mf	0	4+mf	4+	0	0	0	4+

Type: NTD Positive

Blood type

Resolved with history- recent transfusion of O pos pRBC

Anti-A	Anti-B	Anti-A,B	Anti-D	Rh control	A_1 cells	A_2 cells	B cells
4+mf	0	4+mf	4+	0	0	0	4+

Type: A Positive

DAT: Tube testing

Polyspecific; anti-IgG; anti-C3b, -C3d

Poly, IS	Control, IS
1+	0

Anti-IgG, IS	Control, IS
1+	0

Anti-C3, 5’ RT	Control, 5’ RT
w+	0

Initial panel: IS

American Red Cross
Missouri and Arkansas Region

	Supplier/ Lot	Donor / RhHr - Vial	Rh-Hr								MNS				Lewis		P	Kell						Duffy		Kidd		Luth		X	Additional antigens	Test Results		
			D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Kp^b	Js^a	Js^b	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b	Xg^a		IS		
1	Ortho RA256	313310 R1wR1	+	+	0	0	+	0	0	+	+	0	+	+	0	+	0	+	+	0	+	/	+	+	0	+	0	0	+	+	HLA+	0		
2	Ortho RA256	329008 R1R1	+	+	0	0	+	0	0	0	0	+	0	+	0	+	+s	0	+	0	+	/	+	+	0	0	+	0	+	+		0		
3	Ortho RA256	326835 R2R2	+	0	+	+	0	0	0	0	+	+	+	+	0	+	0	0	+	0	+	/	+	0	+	+	+	+	+	+		0		
4	Ortho RA256	324994 Ror	+	0	0	+	+	+	+	0	+	+	0	+	0	0	+s	0	+	0	+	/	+	0	+	+	0	0	+	+		0		
5	Ortho RA256	329233 r'r	0	+	0	+	+	+	0	0	+	+	0	+	+	0	+s	0	+	0	+	/	+	+	0	0	+	+	+	+		0		
6	Ortho RA256	314163 r"r	0	0	+	+	+	+	0	0	+	+	0	+	0	+	0	0	+	0	+	/	+	+	+	+	+	0	+	+		0		
7	Ortho RA256	330189 rr	0	0	0	+	+	+	0	0	+	+	0	+	+	0	+s	+	+	0	+	/	+	0	+	+	+	0	+	+		0		
8	Ortho RA256	307778 rr	0	0	0	+	+	+	0	0	0	+	+	+	0	+	+	0	+	0	+	0	+	+	+	+	0	+	0	+	+	HLA+	0		
9	Ortho RA256	327460 rr	0	0	0	+	+	+	0	0	+	0	+	0	0	+	+	0	+	0	+	/	+	+	+	+	+	0	0	+	0		0		
10	Ortho RA256	324801 rr	0	0	0	+	+	+	0	0	+	+	0	+	0	+	+	0	+	0	+	/	+	+	0	+	0	0	+	+	HLA+	0		
11	Ortho RA256	327923 R1R1	+	+	0	0	+	0	0	0	+	0	+	0	0	0	+s	0	+	0	+	/	+	0	+	+	+	0	+	0	HLA+	0		
	Auto Control																															0		

Initial panel: IS + PeG/AHG

American Red Cross
Missouri and Arkansas Region

	Supplier/ Lot	Donor / RhHr - Vial	Rh-Hr								MNS				Lewis		P	Kell						Duffy		Kidd		Luth		X	Additional antigens	Test Results		
			D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Kp^b	Js^a	Js^b	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b	Xg^a		IS	PeG AHG	
1	Ortho RA256	313310 R1wR1	+	+	0	0	+	0	0	+	+	0	+	+	0	+	0	+	+	0	+	/	+	+	0	+	0	0	+	+	HLA+	0	2+	
2	Ortho RA256	329008 R1R1	+	+	0	0	+	0	0	0	0	+	0	+	0	+	+s	0	+	0	+	/	+	+	0	0	+	0	+	+		0	1+	
3	Ortho RA256	326835 R2R2	+	0	+	+	0	0	0	0	+	+	+	+	0	+	0	0	+	0	+	/	+	0	+	+	+	+	+	+		0	1+	
4	Ortho RA256	324994 Ror	+	0	0	+	+	+	+	0	+	+	0	+	0	0	+s	0	+	0	+	/	+	0	+	+	0	0	+	+		0	1+	
5	Ortho RA256	329233 r'r	0	+	0	+	+	+	0	0	+	+	0	+	+	0	+s	0	+	0	+	/	+	+	0	0	+	+	+	+		0	2+	
6	Ortho RA256	314163 r"r	0	0	+	+	+	+	0	0	+	+	0	+	0	+	0	0	+	0	+	/	+	+	+	+	+	0	+	+		0	1+	
7	Ortho RA256	330189 rr	0	0	0	+	+	+	0	0	+	+	0	+	+	0	+s	+	+	0	+	/	+	0	+	+	+	0	+	+		0	1+	
8	Ortho RA256	307778 rr	0	0	0	+	+	+	0	0	0	+	+	+	0	+	+	0	+	0	+	0	+	+	+	+	0	+	0	+	+	HLA+	0	1+	
9	Ortho RA256	327460 rr	0	0	0	+	+	+	0	0	+	0	+	0	0	+	+	0	+	0	+	/	+	+	+	+	+	0	0	+	0		0	1+	
10	Ortho RA256	324801 rr	0	0	0	+	+	+	0	0	+	+	0	+	0	+	+	0	+	0	+	/	+	+	0	+	0	0	+	+	HLA+	0	1+	
11	Ortho RA256	327923 R1R1	+	+	0	0	+	0	0	0	+	0	+	0	0	0	+s	0	+	0	+	/	+	0	+	+	+	0	+	0	HLA+	0	2+	
	Auto Control																															0	1+	

Plan an approach

American Red Cross
Missouri and Arkansas Region

- Evaluate reactivity in plasma
- Evaluate reactive DAT
- Prove autoantibody

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

- Evaluate reactivity in plasma
  - Panreactivity, slightly stronger on C+ cells, reactive autocontrol- consistent with reported history
  - Alloadsorb to remove presumed WAA interference
- Evaluate reactive DAT
- Prove autoantibody

Papain treated adsorption cells, plasma adsorbed 1x @ 37°C

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 G256 #7	0	0	0	+	+	+		0	0	+	0	+	0	+	0	+	+	0	0	0	+	0	+	0	+	Lu:14	0 √		
B 9450011-00 304320 #2	+	0	+	+	0			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		w+		
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	+	+		0	+	0	0	+	0	+	+	0	+	0	0	+	0	+	0	0	+	Sc:2	0 √		
W 51918 C5673 #3	+	0	+	+	0			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		w+		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	+	0	+	0	+	+	+	+	0	0	+	0	0	+	0	w		0 √		
W 49905 C6404 #7	+	0	+	+	0			0	+	+	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		w+		
W 49905 B11257 #10	+	+	0	0	+			0	+	+	0	+	0	0	+	0	+	0	0	0	+	+	+	0	+		w+		

Papain treated adsorption cells, plasma adsorbed 1x @ 37°C

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 G256 #7	0	0	0	~~+~~	+	~~+~~		0	0	+	0	+	0	+	0	~~+~~	+	0	0	0	~~+~~	0	~~+~~	0	+	Lu:14	0 √		
B 9450011-00 304320 #2	+	0	+	+	0			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		w+		
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	~~+~~	+		0	+	0	0	+	0	~~+~~	+	0	+	0	0	+	0	~~+~~	0	0	+	Sc:2	0 √		
W 51918 C5673 #3	+	0	+	+	0			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		w+		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	~~+~~	0	~~+~~	0	+	+	+	+	0	0	~~+~~	0	0	+	0	w		0 √		
W 49905 C6404 #7	+	0	+	+	0			0	+	+	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		w+		
W 49905 B11257 #10	+	+	0	0	+			0	+	+	0	+	0	0	+	0	+	0	0	0	+	+	+	0	+		w+		

Papain treated adsorption cells, plasma adsorbed 1x @ 37°C

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 G256 #7	0	0	0	+/	+	+/		0	0	+	0	+	0	+	0	+/	+	0	0	0	+/	0	+/	0	+	Lu:14	0 √		
B 9450011-00 304320 #2	+	0	+	+	0			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		w+		
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	+/	+		0	+	0	0	+	0	+/	+	0	+	0	0	+	0	+/	0	0	+	Sc:2	0 √		
W 51918 C5673 #3	+	0	+	+	0			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		W+		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	+/	0	+/	0	+	+	+	+	0	0	+/	0	0	+	0	w		0 √		
W 49905 C6404 #7	+	0	+	+	0			0	+	+	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		w+		
W 49905 B11257 #10	+	+	0	0	+			0	+	+	0	+	0	0	+	0	+	0	0	0	+	+	+	0	+		W+		

Papain treated adsorption cells, plasma adsorbed 1x @ 37°C

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 G256 #7	0	0	0	~~+~~	+	~~+~~		0	0	+	0	+	0	+	0	~~+~~	+	0	0	0	~~+~~	0	~~+~~	0	+	Lu:14	0 √		
B 9450011-00 304320 #2	+	0	+	+	0			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		W+	?	
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	~~+~~	+		0	+	0	0	+	0	~~+~~	+	0	+	0	0	+	0	~~+~~	0	0	+	Sc:2	0 √		
W 51918 C5673 #3	+	0	+	+	0			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		W+		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	~~+~~	0	~~+~~	0	+	+	+	+	0	0	~~+~~	0	0	+	0	w		0 √		
W 49905 C6404 #7	+	0	+	+	0			0	+	+	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		W+	?	
W 49905 B11257 #10	+	+	0	0	+			0	+	+	0	+	0	0	+	0	+	0	0	0	+	+	+	0	+		W+		

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

- Evaluate reactivity in plasma
  - Panreactivity, slightly stronger on C+ cells, reactive autocontrol- consistent with reported history
  - Alloadsorb to remove presumed WAA interference
- Evaluate reactive DAT
- Prove autoantibody

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

- Evaluate reactivity in plasma
  - Panreactivity, slightly stronger on C+ cells, reactive autocontrol- consistent with reported history
  - Alloadsorb to remove presumed WAA interference- successful? anti-C reactivity in adsorbed plasma
  - Test more cells, ID ?new antibody?
- Evaluate reactive DAT
- Prove autoantibody

Papain trt'd adsorption cells, plasma ads. 1x @ 37°C R_1R_1 ads

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W184024028155002	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 G256 #7	0	0	0	✓	+	✓		0	0	+	0	+	0	+	0	✓	+	0	0	0	✓	0	✓	0	+	Lu:14	0√		
B 9450011-00 304320 #2	+	0	+	+	0			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		w+		
Patient phenotype predicted by HEA molecular	+	+	+	0	+				+	+	0	+				0	+	0	0	+	+	+	+	0	+				

Papain trt'd adsorption cells, plasma ads. 1x @ 37°C R_1R_1 ads

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W184024028155002	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 G256 #7	0	0	0	✓	+	✓		0	0	+	0	+	0	+	0	✓	+	0	0	0	✓	0	✓	0	+	Lu:14	0√		
B 9450011-00 304320 #2	+	0	+	+	0			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		w+		
W 51918 C5673 #3	+	0	+	+	0			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		w+		
W 47887 B9624 #1	+	+	0	0	+	0		0	+	0	✓	0	✓	0	+	+	+	0	0	+	+	+	0	0	+		0√		
D V279471 164303 #11	+	+	+	0	+	0	0	0	✓	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		0√		
Patient phenotype predicted by HEA molecular	+	+	+	0	+				+	+	0	+				0	+	0	0	+	+	+	+	0	+				

Papain trt'd adsorption cells, plasma ads. 1x @ 37°C R_1R_1 ads

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	**E**	c	e	f	V	C^W	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W184024028155002	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 **rr** G256 #7	0	0	0	~~+~~	+	~~+~~		0	0	+	0	+	0	+	0	~~+~~	+	0	0	0	~~+~~	0	~~+~~	0	+	Lu:14	0√		
B 945001 **R_2R_2** 304320 #2	+	0	**+**	+	**0**			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		**w+**		
W 51918 **R_2R_2** C5673 #3	+	0	**+**	+	**0**			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		**w+**		
W 47887 **R_1R_1** B9624 #1	+	+	0	0	+	0		0	+	0	~~+~~	0	~~+~~	0	+	+	+	0	0	+	+	+	0	0	+		0√		
D V27947 **R_1R_Z** 164303 #11	+	+	+	0	+	0	0	0	~~+~~	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		0√		
Patient phenotype predicted by HEA molecular	+	+	+	0	+				+	+	0	+				0	+	0	0	+	+	+	+	0	+				

Papain trt'd adsorption cells, plasma ads. 1x @ 37°C R_1R_1 ads

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	**E**	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W184024028155002	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
W 17887 **rr** G256 #7	0	0	0	~~+~~	+	~~+~~		0	0	+	0	+	0	+	0	~~+~~	+	0	0	0	~~+~~	0	~~+~~	0	+	Lu:14	0√		
B 945001 **R_2R_2** 304320 #2	+	0	**+**	+	**0**			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		**w+**		
W 51918 **R_2R_2** C5673 #3	+	0	**+**	+	**0**			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		**w+**		
W 47887 **R_1R_1** B9624 #1	+	+	0	0	+	0		0	+	0	~~+~~	0	~~+~~	0	+	+	+	0	0	+	+	+	0	0	+		0√		
D V27947 **R_1R_2** 164303 #11	+	+	**+**	0	**+**	0	0	0	~~+~~	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		**0√**		
Patient phenotype predicted by HEA molecular	+	+	+	0	+				+	+	0	+				0	+	0	0	+	+	+	+	0	+				

Papain trt'd adsorption cells, plasma ads. 1x @ 37°C R_1R_1 ads

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			Rh-Hr						MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
		D	C	**E**	c	e	f	V	C^W	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H		+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W184024028155002		+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W181124188137000		0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																														
W 17887	**rr** G256 #7	0	0	0	~~+~~	+	~~+~~		0	0	+	0	+	0	+	0	~~+~~	+	0	0	0	~~+~~	0	~~+~~	0	+	Lu:14	0√		
B 945001	**R_2R_2** 304320 #2	+	0	**+**	+	**0**			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		**w+**		
W 51918	**R_2R_2** C5673 #3	+	0	**+**	+	**0**			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		**w+**		
W 47887	**R_1R_1** B9624 #1	+	+	0	0	+	0		0	+	0	~~+~~	0	~~+~~	0	+	+	+	0	0	+	+	+	0	0	+		0√		
D V27947	**R_1R_Z** 164303 #11	+	+	**+**	0	**+**	0	0	0	~~+~~	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		**0√**		
W 43857	A5009 #1	+	+	+	0	+	0	0	0	0	+	0	+	0	+	+	0	+	0	0	0	+	0	+	0	+		0√		
W 47887	F454 #6	0	0	+	+	+			0	+	+	0	+	0	+	0	0	+	0	0	+	+	+	+	0	+		W+		
Patient phenotype predicted by HEA molecular		+	+	+	0	+				+	+	0	+				0	+	0	0	+	+	+	+	0	+				

Papain trt'd adsorption cells, plasma ads. 1x @ 37°C R_1R_1 ads

American Red Cross
Missouri and Arkansas Region

			Rh-Hr						MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
		D	C	**E**	c	e	f	V	C^W	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		PeG AHG		
R_1R_1 W18112414667100H		+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W184024028155002		+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C		0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																														
W 17887	**rr** G256 #7	0	0	0	~~+~~	+	~~+~~		0	0	+	0	+	0	+	0	~~+~~	+	0	0	0	~~+~~	0	~~+~~	0	+	Lu:14	0√		
B 945001	**R_2R_2** 304320 #2	+	0	**+**	+	**0**			0	+	0	+	0	+	0	s	0	+	0	0	+	0	+	0	0	+		**w+**		
W 51918	**R_2R_2** C5673 #3	+	0	**+**	+	**0**			0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+		**w+**		
W 47887	**R_1R_1** B9624 #1	+	+	0	0	+	0		0	+	0	~~+~~	0	~~+~~	0	+	+	+	0	0	+	+	+	0	0	+		0√		
D V27947	**R_1R_Z** 164303 #11	+	+	**+**	0	**+**	0	0	0	~~+~~	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		**0√**		
W 43857	**R_1R_Z** A5009 #1	+	+	**+**	0	**+**	0	0	0	0	+	0	+	0	+	+	0	+	0	0	0	+	0	+	0	+		**0√**		
W 47887	**r"r** F454 #6	0	0	**+**	+	**+**			0	+	+	0	+	0	+	0	0	+	0	0	+	+	+	+	0	+		**w+**		
Patient phenotype predicted by HEA molecular		+	+	+	0	+				+	+	0	+				0	+	0	0	+	+	+	+	0	+				

Additional testing summary

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Do we have an ID?

- rr adsorption was reactive with R_2R_2 cells and r”r cells, no difference from R_1R_1 adsorption
  - Unable to test vs R_1R_Z cells due to probable autoanti-C interference
  - Anti-D ruled out on R_or cells

- All other common alloantibodies ruled out, except for anti-E
  - Something is unusual about the reactivity

A closer look

Make a list

- (probable auto-) anti-E
  - Evidence for: reactions on E+ cells, could be showing dosage
  - Evidence against: did react with r”r cell

	Rh-Hr							
	D X	C	**E**	c X	**e** X	f X		PeG AHG
R_1R_1	+	+	**0**	0	+			
B 94500 **R_2R_2** 304320 #2	+	0	**+**	+	**0**			w+
W 51918 **R_2R_2** C5673 #3	+	0	**+**	+	**0**			w+
W 47887 **r”r** F454 #6	0	0	**+**	+	**+**			w+
W 43857 **R_1R_Z** A5009 #1	+	+	**+**	0	**+**	0		0 √
D V2794 **R_1R_Z** 164303 #11	+	+	**+**	0	**+**	0		0 √
Patient phenotype predicted by HEA molecular	+	+	**+**	0	+			

A closer look

Make a list

- (probable auto-) anti-E
  - Evidence for: reactions on E+ cells, could be showing dosage
  - Evidence against: did react with r”r cell
- Anti-c
  - Evidence for: reactions match, patient able to make anti-c
  - Evidence against: anti-c ruled out, reactive with rr plasma

	Rh-Hr							
	D X	C	E	**c** X	e X	f X		PeG AHG
R_1R_1	+	+	0	**0**	+			
B 94500 **R_2R_2** 304320 #2	+	0	+	**+**	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	+	**+**	0			w+
W 47887 **r”r** F454 #6	0	0	+	**+**	+			w+
W 43857 **R_1R_Z** A5009 #1	+	+	+	**0**	+	0		0 √
D V2794 **R_1R_Z** 164303 #11	+	+	+	**0**	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	**0**	+			

A closer look

Make a list

- (probable auto-) anti-E
  - Evidence for: reactions on E+ cells, could be showing dosage
  - Evidence against: did react with r”r cell

- ~~Anti-c~~
  - Evidence for: reactions match, patient able to make anti-c
  - Evidence against: anti-c ruled out, reactive with rr plasma

	Rh-Hr							
	D X	C	E	**c** X	e X	f X		PeG AHG
R_1R_1	+	+	0	**0**	+			
B 94500 **R_2R_2** 304320 #2	+	0	+	**+**	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	+	**+**	0			w+
W 47887 **r”r** F454 #6	0	0	+	**+**	+			w+
W 43857 **R_1R_Z** A5009 #1	+	+	+	**0**	+	0		0 √
D V2794 **R_1R_Z** 164303 #11	+	+	+	**0**	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	**0**	+			

A closer look

Make a list

- (probable auto-) anti-E
  - Evidence for: reactions on E+ cells, could be showing dosage
  - Evidence against: did react with r”r cell
- ~~Anti-c~~
  - Evidence for: reactions match, patient able to make anti-c
  - Evidence against: anti-c ruled out, reactive with rr plasma
- Incomplete adsorption
  - Evidence for: always possible, pattern doesn’t fully match
  - Evidence against: reactivity predictable, consistent

	Rh-Hr							
	D X	C	E	c X	e X	f X		PeG AHG
R_1R_1	+	+	0	0	+			
B 94500 R_2R_2 304320 #2	+	0	+	+	0			w+
W 51918 R_2R_2 C5673 #3	+	0	+	+	0			w+
W 47887 **r”r** F454 #6	0	0	+	+	+			w+
W 43857 R_1R_Z A5009 #1	+	+	+	0	+	0		0 √
D V2794 R_1R_Z 164303 #11	+	+	+	0	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	0	+			

A closer look

Make a list

- (probable auto-) anti-E
  - Evidence for: reactions on E+ cells, could be showing dosage
  - Evidence against: did react with r”r cell
- ~~Anti-c~~
  - Evidence for: reactions match, patient able to make anti-c
  - Evidence against: anti-c ruled out, reactive with rr plasma
- ~~Incomplete adsorption~~
  - Evidence for: always possible, pattern doesn’t fully match
  - Evidence against: reactivity predictable, consistent

	Rh-Hr							
	D X	C	E	c X	e X	f X		PeG AHG
R_1R_1	+	+	0	0	+			
B 94500 R_2R_2 304320 #2	+	0	+	+	0			w+
W 51918 R_2R_2 C5673 #3	+	0	+	+	0			w+
W 47887 **r”r** F454 #6	0	0	+	+	+			w+
W 43857 R_1R_Z A5009 #1	+	+	+	0	+	0		0 √
D V2794 R_1R_Z 164303 #11	+	+	+	0	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	0	+			

A closer look

Make a list

- (probable auto-) anti-E
  - Evidence for: reactions on E+ cells, could be showing dosage
  - Evidence against: did react with r”r cell
- ~~Anti-c~~
  - Evidence for: reactions match, patient able to make anti-c
  - Evidence against: anti-c ruled out, reactive with rr plasma
- ~~Incomplete adsorption~~
  - Evidence for: always possible, pattern doesn’t fully match
  - Evidence against: reactivity predictable, consistent
- Something else
  - Evidence for: none of the other options seem fully correct. Patient actively hemolyzing, needs further investigation

	Rh-Hr							
	D X	C	E	c X	e X	f X		PeG AHG
R_1R_1	+	+	0	0	+			
B 94500 R_2R_2 304320 #2	+	0	+	+	0			w+
W 51918 R_2R_2 C5673 #3	+	0	+	+	0			w+
W 47887 **r”r** F454 #6	0	0	+	+	+			w+
W 43857 R_1R_Z A5009 #1	+	+	+	0	+	0		0 √
D V2794 R_1R_Z 164303 #11	+	+	+	0	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	0	+			

Something else

What if…

- What looks like anti-E, but isn't?

Anti-cE?

	Rh-Hr							
	D X	C	E	c X	e X	f X		PeG AHG
R_1R_1	+	+	0	0	+			
B 94500 **R_2R_2** 304320 #2	+	0	+	+	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	+	+	0			w+
W 47887 **r"r** F454 #6	0	0	+	+	+			w+
W 43857 **R_1R_Z** A5009 #1	+	+	+	0	+	0		0 √
D V2794 **R_1R_Z** 164303 #11	+	+	+	0	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	0	+			

Is there anything else it could be?

Consider common problem, presenting unusually

- Recall:
  - (probable auto-) anti-E
    - Evidence for: reactions on E+ cells, could be showing dosage
    - Evidence against: did react with r”r cell
- Antibodies can react inconsistently
- Reaction strength w+
- Already has probable auto-anti-C, WAA
  - Not unusual to have multiple autoantibodies with Rh specificities [2]
- Patient hemolyzing, but could be due to WAIHA or other cause

	Rh-Hr							
	D X	C	**E**	c X	e X	f X		PeG AHG
R_1R_1	+	+	**0**	0	+			
B 94500 **R_2R_2** 304320 #2	+	0	**+**	+	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	**+**	+	0			w+
W 47887 **r”r** F454 #6	0	0	**+**	+	+			w+
W 43857 **R_1R_Z** A5009 #1	+	+	**+**	0	+	0		0 √
D V2794 **R_1R_Z** 164303 #11	+	+	**+**	0	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	+	0	+			

Anti-cE (anti-Rh27)

Does it make sense?

- Which adsorbing cells would remove it?
  - R_2R_2 cells only
  - R_1R_1 and rr should still have it left behind
- Can this patient make anti-cE?
  - Yes, probably R_1R_z (DCe/DCE)
  - c-, therefore no cE
- Does the reaction pattern match?

	Rh-Hr							
	D X	C	**E**	**c** X	e X	f X		PeG AHG
R_1R_1	+	+	**0**	**0**	+			
B 94500 **R_2R_2** 304320 #2	+	0	**+**	**+**	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	**+**	**+**	0			w+
W 47887 **r"r** F454 #6	0	0	**+**	**+**	+			w+
W 43857 **R_1R_z** A5009 #1	+	+	**+**	**0**	+	0		0 √
D V2794 **R_1R_z** 164303 #11	+	+	**+**	**0**	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	**+**	**0**	+			

Anti-cE (anti-Rh27)

Does it make sense?

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  - Yes, probably R_1R_z (DCe/DCE)
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- Does the reaction pattern match?
  - **Yes**

	Rh-Hr							
	D	C	E	c	e	f		PeG AHG
R_1R_1	+	+	**0**	**0**	+			
B 94500 **R_2R_2** 304320 #2	+	0	**+**	**+**	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	**+**	**+**	0			w+
W 47887 **r''r** F454 #6	0	0	**+**	**+**	+			w+
W 43857 **R_1R_z** A5009 #1	+	+	**+**	**0**	+	0		0 √
D V2794 **R_1R_z** 164303 #11	+	+	**+**	**0**	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	**+**	**0**	+			

Anti-cE (anti-Rh27)

Are we sure?

- How to prove anti-cE vs probable auto-anti-E?
  - Test vs R_ZR_Z (DCE / DCE) cells
    - Double dose of E antigen, without cE antigen
    - Reactive? Auto-anti-E
    - Not particularly difficult- use frozen reagent cells
  - Adsorb neat plasma with E+, cE- adsorption cells
    - If reactivity remained, know anti-cE not adsorbed out
    - Difficult to find appropriate unit

- Academic questions, because plasma was fully exhausted

	Rh-Hr							
	D	C	E	c	e	f		PeG AHG
R_1R_1	+	+	**0**	**0**	+			
B 94500 **R_2R_2** 304320 #2	+	0	**+**	**+**	0			w+
W 51918 **R_2R_2** C5673 #3	+	0	**+**	**+**	0			w+
W 47887 **r"r** F454 #6	0	0	**+**	**+**	+			w+
W 43857 **R_1R_Z** A5009 #1	+	+	**+**	**0**	+	0		0 √
D V2794 **R_1R_Z** 164303 #11	+	+	**+**	**0**	+	0		0 √
Patient phenotype predicted by HEA molecular	+	+	**+**	**0**	+			

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

- Evaluate reactivity in plasma
  - Panreactivity, slightly stronger on C+ cells, reactive autocontrol- consistent with reported history
  - Alloadsorb to remove presumed WAA interference- successful, anti-C reactivity in adsorbed plasma
  - Test more cells, ID ?new antibody?
- Evaluate reactive DAT
- Prove autoantibody

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- Evaluate reactive DAT
  - Perform elution
- Prove autoantibody

Accomplish the plan

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Missouri and Arkansas Region

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  - Alloadsorb to remove presumed WAA interference- successful, anti-C reactivity in adsorbed plasma
  - Test more cells, ID new antibody- auto-anti-E vs anti-cE reactivity

- Evaluate reactive DAT
  - Perform elution
  - If panreactive, adsorb eluate

- Prove autoantibody

Acid eluate

American Red Cross
Missouri and Arkansas Region

Supplier/ Lot	Donor / RhHr - Vial	Rh-Hr								MNS				Lewis		P	Kell						Duffy		Kidd		Luth		X	Additional antigens	Test Results			
		D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Kp^b	Js^a	Js^b	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b	Xg^a		FW AHG		Elu AHG	
Biorad 9450011-00	904601 R1R1 #1	+	+	0	0	+			0	0	+	0	+	+	0	+	0	+	0	+	nt	nt	+	0	+	0	0	+	+		0/0		2+	
Biorad 9450011-00	104241 R2R2 #2	+	0	+	+	0			0	+	0	+	+	0	+	+	0	+	0	+	nt	nt	0	+	0	+	0	+	+		0/0		1+	
Biorad 9450011-00	904566 rr #3	0	0	0	+	+			0	+	0	+	0	0	+	+	+	+	0	+	nt	nt	+	0	+	+	0	+	0		0/0		1+	
Auto Control																																	

Eluate adsorbed 1x @ 37°C R_1R_1 adsorption

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		Eluate AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
D V279471 2WH3KU5 #7	0	0	0	~~+~~	+	~~+~~	0	0	~~+~~	0	~~+~~	0	0	+	0	+	+	0		0	~~+~~	0	~~+~~	0	+		$0/0\ \sqrt{}$		
B 9450011-00 904601 #1	+	+	0	0	+			0	0	+	0	+	~~+~~	0	+	0	+	0		+	0	+	0	0	+		$0/0\ \sqrt{}$		
D V279471 4207222 #3	+	0	+	+	0	0	0	0	+	+	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+		$0/m+$		
W 49905 C6404 #7	+	0	+	+	0			0	+	+	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		$0/m+$		
W 47887 F454 #6	0	0	+	+	+			0	+	+	0	+	0	+	0	0	+	0	0	+	+	+	+	0	+		$0/m+$		
W 43856 A5250 #7	+	+	+	0	+			0	+	0	+	0	0	+	+	0	+	0	0	0	+	+	0	0	+		$0/0\ \sqrt{}$		
D V279471 164303 #11	+	+	+	0	+	0	0	0	+	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		$0/0\ \sqrt{}$		
423C thawed	+	+	+	0	0			0	0	+	0	+	0	+	0	0	+			+	+	0	+				$0/0\ \sqrt{}$		

Eluate adsorbed 1x @ 37°C R_1R_1 adsorption

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^W	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		Eluate AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_1R_1																													
D V279471 **rr** 2WH3KU5 #7	0	0	0	~~+~~	+	~~+~~	0	0	~~+~~	0	~~+~~	0	0	+	0	+	+	0		0	~~+~~	0	~~+~~	0	+		$0/0\ \sqrt{}$		
B 945001 **R_1R_1** 904601 #1	+	+	0	0	+			0	0	+	0	+	~~+~~	0	+	0	+	0		+	0	+	0	0	+		$0/0\ \sqrt{}$		
D V27947 **R_2R_2** 4207222 #3	+	0	+	+	0	0	0	0	+	+	0	+	+	0	+	+	+	0	0	+	0	+	0	0	+		$0/m+$		
W 49905 **R_2R_2** C6404 #7	+	0	+	+	0			0	+	+	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		$0/m+$		
W 47887 **r''r** F454 #6	0	0	+	+	+			0	+	+	0	+	0	+	0	0	+	0	0	+	+	+	+	0	+		$0/m+$		
W 43856 **R_1R_Z** A5250 #7	+	+	+	0	+			0	+	0	+	0	0	+	+	0	+	0	0	0	+	+	0	0	+		$0/0\ \sqrt{}$		
D V27947 **R_1R_Z** 164303 #11	+	+	+	0	+	0	0	0	+	0	0	+	+	0	+	0	+	0	0	0	+	0	+	0	+		$0/0\ \sqrt{}$		
423C **R_ZR_Z** thawed	+	+	~~+~~	0	0			0	0	+	0	+	0	+	0	0	+			+	+	0	+				$0/0\ \sqrt{}$		

Eluate adsorbed 1x @ 37°C R_2R_2 and rr adsorptions

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		Eluate AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	+	+		0	+	0	0	+	0	+	+	0	+	0	0	+	0	+	0	0	+	Sc:2	0/0 √		
W 49905 G1768 #19	0	0	0	+	+			0	+	+	0	+	+	0	+	+	0	0	0	+	w	+	+	0	+		0/0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		0/m +		
B 9450011-00 305405 #7	+	+	0	0	+			0	0	+	0	+	+	0	+	0	+	0		+	0	+	0	0	+		0/m +		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	+	0	+	0	+	+	+	+	0	0	+	0	0	+	0	w		0/0 √		
W 51917 D1863 #4	+	0	0	+	+			0	0	+	0	+	0	0	+	0	+	0	0	0	0	+	0	0	+		0/0 √		
B 9450011-00 306503 #10	+	0	0	+	+			0	0	+	0	+	0	+	+	0	+	0	+	0	0	+	0	0	+	Js^b -	0/0 √		
D V279471 1177-859-4 #6	+	0	0	+	+			0	+	+	0	+	0	+	+	0	+	0	0	0	0	+	0	0	+		0/0 √		
B 9450011-00 104241 #2	+	0	+	+	0			0	+	0	+	+	0	+	+	0	+	0		0	+	0	+	0	+		0/m +		

Eluate adsorbed 1x @ 37°C R_2R_2 and rr adsorptions

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		Eluate AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	~~+~~	+		0	+	0	0	+	0	~~+~~	+	0	+	0	0	+	0	~~+~~	0	0	+	Sc:2	0/0 √		
W 49905 G1768 #19	0	0	0	+	+			0	+	+	0	+	+	0	+	~~+~~	0	0	0	+	w	+	+	0	+		0/0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		0/m +		
B 9450011-00 305405 #7	+	+	0	0	+			0	0	+	0	+	+	0	+	0	+	0		+	0	+	0	0	+		0/m +		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	~~+~~	0	~~+~~	0	+	+	+	+	0	0	~~+~~	0	0	+	0	w		0/0 √		
W 51917 D1863 #4	~~+~~	0	0	+	+			0	0	+	0	+	0	0	+	0	+	0	0	0	0	+	0	0	+		0/0 √		
B 9450011-00 306503 #10	~~+~~	0	0	+	+			0	0	+	0	+	0	+	+	0	+	0	+	0	0	+	0	0	+	Js^b -	0/0 √		
D V279471 1177-859-4 #6	~~+~~	0	0	+	+			0	+	+	0	+	0	+	+	0	+	0	0	0	0	+	0	0	+		0/0 √		
B 9450011-00 104241 #2	+	0	+	+	0			0	+	0	+	+	0	+	+	0	+	0		0	+	0	+	0	+		0/m +		

Eluate adsorbed 1x @ 37°C R_2R_2 and rr adsorptions

American Red Cross
Missouri and Arkansas Region

	Rh-Hr								MNS				Lewis		P	Kell				Duffy		Kidd		Luth		Additional antigens	Test Results		
	D	C	E	c	e	f	V	C^w	M	N	S	s	Le^a	Le^b	P1	K	k	Kp^a	Js^a	Fy^a	Fy^b	Jk^a	Jk^b	Lu^a	Lu^b		Eluate AHG		
R_1R_1 W18112414667100H	+	+	0	0	+				0	+	0	+	0	+	+	0				+	0	+	0						
R_2R_2 W18402402815500Z	+	0	+	+	0				+	+	0	+	+	0	+	0				+	+	0	+						
rr W18112418813700C	0	0	0	+	+				+	0	+	0	+	0	+	0				0	+	+	+						
R_2R_2																													
W 51918 H1652 #8	0	0	0	+	~~+~~	+		0	+	0	0	+	0	~~+~~	+	0	+	0	0	+	0	~~+~~	0	0	+	Sc:2	0/0 √		
W 49905 G1768 #19	0	0	0	+	+			0	+	+	0	+	+	0	+	~~+~~	0	0	0	+	w	+	+	0	+		0/0 √		
W 51917 B10383 #1	+	+	0	0	+			0	+	0	0	+	0	+	+	0	+	0	0	+	0	0	+	0	+		0/m +		
B 9450011-00 305405 #7	+	+	0	0	+			0	0	+	0	+	+	0	+	0	+	0		+	0	+	0	0	+		0/m +		
rr																													
B 9450011-00 305405 #7	0	0	0	+	+			0	0	~~+~~	0	~~+~~	0	+	+	+	+	0	0	~~+~~	0	0	+	0	w		0/0 √		
W 51917 D1863 #4	~~+~~	0	0	+	+			0	0	+	0	+	0	0	+	0	+	0	0	0	0	+	0	0	+		0/0 √		
B 9450011-00 306503 #10	~~+~~	0	0	+	+			0	0	+	0	+	0	+	+	0	+	0	+	0	0	+	0	0	+	Js^b -	0/0 √		
D V279471 1177-859-4 #6	~~+~~	0	0	+	+			0	+	+	0	+	0	+	+	0	+	0	0	0	0	+	0	0	+		0/0 √		
B 9450011-00 104241 #2	+	0	+	+	0			0	+	0	+	+	0	+	+	0	+	0		0	+	0	+	0	+		0/m +		

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

- Evaluate reactivity in plasma
  - Panreactivity, slightly stronger on C+ cells, reactive autocontrol- consistent with reported history
  - Alloadsorb to remove presumed WAA interference- successful, anti-C reactivity in adsorbed plasma
  - Test more cells, ID new antibody- auto-anti-E vs anti-cE reactivity

- Evaluate reactive DAT
  - Perform elution
  - If panreactive, adsorb eluate

- Prove autoantibody

Accomplish the plan

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Missouri and Arkansas Region

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  - Test more cells, ID new antibody- auto-anti-E vs anti-cE reactivity

- Evaluate reactive DAT
  - Perform elution- reactive with all screen cells
  - If panreactive, adsorb eluate- successful
  - Probable auto-anti-C in eluate, same auto-anti-E vs anti-cE reactivity in eluate

- Prove autoantibody

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

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- Prove autoantibody
  - Recently transfused- perform reticulocyte separation

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

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  - Alloadsorb to remove presumed WAA interference- successful, anti-C reactivity in adsorbed plasma
  - Test more cells, ID new antibody- auto-anti-E vs anti-cE reactivity
  - Test vs DAT negative patient cells to confirm autoantibody
- Evaluate reactive DAT
  - Perform elution- reactive with all screen cells
  - If panreactive, adsorb eluate- successful
  - Probable auto-anti-C in eluate, same auto-anti-E vs anti-cE reactivity in eluate
  - Test vs DAT negative patient cells to confirm autoantibody
- Prove autoantibody
  - Recently transfused- perform reticulocyte separation
  - EGA treat retics for DAT negative patient cells

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

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  - Probable auto-anti-C in eluate, same auto-anti-E vs anti-cE reactivity in eluate
  - Test vs DAT negative patient cells to confirm autoantibody
- Prove autoantibody
  - Recently transfused- perform reticulocyte separation- limited sample sent, all used for eluate
  - EGA treat retics for DAT negative patient cells

Accomplish the plan

American Red Cross
Missouri and Arkansas Region

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  - ~~Test vs DAT negative patient cells to confirm autoantibody~~
- Evaluate reactive DAT
  - Perform elution- reactive with all screen cells
  - If panreactive, adsorb eluate- successful
  - Probable auto-anti-C in eluate, same auto-anti-E vs anti-cE reactivity
  - ~~Test vs DAT negative patient cells to confirm autoantibody~~
- ~~Prove autoantibody~~
  - Recently transfused- perform reticulocyte separation- limited sample sent, all used for eluate
  - ~~EGA treat retics for DAT negative patient cells~~

When all else fails, think about it logically

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Missouri and Arkansas Region

What are the options?

- Probable auto-anti-E vs anti-cE
  - Reasonable argument either way
    - Probable auto-anti-E with spotty reactivity more likely
    - Technically could call anti-cE with current results, but would like more evidence
  - Transfusion not an issue either way
  - Recommend E- units, avoid cE antigen and (unlikely)[8] chance of E variant

- Safer for patient to call probable anti-cE
  - Alloantibody will be honored
  - ‘Probable’ - not certain
    - Subsequent testing likely to provide more clarity

When all else fails, think about it logically

American Red Cross
Missouri and Arkansas Region

To C, or not to C?

(eyyyyyyyy)

- Transfuse C- vs c-
  - Unknown if patient is variant able to make allo-anti-C
    - No *RHCE* molecular testing- HEA insufficient to determine
    - Transfused C untested units, potential reaction
  - Give c-?
    - Patient able to make anti-c
    - Active hemolysis, avoid exposure to ‘foreign’ Rh antigen
    - Listed as Caucasian, less likely to carry variant alleles [6, 8]

Blood Group	Antigen	Result
Rh	c	0
	C	+
	e	+
	E	+
	V	0
	VS	0

- Recommend C- units
  - Confident no anti-c right now
  - Able to avoid probable anti-cE with E-
  - Avoid risk of transfusing C+ units to allo- vs auto-anti-C

Finally, closure

Putting it all together

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Missouri and Arkansas Region

Plasma	Eluate
Probable warm autoantibody	Probable warm autoantibody
Probable auto-anti-C	Probable auto-anti-C
Probable anti-cE	Probable anti-cE

Recommended transfuse E-, C- pRBC
Evaluate for possible delayed transfusion reaction
Recommend *RHCE* molecular testing

Outcome

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Missouri and Arkansas Region

- Hospital requested 2 units C- E- pRBC
- Patient’s family uncomfortable with least incompatible transfusion, left hospital without being transfused
- Hasn’t been seen since

Molecular results

A week later

TESTING REQUESTED: Genotype for *RHCE* variants

RHCE GENOTYPING PERFORMED			RESULT
***RHCE* Common**	**Method**	**Analyte**	**Product present/absent**
***RHCE* gene**	*RHCE* Array	C	present
		c	absent
		Analyte: Nucleotide (Amino Acid)	**Nucleotide(s) Detected**
***RHCE* Exon 5**	*RHCE* Array	676G>C (A226P)	G/C
***RHCE* Variants**	**Method**	**Analyte: Nucleotide (Amino Acid)**	**Nucleotide(s) Detected**
***RHCE* Exon 2**	RFLP	254C>G (A85G)	No diagnostic bands
***RHCE* Exon 4**	RFLP	577A>G (K193E)	A
w*RHCE* BEADCHIP™	*RHCE* Array*	No variant markers detected	

*Only nucleotides which differ from consensus sequence are listed.

Probable *RHCE* Genotype: *RHCE*Ce / RHCE*CE*

Predicted phenotype: C+ E+ c- e+ VS- V- hr^S+ hr^B+

COMMENTS: Medium-resolution testing did not detect RH variants associated with weak or partial Rh antigens. Based on the alleles identified, the patient is predicted to be at risk for allo-anti-c and -f (ce).

Molecular results

A week later

TESTING REQUESTED: Genotype for *RHCE* variants

RHCE GENOTYPING PERFORMED			RESULT
***RHCE* Common**	**Method**	**Analyte**	**Product present/absent**
***RHCE* gene**	*RHCE* Array	C	present
		c	absent
		Analyte: Nucleotide (Amino Acid)	**Nucleotide(s) Detected**
***RHCE* Exon 5**	*RHCE* Array	676G>C (A226P)	G/C
***RHCE* Variants**	**Method**	**Analyte: Nucleotide (Amino Acid)**	**Nucleotide(s) Detected**
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w*RHCE* BEADCHIP™	*RHCE* Array*	No variant markers detected	

*Only nucleotides which differ from consensus sequence are listed.

Probable *RHCE* Genotype: *RHCE*Ce / RHCE*CE*

Predicted phenotype: C+ E+ c- e+ VS- V- hr^S+ hr^B+

COMMENTS: Medium-resolution testing did not detect RH variants associated with weak or partial Rh antigens. Based on the alleles identified, the patient is predicted to be at risk for allo-anti-c and -f (ce).

- No variants detected
- If patient returned with same reactivity, would recommend:
  - E or c negative pRBC, preferably c neg

Takeaways

American Red Cross
Missouri and Arkansas Region

- Compound antigens and antibodies
  - Additional gene product of a given *RHCE* allele
  - Can be mistaken for other Rh antibodies
- Get a good history
- Send sufficient specimen
- Sometimes real life is messy
  - Unable to conclusively distinguish between auto-anti-E and anti-cE
  - Not every story has a satisfying ending
- When all else fails, think it through, consult a supervisor, and do what's safest for the patient

References

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Neil D. Avent, Marion E. Reid, The Rh blood group system: a review. Blood, Volume 95, Issue 2, 2000, Pages 375-387, ISSN 0006-4971, https://doi.org/10.1182/blood.V95.2.375.

Contact Information

Roxie Gould

American Red Cross- St Louis IRL

roxanna.gould@redcross.org

Thank you

American Red Cross

Reference slides

Antibodies to compound antigens, with or without overlying antibodies

The Rh system

Anti-c + anti-ce (anti-f, -Rh6)

- Anti-c and anti-ce
  - Looks like straightforward anti-c

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	**0**	+	0		0 √		
2	R_2R_2 DcE / DcE	+	0	+	**+**	0	0		2+		
3	R_0r Dce / dce	+	0	0	**+**	+	+		3+		
4	r'r dCe / dce	0	+	0	**+**	+	+		3+		
5	r''r dcE / dce	0	0	+	**+**	+	+		3+		
6	rr dce / dce	0	0	0	**+**	+	+		3+		
7	R_1R_Z DCe / DCE	+	+	+	**0**	+	0		0 √		
8	R_Zr DCE / dce	+	+	+	**+**	+	+		3+		
9	R_ZR_Z DCE / DCE	+	+	+	**0**	0	0		0 √		
10	R_2R_Z DcE / DCE	+	+	+	**+**	0	0		2+		
11	R_1R_2 DCe / DcE	+	+	+	**+**	+	0		2+		
	Auto Control								0 √		

The Rh system

Anti-c + anti-ce (anti-f, -Rh6)

- Anti-c and anti-ce
  - Looks like straightforward anti-c
    - Anti-ce only visible if adsorb with e+, ce- cell

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	**0**	+	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	+	**+**	0	**0**		2+		
3	**R_0r** D**ce** / d**ce**	+	0	0	**+**	+	**+**		3+		
4	r'**r** dCe / d**ce**	0	+	0	**+**	+	**+**		3+		
5	r''**r** dcE / d**ce**	0	0	+	**+**	+	**+**		3+		
6	**rr** d**ce** / d**ce**	0	0	0	**+**	+	**+**		3+		
7	R_1R_Z DCe / DCE	+	+	+	**0**	+	**0**		0 √		
8	R_Z**r** DCE / d**ce**	+	+	+	**+**	+	**+**		3+		
9	R_ZR_Z DCE / DCE	+	+	+	**0**	0	**0**		0 √		
10	R_2R_Z DcE / DCE	+	+	+	**+**	0	**0**		2+		
11	R_1R_2 DCe / DcE	+	+	+	**+**	+	**0**		2+		
	Auto Control								0 √		

The Rh system

Anti-e + anti-ce (anti-f, -Rh6)

- Anti-c and anti-ce
  - Looks like straightforward anti-c
    - Anti-ce only visible if adsorb with e+, ce- cell

- Anti-e and anti-ce
  - Looks like straightforward anti-e
    - Anti-ce only visible if adsorb with e+, ce- cell

- Transfuse c- or e- units as appropriate, avoid ce antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	0		2+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	**R_0r** D**ce** / d**ce**	+	0	0	+	+	+		3+		
4	r'**r** dCe / d**ce**	0	+	0	+	+	+		3+		
5	r''**r** dcE / d**ce**	0	0	+	+	+	+		3+		
6	**rr** d**ce** / d**ce**	0	0	0	+	+	+		3+		
7	R_1R_Z DCe / DCE	+	+	+	0	+	0		2+		
8	R_Z**r** DCE / d**ce**	+	+	+	+	+	+		3+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	0		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	0		2+		
	Auto Control								0 √		

The Rh system

Anti-ce (anti-f, -Rh6)

- Anti-ce alone
  - Easiest of compound antigens to detect alone

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	+	+	0	**0**		0 √		
3	**R_0r** D**ce** / d**ce**	+	0	0	+	+	**+**		2+		
4	**r'r** dCe / d**ce**	0	+	0	+	+	**+**		2+		
5	**r''r** dcE / d**ce**	0	0	+	+	+	**+**		2+		
6	**rr** d**ce** / d**ce**	0	0	0	+	+	**+**		2+		
7	R_1R_Z DCe / DCE	+	+	+	0	+	**0**		0 √		
8	R_Z**r** DCE / d**ce**	+	+	+	+	+	**+**		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	**0**		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	0	**0**		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**0**		0 √		
	Auto Control								0 √		

The Rh system

Anti-ce (anti-f, -Rh6)

- Anti-ce alone
  - Easiest of compound antigens to detect alone
  - Rule out anti-e and anti-c on R_1R_1 and R_2R_2 cells
- Usually ID in R_1R_2 (DCe/DcE) individuals

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	ce		PeG AHG		
1	R_1R_1 DCe / DCe	~~+~~	~~+~~	0	0	~~+~~	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	~~+~~	~~+~~	0	**0**		0 √		
3	**R_0r** D**ce** / d**ce**	+	0	0	+	+	**+**		2+		
4	**r'r** dCe / d**ce**	0	+	0	+	+	**+**		2+		
5	**r''r** dcE / d**ce**	0	0	+	+	+	**+**		2+		
6	**rr** d**ce** / d**ce**	0	0	0	+	+	**+**		2+		
7	R_1R_Z DCe / DCE	+	+	+	0	+	**0**		0 √		
8	R_Z**r** DCE / d**ce**	+	+	+	+	+	**+**		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	**0**		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	0	**0**		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**0**		0 √		
	Auto Control								0 √		

The Rh system

Anti-e + anti-Ce (anti-Rh7, -rh$_i$)

- Anti-e and anti-Ce
  - Looks like straightforward anti-e

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	+		3+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		2+		
4	r'r dCe / dce	0	+	0	+	+	+		3+		
5	r''r dcE / dce	0	0	+	+	+	0		2+		
6	rr dce / dce	0	0	0	+	+	0		2+		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		3+		
8	R_Zr DCE / dce	+	+	+	+	+	0		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	0		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-e + anti-Ce (anti-Rh7, -rh$_i$)

- Anti-e and anti-Ce
  - Looks like straightforward anti-e
    - Anti-Ce only visible if adsorb with e+, Ce- cell

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R_1R_1** D**Ce** / D**Ce**	+	+	0	0	+	+		3+		
2	R_2R_2 DcE / DcE	+	0	+	+	**0**	**0**		0 √		
3	R_0r Dce / dce	+	0	0	+	+	**0**		2+		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		3+		
5	r''r dcE / dce	0	0	+	+	+	**0**		2+		
6	rr dce / dce	0	0	0	+	+	**0**		2+		
7	**R_1**R_Z D**Ce** / DCE	+	+	+	0	+	+		3+		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	**0**	**0**		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	**0**	**0**		0 √		
11	**R_1**R_2 D**Ce** / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-C + anti-Ce (anti-Rh7, -rh$_i$)

- Anti-e and anti-Ce
  - Looks like straightforward anti-e
    - Anti-Ce only visible if adsorb with e+, Ce- cell
- Anti-C and anti-Ce
  - Looks like straightforward anti-C
    - Anti-Ce only visible if adsorb with C+, Ce- cell
- Transfuse C- or e- units as appropriate, avoid Ce antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R$_1$R$_1$** D**Ce** / D**Ce**	+	+	0	0	+	+		3+		
2	R$_2$R$_2$ DcE / DcE	+	**0**	+	+	0	**0**		0 √		
3	R$_0$r Dce / dce	+	**0**	0	+	+	**0**		0 √		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		3+		
5	r''r dcE / dce	0	**0**	+	+	+	**0**		0 √		
6	rr dce / dce	0	**0**	0	+	+	**0**		0 √		
7	**R$_1$**R$_Z$ D**Ce** / DCE	+	+	+	0	+	+		3+		
8	R$_Z$r DCE / dce	+	+	+	+	+	**0**		2+		
9	R$_Z$R$_Z$ DCE / DCE	+	+	+	0	0	**0**		2+		
10	R$_2$R$_Z$ DcE / DCE	+	+	+	+	0	**0**		2+		
11	**R$_1$**R$_2$ D**Ce** / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R$_1$R$_1$** D**Ce** / D**Ce**	+	+	0	0	+	+		2+		
2	R$_2$R$_2$ DcE / DcE	+	0	+	+	0	**0**		0 √		
3	R$_0$r Dce / dce	+	0	0	+	+	**0**		0 √		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	**0**		0 √		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	**R$_1$**R$_Z$ D**Ce** / DCE	+	+	+	0	+	+		2+		
8	R$_Z$r DCE / dce	+	+	+	+	+	**0**		0 √		
9	R$_Z$R$_Z$ DCE / DCE	+	+	+	0	0	**0**		0 √		
10	R$_2$R$_Z$ DcE / DCE	+	+	+	+	0	**0**		0 √		
11	**R$_1$**R$_2$ D**Ce** / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C
  - Panels usually lack rarer Rh haplotype combinations

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	**R$_1$R$_1$** D**Ce** / D**Ce**	+	+	0	0	+	+		2+		
2	R$_2$R$_2$ DcE / DcE	+	0	+	+	0	0		0 √		
3	R$_0$r Dce / dce	+	0	0	+	+	0		0 √		
4	**r'**r d**Ce** / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	0		0 √		
6	rr dce / dce	0	0	0	+	+	0		0 √		
7	**R$_1$**R$_Z$ D**Ce** / DCE	+	+	+	0	+	+		2+		
8	R$_Z$r DCE / dce	+	+	+	+	+	0		0 √		
9	R$_Z$R$_Z$ DCE / DCE	+	+	+	0	0	0		0 √		
10	R$_2$R$_Z$ DcE / DCE	+	+	+	+	0	0		0 √		
11	**R$_1$**R$_2$ D**Ce** / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C
  - Panels usually lack rarer Rh haplotype combinations
  - No specific reason to test R_2R_Z cell
    - If tested, easy to mistake for dosage

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	+		2+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		0 √		
4	r'r dCe / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	0		0 √		
6	rr dce / dce	0	0	0	+	+	0		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		2+		
8	R_Zr DCE / dce	+	+	+	+	+	0		0 √		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	0		0 √		
10	**R_2R_Z DcE / DCE**	+	±	+	±	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-Ce (anti-Rh7, -rh$_i$)

- Anti-Ce alone easily mistaken for anti-C
  - Panels usually lack rarer Rh haplotype combinations
  - No specific reason to test R_2R_Z cell
    - If tested, easy to mistake for dosage
  - Very unlikely to have R_ZR_Z cells available
- As misidentifications go, unlikely to cause problems
  - C- units lack Ce antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	Ce		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	+		2+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		0 √		
4	r'r dCe / dce	0	+	0	+	+	+		2+		
5	r''r dcE / dce	0	0	+	+	+	0		0 √		
6	rr dce / dce	0	0	0	+	+	0		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		2+		
8	R_Zr DCE / dce	+	+	+	+	+	0		0 √		
9	**R_ZR_Z DCE / DCE**	+	**+**	+	**0**	0	0		**0 √**		
10	R_2R_Z DcE / DCE	+	+	+	+	0	0		0 √		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		2+		
	Auto Control								0 √		

The Rh system

Anti-E + anti-cE (anti-Rh27)

- Anti-E and anti-cE
  - Looks like straightforward anti-E

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	**0**	0	+	0		0 √		
2	R_2R_2 DcE / DcE	+	0	+	+	0	+		3+		
3	R_0r Dce / dce	+	0	**0**	+	+	0		0 √		
4	r'r dCe / dce	0	+	**0**	+	+	0		0 √		
5	r''r dcE / dce	0	0	+	+	+	+		3+		
6	rr dce / dce	0	0	**0**	+	+	0		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	0		2+		
8	R_Zr DCE / dce	+	+	+	+	+	0		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	0		2+		
10	R_2R_Z DcE / DCE	+	+	+	+	0	+		3+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-E + anti-cE (anti-Rh27)

- Anti-E and anti-cE
  - Looks like straightforward anti-E
    - Anti-cE only visible if adsorb with E+, cE- cell

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	**0**	0	+	**0**		0 √		
2	**R_2R_2** D**cE** / D**cE**	+	0	+	+	0	+		3+		
3	R_0r Dce / dce	+	0	**0**	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	**0**	+	+	**0**		0 √		
5	**r"**r d**cE** / dce	0	0	+	+	+	+		3+		
6	rr dce / dce	0	0	**0**	+	+	**0**		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	**0**		2+		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		2+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	**0**		2+		
10	**R_2**R_Z D**cE** / DCE	+	+	+	+	0	+		3+		
11	R_1**R_2** DCe / D**cE**	+	+	+	+	+	+		3+		
	Auto Control								0 √		

The Rh system

Anti-c + anti-cE (anti-Rh27)

- Anti-E and anti-cE
  - Looks like straightforward anti-E
    - Anti-cE only visible if adsorb with E+, cE- cell
- Anti-c and anti-cE
  - Looks like straightforward anti-c
    - Anti-cE only visible if adsorb with c+, cE- cell
- Transfuse c- or E- units as appropriate, avoid cE antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	**0**	+	**0**		0 √		
2	**R_2R_2** D**cE** / D**cE**	+	0	+	**+**	0	**+**		3+		
3	R_0r Dce / dce	+	0	0	**+**	+	**0**		2+		
4	r'r dCe / dce	0	+	0	**+**	+	**0**		2+		
5	**r''**r d**cE** / dce	0	0	+	**+**	+	**+**		3+		
6	rr dce / dce	0	0	0	**+**	+	**0**		2+		
7	R_1R_Z DCe / DCE	+	+	+	**0**	+	**0**		0 √		
8	R_Zr DCE / dce	+	+	+	**+**	+	**0**		2+		
9	R_ZR_Z DCE / DCE	+	+	+	**0**	0	**0**		0 √		
10	**R_2**R_Z D**cE** / DCE	+	+	+	**+**	0	**+**		3+		
11	R_1**R_2** DCe / D**cE**	+	+	+	**+**	+	**+**		3+		
	Auto Control								0 √		

The Rh system

Anti-cE (anti-Rh27)

- Anti-cE alone easily mistaken for anti-E

`	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		0 √		
2	**R_2R_2** D**cE** / D**cE**	+	0	+	+	0	**+**		2+		
3	R_0r Dce / dce	+	0	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		0 √		
5	**r"**r d**cE** / dce	0	0	+	+	+	**+**		2+		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	**0**		0 √		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		0 √		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	**0**		0 √		
10	**R_2**R_Z D**cE** / DCE	+	+	+	+	0	**+**		2+		
11	R_1**R_2** DCe / D**cE**	+	+	+	+	+	**+**		2+		
	Auto Control								0 √		

The Rh system

Anti-cE (anti-Rh27)

- Anti-cE alone easily mistaken for anti-E
  - Panels usually lack rarer Rh haplotype combinations

`	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		0 √		
2	**R_2R_2** D**cE** / D**cE**	+	0	+	+	0	**+**		2+		
3	R_0r Dce / dce	+	0	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		0 √		
5	**r''**r d**cE** / dce	0	0	+	+	+	**+**		2+		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	**0**		0 √		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		0 √		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	**0**		0 √		
10	**R_2**R_Z D**cE** / DCE	+	+	+	+	0	**+**		2+		
11	R_1**R_2** DCe / D**cE**	+	+	+	+	+	**+**		2+		
	Auto Control								0 √		

The Rh system

Anti-cE (anti-Rh27)

- Anti-cE alone easily mistaken for anti-E
  - Panels usually lack rarer Rh haplotype combinations
  - No specific reason to test R_1R_Z cell
    - If tested, easy to mistake for dosage

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	+	+	0	**+**		2+		
3	R_0r Dce / dce	+	0	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		0 √		
5	r''r dcE / dce	0	0	+	+	+	**+**		2+		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	**R_1R_Z DCe / DCE**	+	+	**+**	0	**+**	**0**		0 √		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		0 √		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	**0**		0 √		
10	**R_2**R_Z D**cE** / DCE	+	+	+	+	0	**+**		2+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**+**		2+		
	Auto Control								0 √		

The Rh system

Anti-cE (anti-Rh27)

- Anti-cE alone easily mistaken for anti-E
  - Panels usually lack rarer Rh haplotype combinations
  - No specific reason to test R_1R_Z cell
    - If tested, easy to mistake for dosage
  - Very unlikely to have R_ZR_Z cells available

- As misidentifications go, unlikely to cause problems
  - E- units lack cE antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	cE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	+	+	0	**+**		2+		
3	R_0r Dce / dce	+	0	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		0 √		
5	r''r dcE / dce	0	0	+	+	+	**+**		2+		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	**0**		0 √		
8	R_Zr DCE / dce	+	+	+	+	+	**0**		0 √		
9	**R_ZR_Z DCE / DCE**	+	+	**+**	0	**0**	**0**		0 √		
10	R_2R_Z DcE / DCE	+	+	+	+	0	**+**		2+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**+**		2+		
	Auto Control								0 √		

The Rh system

Anti-C + anti-CE (anti-Rh22)

- Anti-C and anti-CE
  - Looks like straightforward anti-C

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	CE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	0		2+		
2	R_2R_2 DcE / DcE	+	0	+	+	0	0		0 √		
3	R_0r Dce / dce	+	0	0	+	+	0		0 √		
4	r'r dCe / dce	0	+	0	+	+	0		2+		
5	r''r dcE / dce	0	0	+	+	+	0		0 √		
6	rr dce / dce	0	0	0	+	+	0		0 √		
7	R_1R_Z DCe / DCE	+	+	+	0	+	+		3+		
8	R_Zr DCE / dce	+	+	+	+	+	+		3+		
9	R_ZR_Z DCE / DCE	+	+	+	0	0	+		3+		
10	R_2R_Z DcE / DCE	+	+	+	+	0	+		3+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	0		2+		
	Auto Control								0 √		

The Rh system

Anti-C + anti-CE (anti-Rh22)

- Anti-C and anti-CE
  - Looks like straightforward anti-C
    - Anti-CE only visible if adsorb with C+, CE- cell

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	CE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		2+		
2	R_2R_2 DcE / DcE	+	**0**	+	+	0	**0**		0 √		
3	R_0r Dce / dce	+	**0**	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		2+		
5	r''r dcE / dce	0	**0**	+	+	+	**0**		0 √		
6	rr dce / dce	0	**0**	0	+	+	**0**		0 √		
7	R_1**R_z** DCe / D**CE**	+	+	+	0	+	+		3+		
8	**R_z**r D**CE** / dce	+	+	+	+	+	+		3+		
9	**R_zR_z** D**CE** / D**CE**	+	+	+	0	0	+		3+		
10	R_2**R_z** DcE / D**CE**	+	+	+	+	0	+		3+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**0**		2+		
	Auto Control								0 √		

The Rh system

Anti-E + anti-CE (anti-Rh22)

- Anti-C and anti-CE
  - Looks like straightforward anti-C
    - Anti-CE only visible if adsorb with C+, CE- cell
- Anti-E and anti-CE
  - Looks like straightforward anti-E
    - Anti-CE only visible if adsorb with E+, CE- cell
- Transfuse C- or E- units as appropriate, avoid CE antigen

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	CE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	**0**	0	+	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	+	+	0	**0**		2+		
3	R_0r Dce / dce	+	0	**0**	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	**0**	+	+	**0**		0 √		
5	r''r dcE / dce	0	0	+	+	+	**0**		2+		
6	rr dce / dce	0	0	**0**	+	+	**0**		0 √		
7	R_1**R_z** DCe / D**CE**	+	+	+	0	+	+		3+		
8	**R_z**r D**CE** / dce	+	+	+	+	+	+		3+		
9	**R_zR_z** D**CE** / D**CE**	+	+	+	0	0	+		3+		
10	R_2**R_z** DcE / D**CE**	+	+	+	+	0	+		3+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**0**		2+		
	Auto Control								0 √		

The Rh system

Anti-CE (anti-Rh22)

- Anti-CE alone
  - Relatively easy to detect, but many panels lack R_Z or r^y cells, so easy to miss

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	CE		PeG AHG		
1	R_1R_1 DCe / DCe	+	+	0	0	+	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	+	+	0	**0**		0 √		
3	R_0r Dce / dce	+	0	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		0 √		
5	r''r dcE / dce	0	0	+	+	+	**0**		0 √		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	R_1**R_Z** DCe / D**CE**	+	+	+	0	+	**+**		2+		
8	**R_Z**r D**CE** / dce	+	+	+	+	+	**+**		2+		
9	**R_ZR_Z** D**CE** / D**CE**	+	+	+	0	0	**+**		2+		
10	R_2**R_Z** DcE / D**CE**	+	+	+	+	0	**+**		2+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**0**		0 √		
	Auto Control								0 √		

The Rh system

Anti-CE (anti-Rh22)

- Anti-CE alone
  - Relatively easy to detect, but many panels lack R_Z or r^y cells, so easy to miss
  - Rule out anti-C and anti-E on R_1R_1 and R_2R_2 cells

	Donor / RhHr - Vial	Rh-Hr							Test Results		
		D	C	E	c	e	CE		PeG AHG		
1	R_1R_1 DCe / DCe	~~+~~	~~+~~	0	0	~~+~~	**0**		0 √		
2	R_2R_2 DcE / DcE	+	0	~~+~~	~~+~~	0	**0**		0 √		
3	R_0r Dce / dce	+	0	0	+	+	**0**		0 √		
4	r'r dCe / dce	0	+	0	+	+	**0**		0 √		
5	r''r dcE / dce	0	0	+	+	+	**0**		0 √		
6	rr dce / dce	0	0	0	+	+	**0**		0 √		
7	R_1**R_Z** DCe / D**CE**	+	+	+	0	+	**+**		2+		
8	**R_Z**r D**CE** / dce	+	+	+	+	+	**+**		2+		
9	**R_ZR_Z** D**CE** / D**CE**	+	+	+	0	0	**+**		2+		
10	R_2**R_Z** DcE / D**CE**	+	+	+	+	0	**+**		2+		
11	R_1R_2 DCe / DcE	+	+	+	+	+	**0**		0 √		
	Auto Control								0 √		