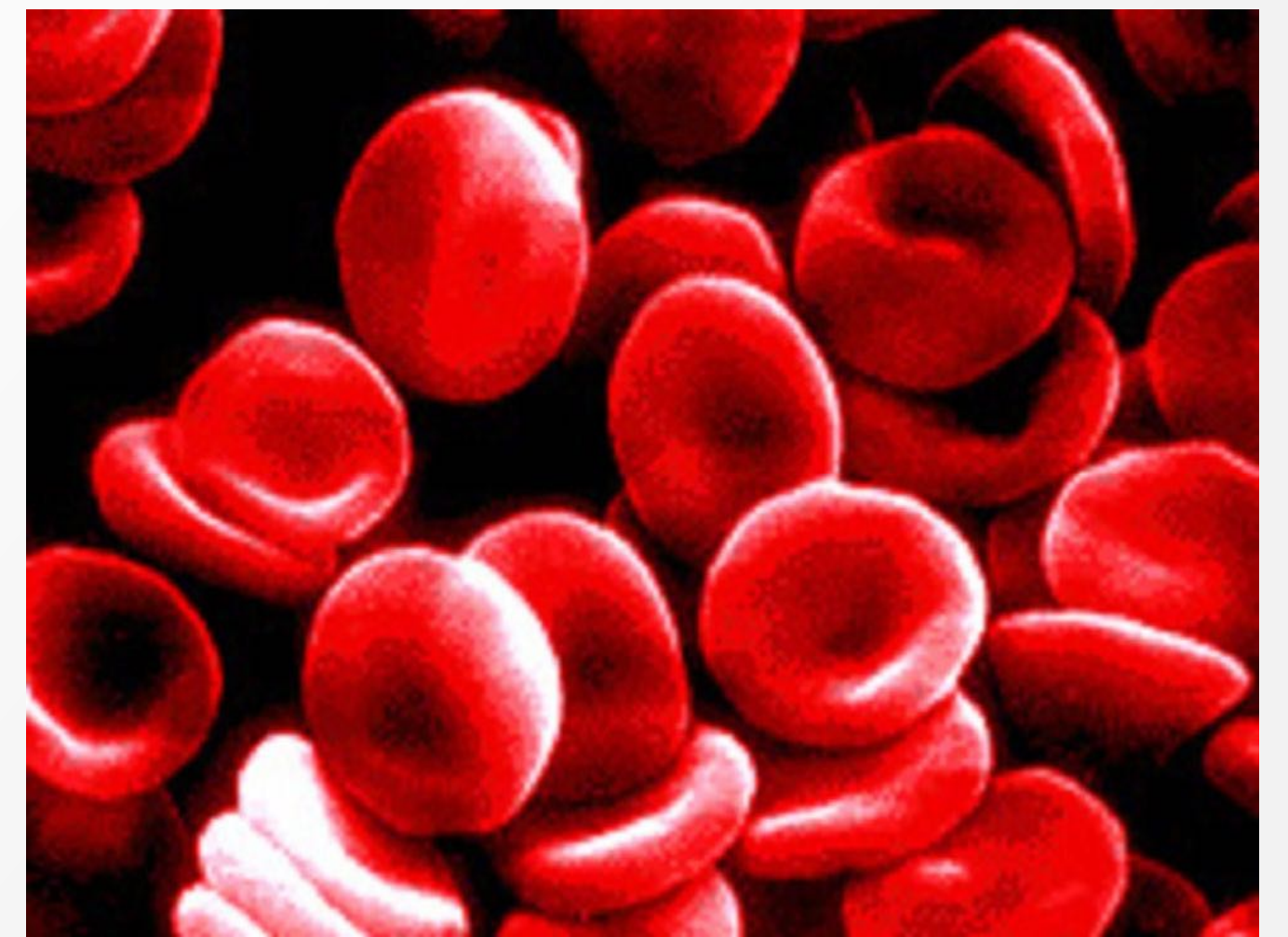


Transfusion Medicine Immunohematology I

D. Joe Chaffin, MD





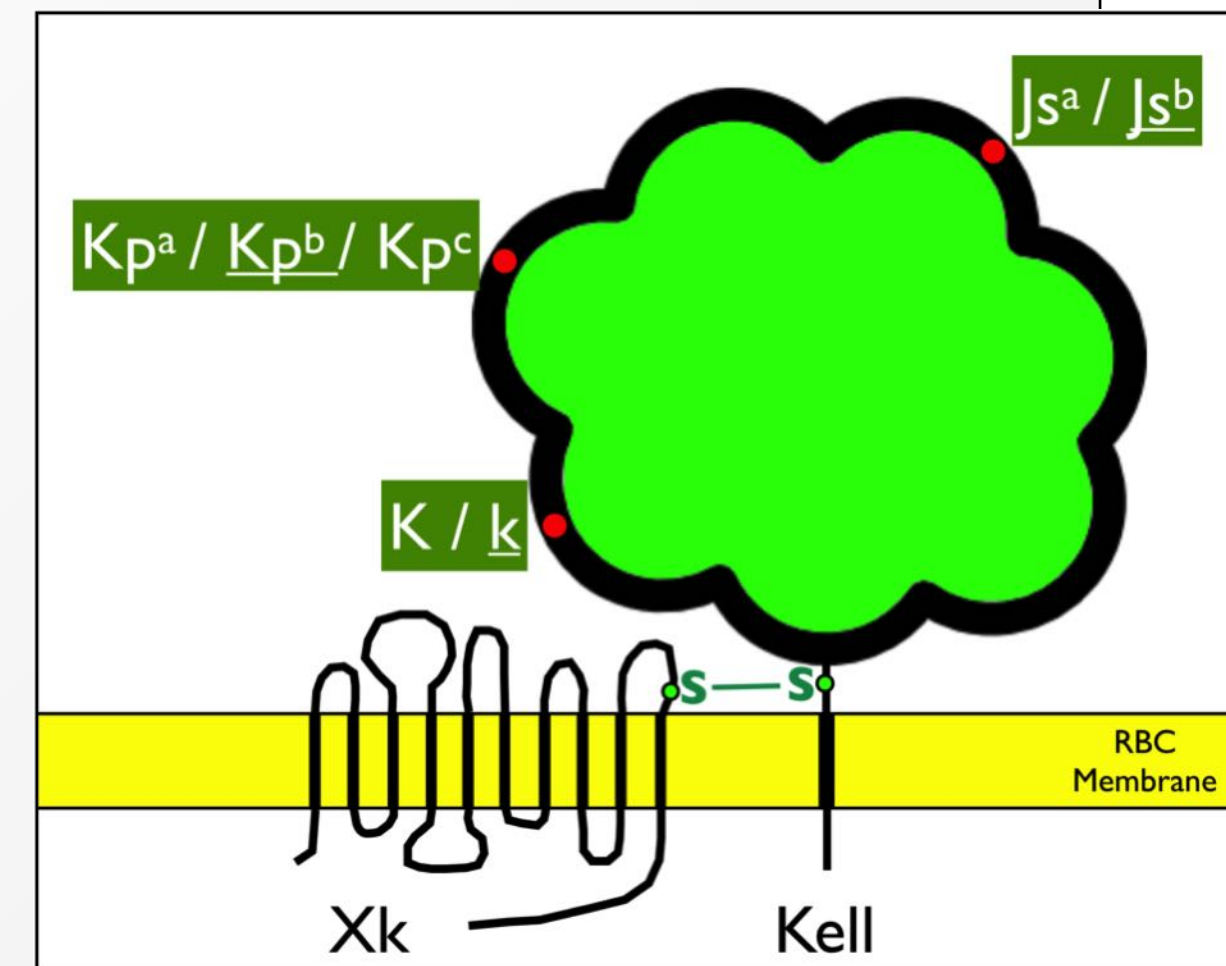
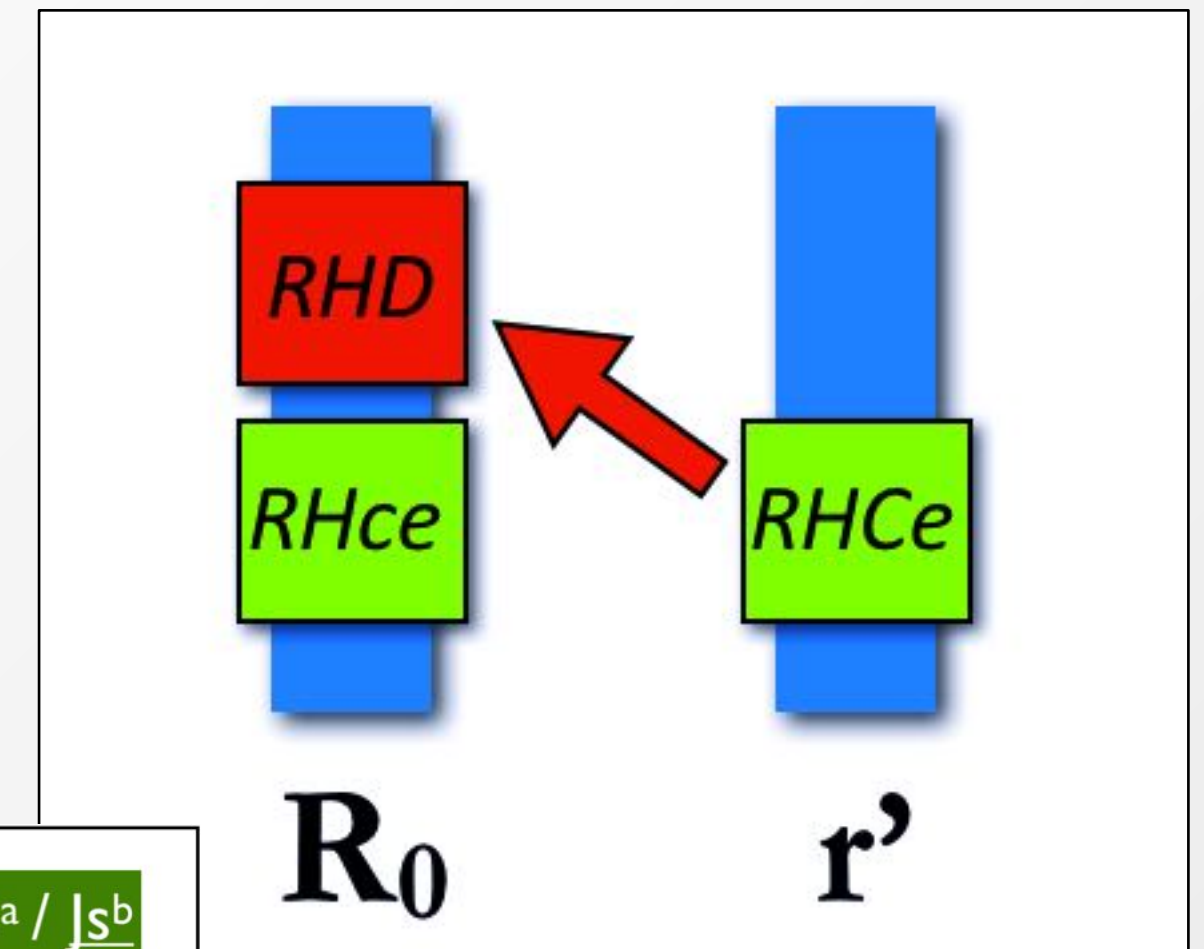
What to Expect





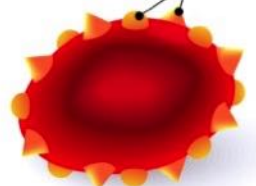




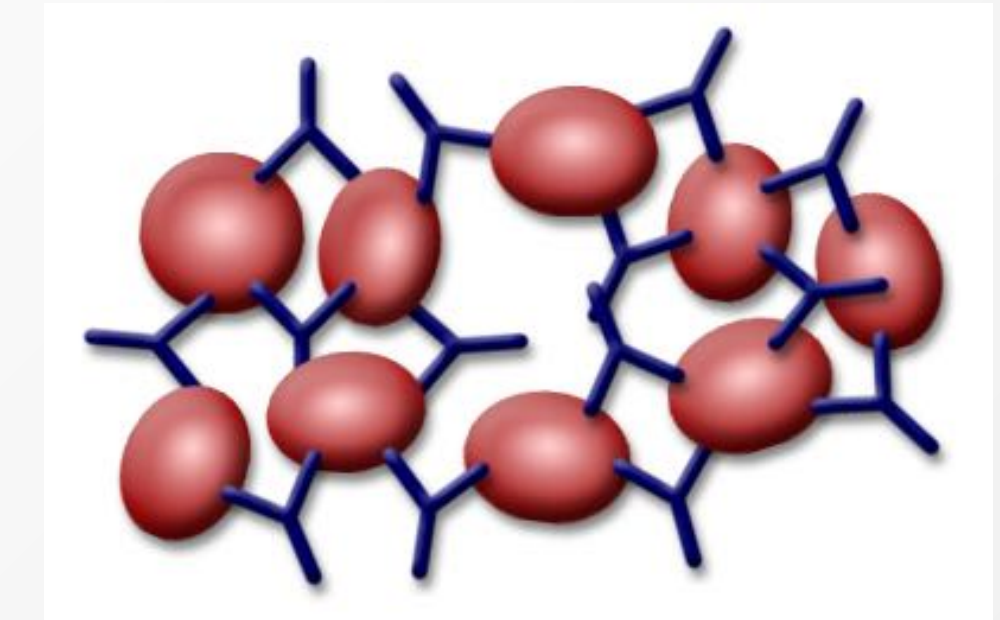
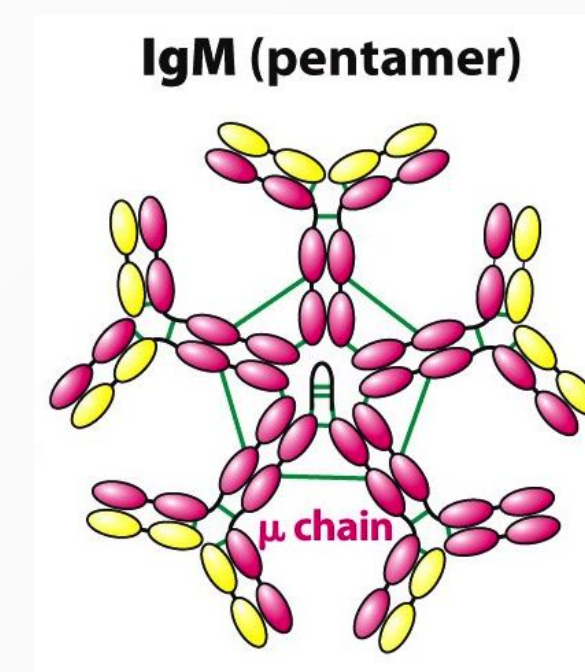
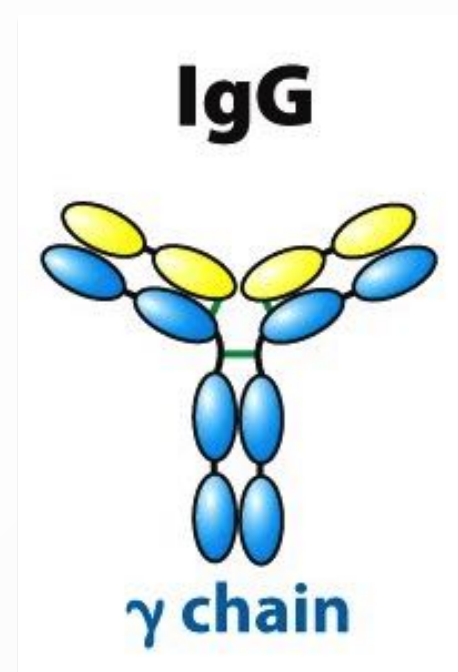
- Today: Immunohematology I
 - Materials at BBGuy.org/LLU
 - Password: LLUPathology
- 1/22: Immunohematology II (PT testing, Ab ID)
 - Interactive session!
- 2/5: Blood Products and Their Uses
- TBD: Transfusion Reactions

Immunohematology I

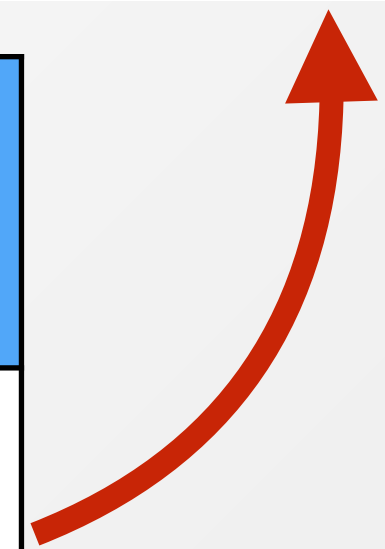
- Basic antigen-antibody testing
 - Basic tests
 - Principles to know
- Blood Groups



ABO blood group	
<p>Type A</p> <p>A-antigen</p>  <p>Plasma antibodies (Anti-B)</p> 	<p>Type B</p> <p>B-antigen</p>  <p>Plasma antibodies (Anti-A)</p> 
<p>Type AB</p> <p>A and B antigens</p>  <p>Plasma antibodies (none)</p>	<p>Type O</p> <p>No antigens</p>  <p>Anti-A and Anti-B</p> 



Best at body temp (“warm”)	Best below body temp (“cold”)
Coats RBCs	Agglutinates/lyses RBCs
Pregnancy, transfusion	“Naturally occurring”
Crosses placenta (HDFN)	Does not cross placenta (no HDFN)
<u>Protein</u> -rich antigens	<u>Carbohydrate</u> -rich antigens



Basic Reactions



Tube



Solid phase



**Gel
(column agglutination)**

4+ → 0

Three "Phases":

Immediate Spin

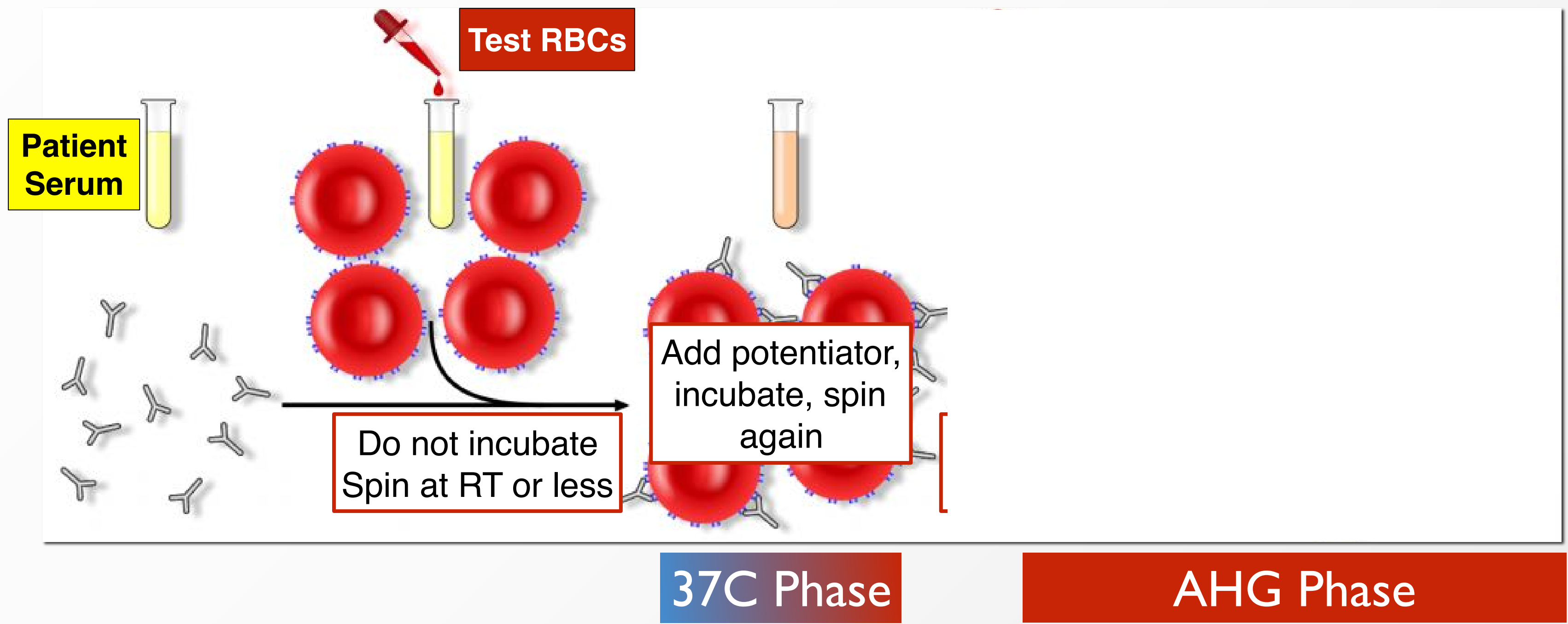
37C Phase

AHG Phase

Tube Testing



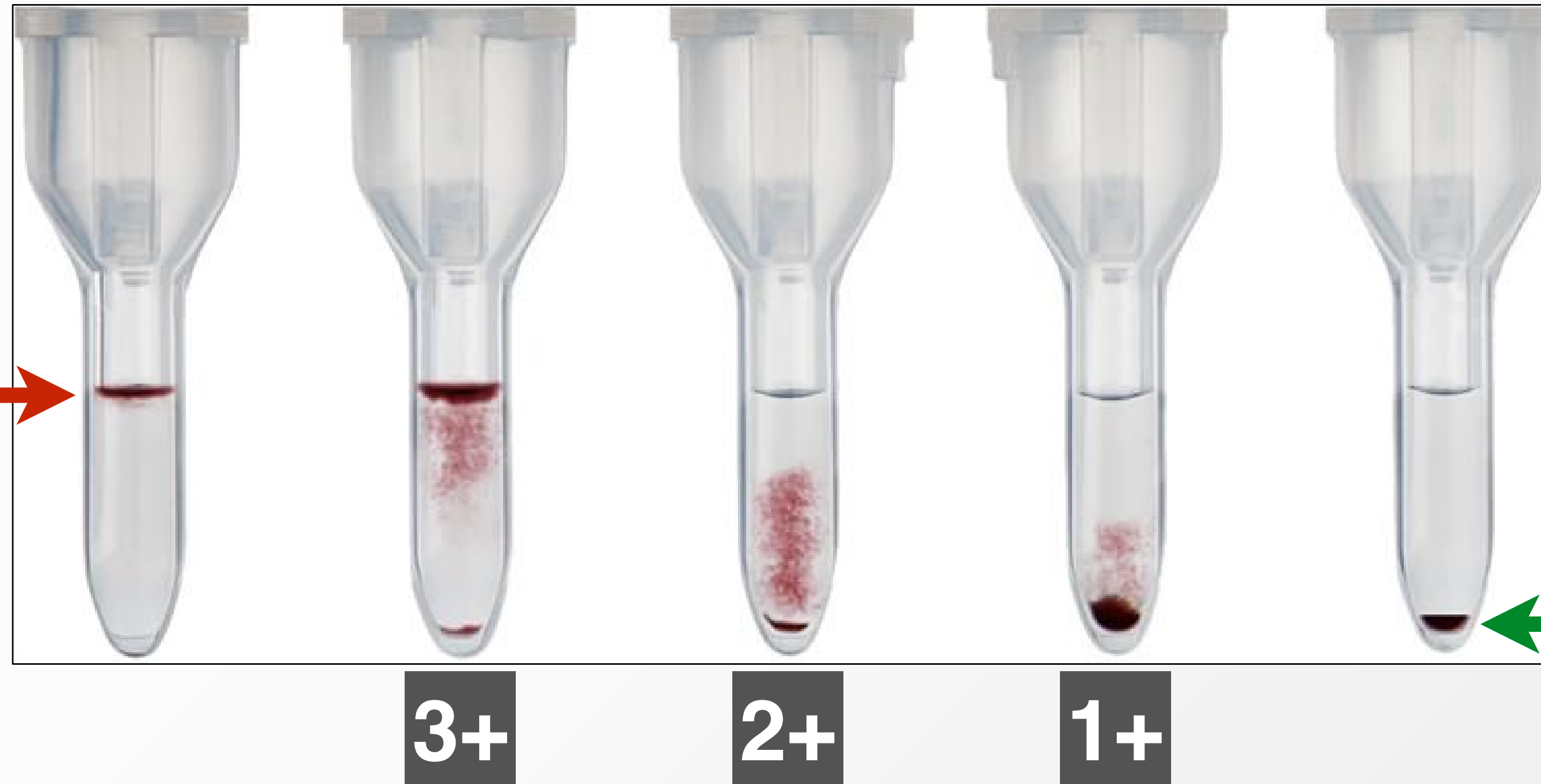
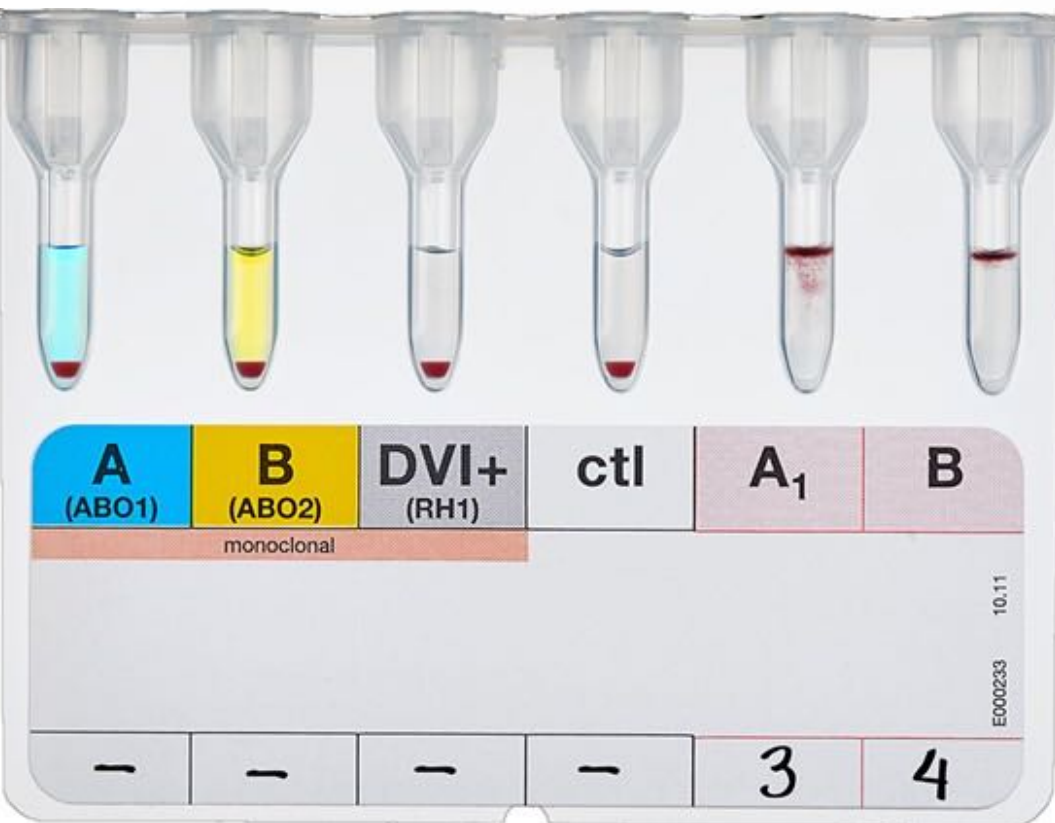
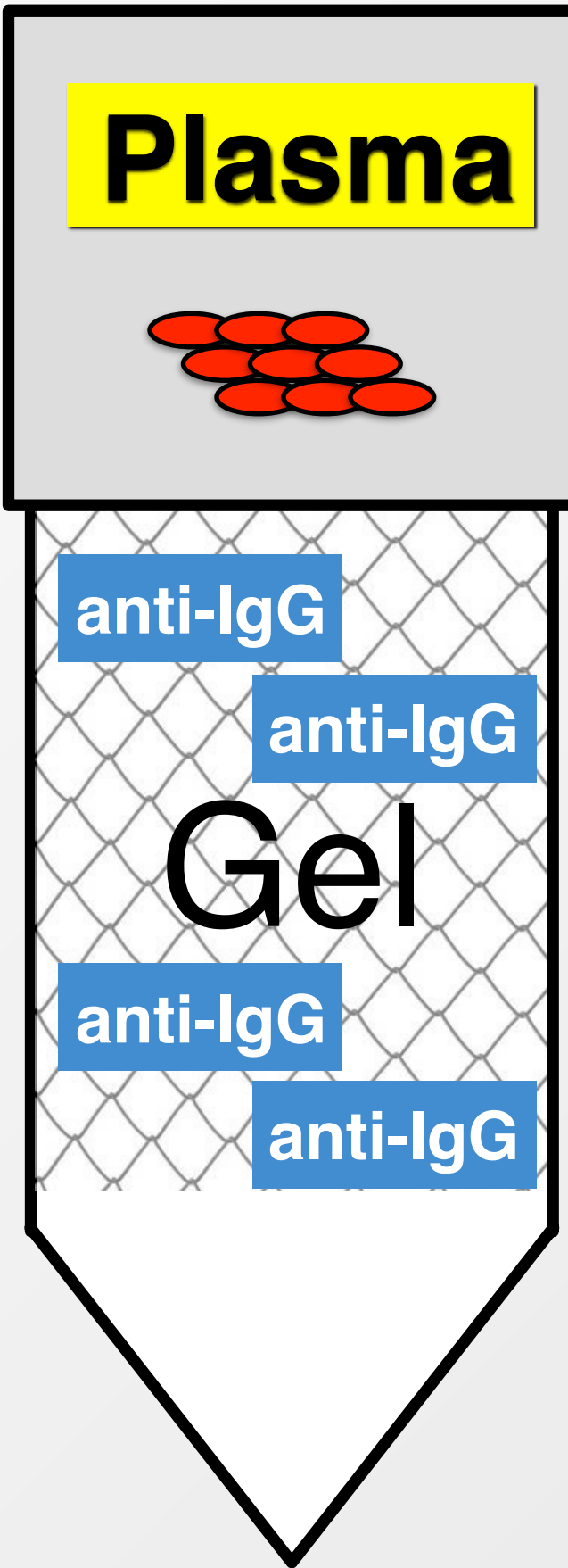
Immediate Spin Phase



Lewis			Results		
Le ^a	Le ^b	Cell	IS	37	AHG
0	+	1	0	1+	3+
0	+	2	0	1+	3+
0	0	3	0	1+	3+
0	0	4	0	1+	3+
+	0	5	0	0	0 ✓
+	0	6	0	0	0 ✓
0	+	7	0	0	0 ✓
+	0	8	0	0	0 ✓
0	+	9	0	0	0 ✓
+	0	10	0	0	0 ✓
0	+	11	0	1+	3+
		AC			

Gel Testing

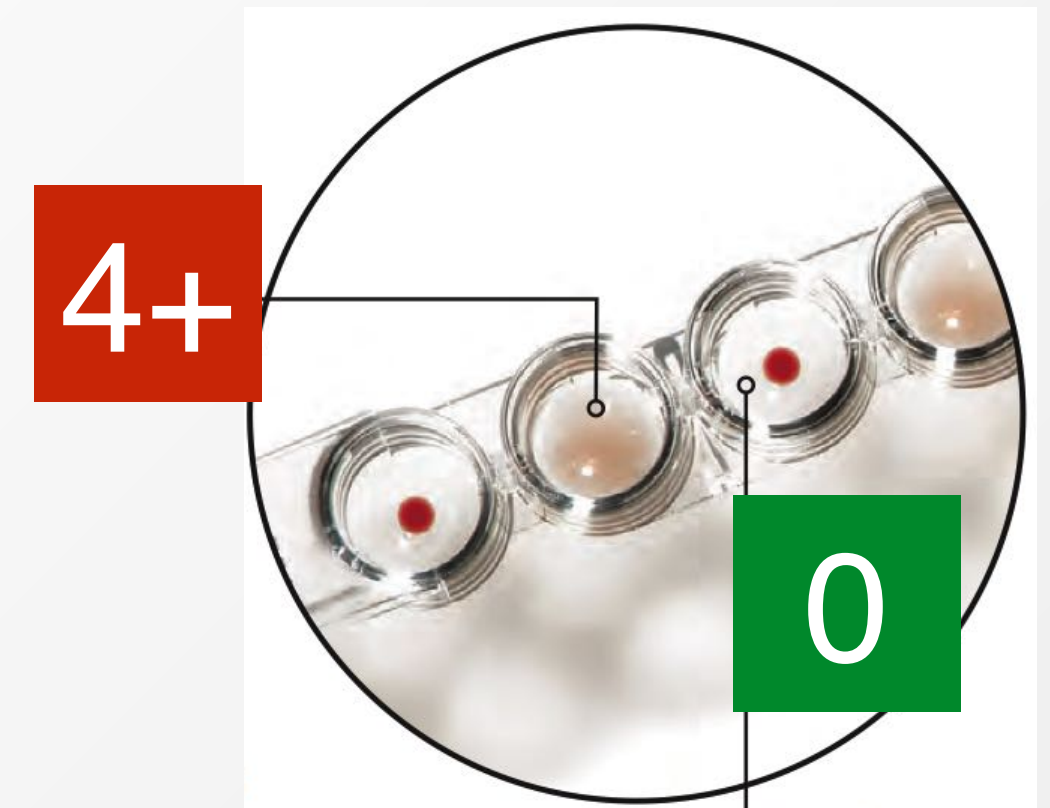
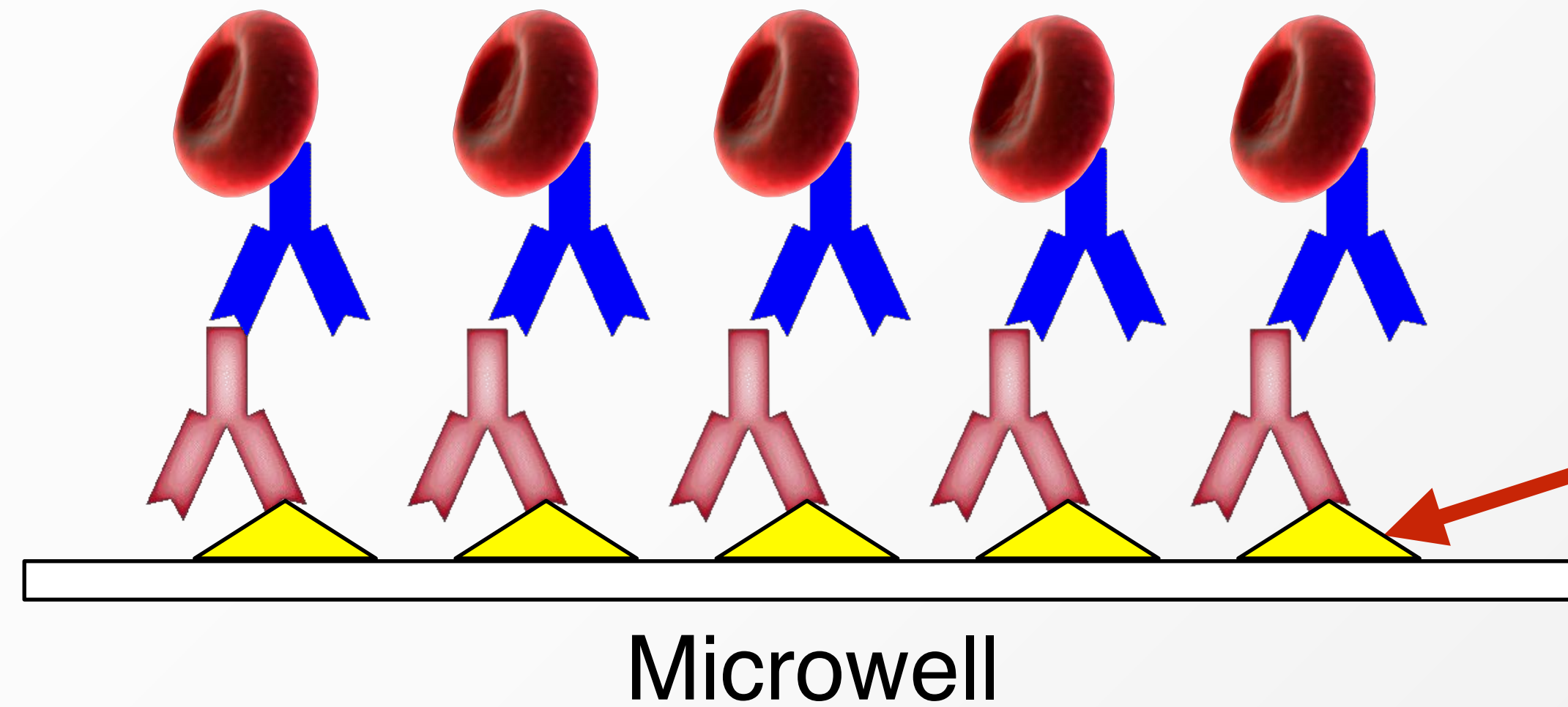
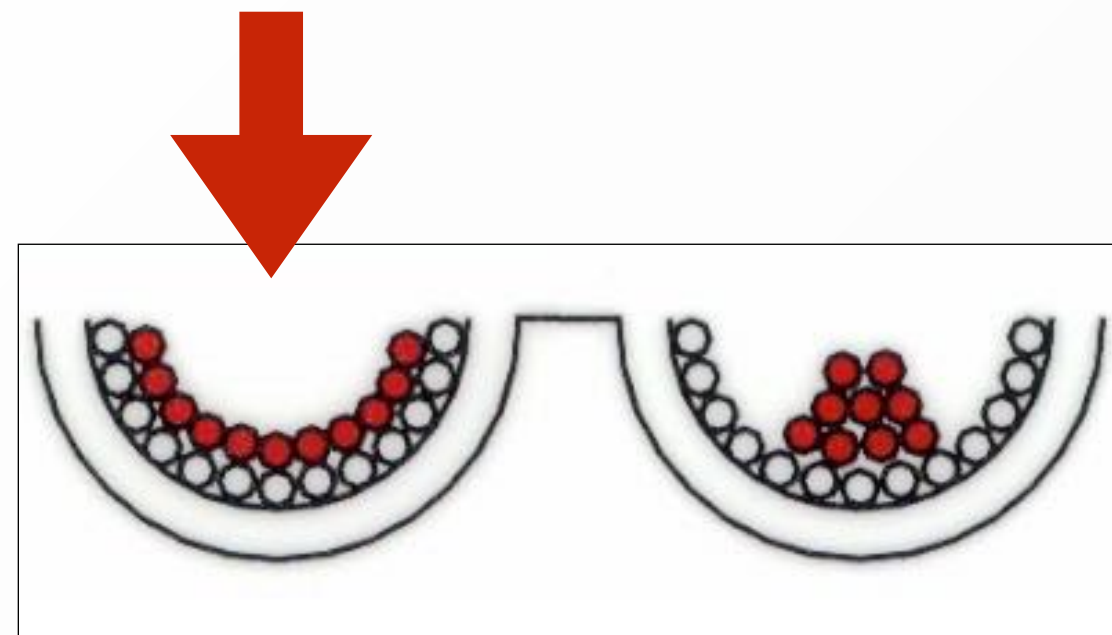
Incubate
& Spin



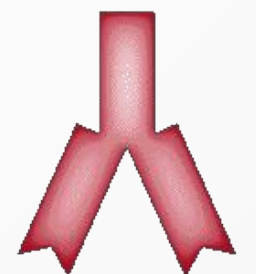
Negative

Images Courtesy of Bio-Rad

Solid Phase Testing



Lysed RBC antigens


Patient antibody

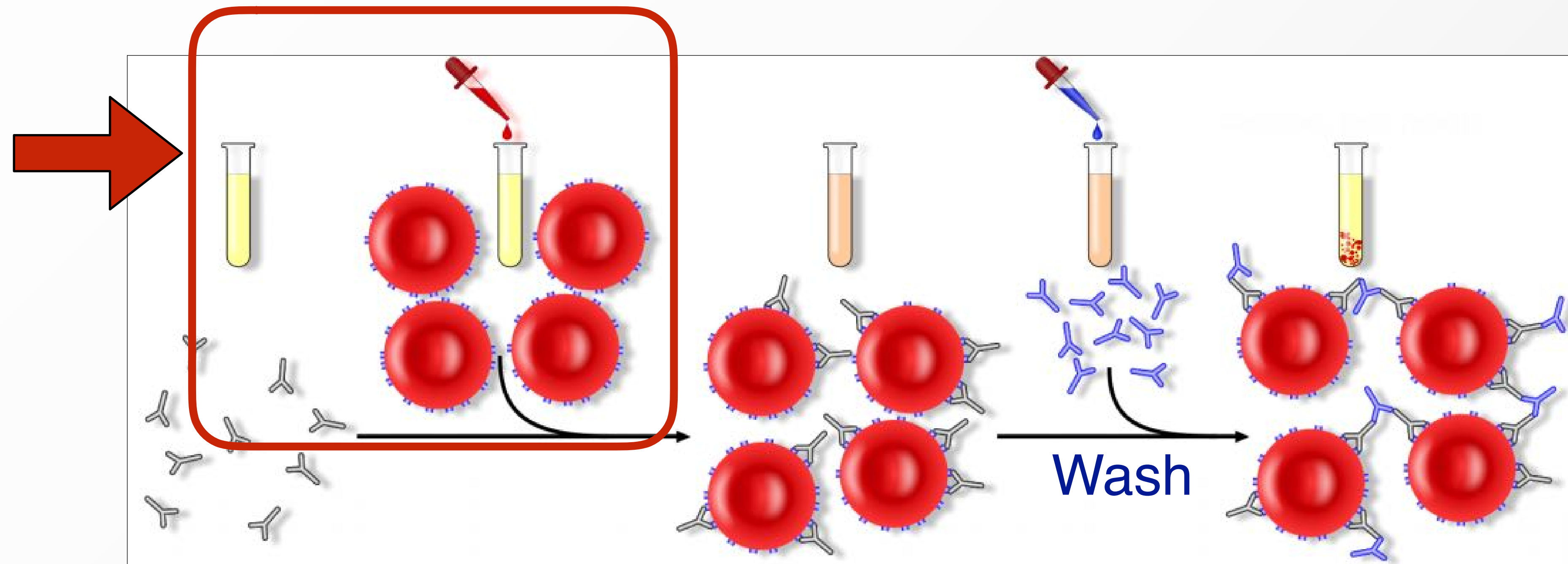

Indicator RBC
with anti-IgG

Image: Courtesy of Immucor

Solid Phase Testing



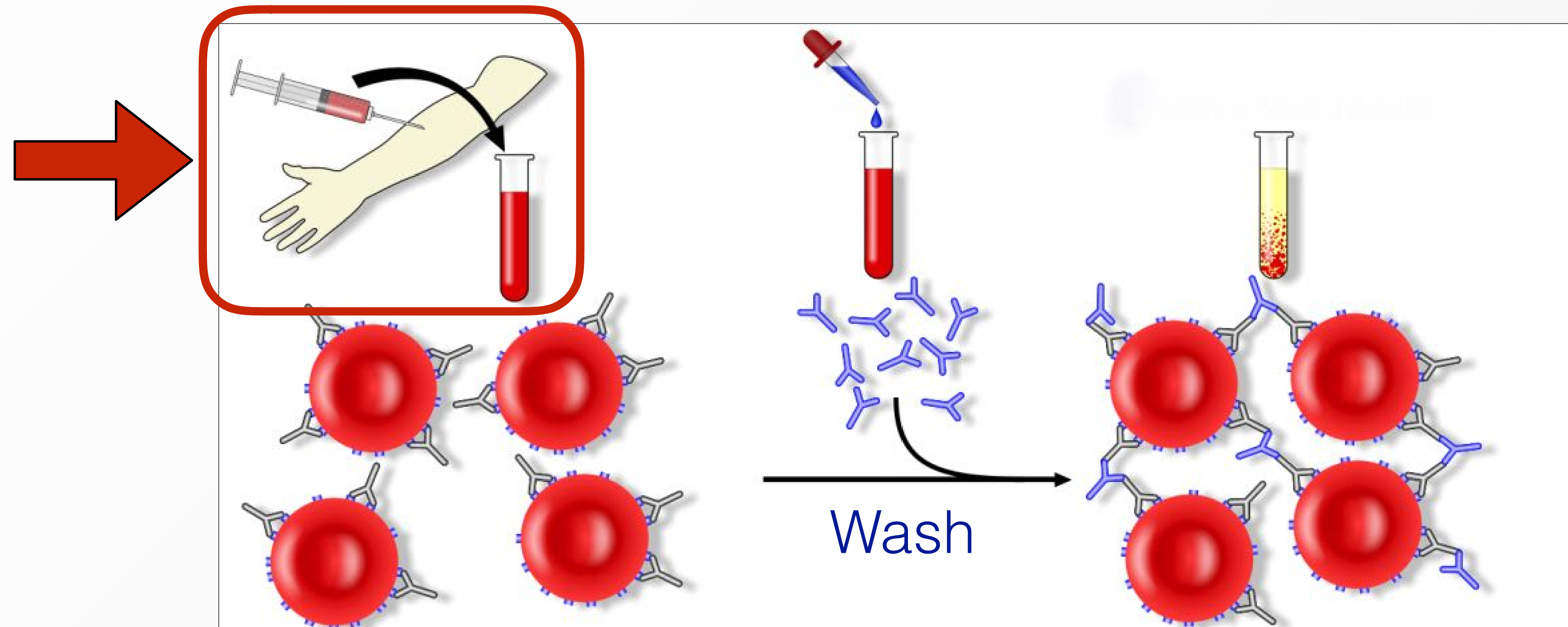
Indirect Antiglobulin Test



IAT: Antibody coating happens in test system

Image credit: Wikipedia Commons, A. Rad, 2006

Direct Antiglobulin Test



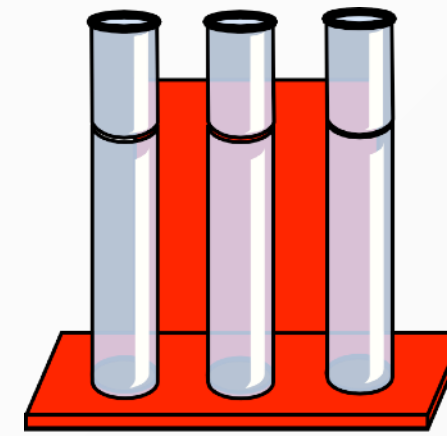
IAT: Antibody coating happens in test system

DAT: Antibody coating happens in the body

Image credit: Wikipedia Commons, A. Rad, 2006

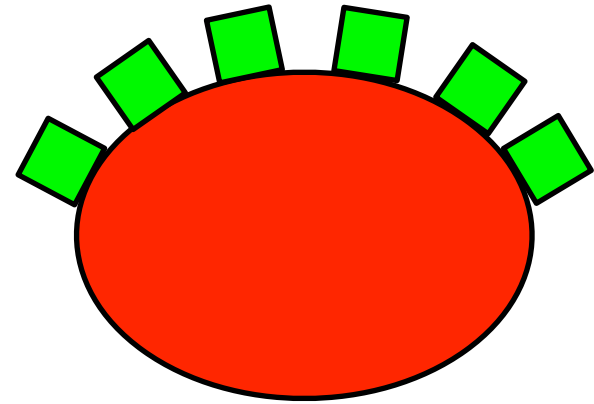
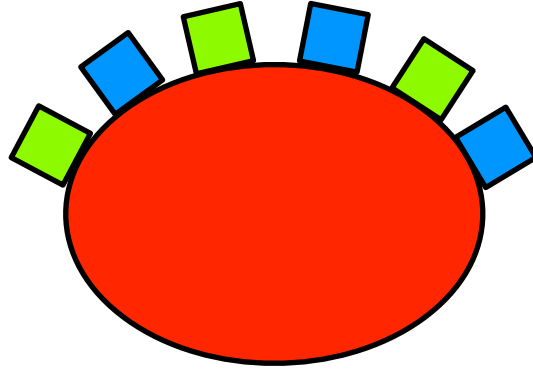
Types of Antiglobulin

- **Anti-IgG, -C3d** →
 - "Polyspecific"
- **Anti-IgG** →
- **Anti-C3d**
 - IgM hemolysis, CAD



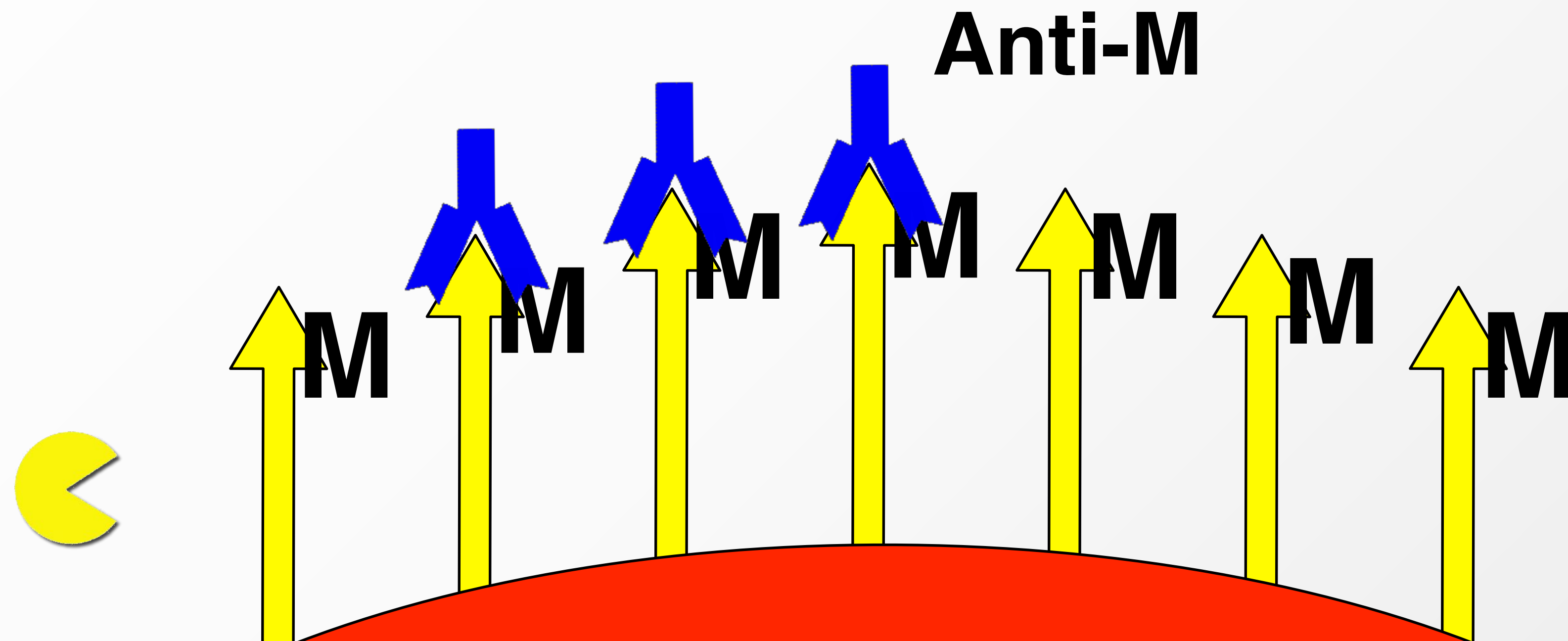
Dosage

**Kidd
Duffy
Rh**

Antibody	RBCs	Reaction
Anti-Fy ^a	Fy(a+b-) 	3+
Anti-Fy ^a	Fy(a+b+) 	0-1+

Proteolytic Enzymes

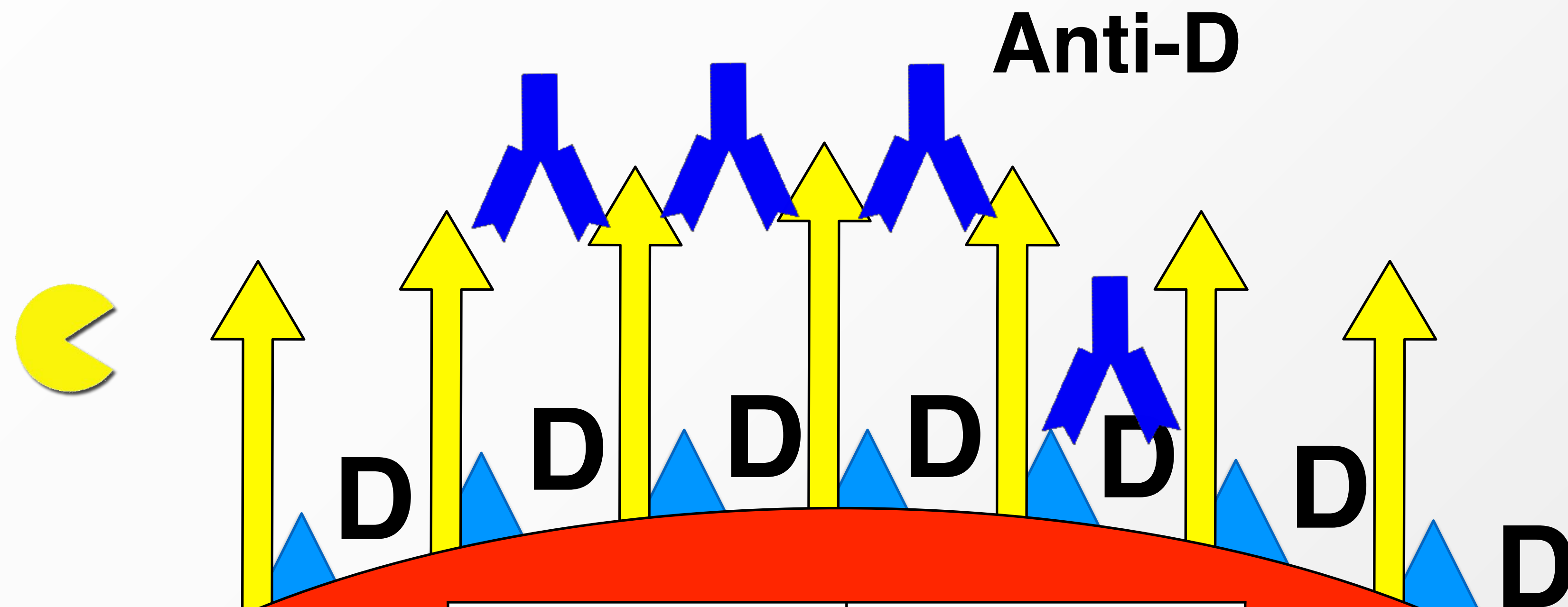
Papain/ficin/bromelain cleave proteins



Anti-M vs M+ (pre)	Anti-M vs M+ (post)
3+	0-1+

Proteolytic Enzymes

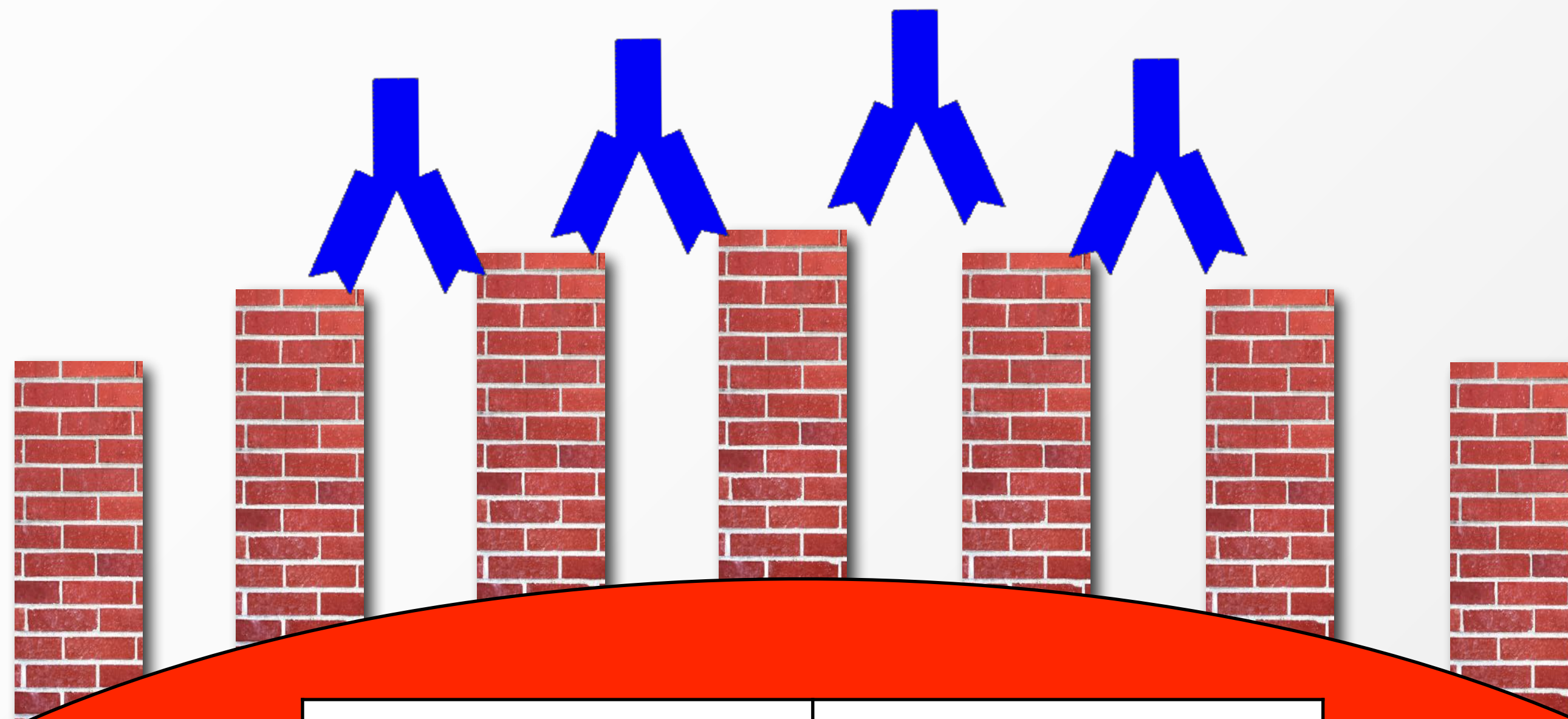
Papain/ficin/bromelain cleave proteins



Anti-D vs D+ (pre)	Anti-D vs D+ (post)
2+	4+

Proteolytic Enzymes

Papain/ficin/bromelain cleave proteins



Anti-K vs K+ (pre)	Anti-K vs K+ (post)
3+	3+

Table of blood group antigens v.8.1_181111

System		Antigen number		
		001	002	003
001	ABO	A	B	A,B
002	MNS	M	N	S
003	P1PK	P1	...	p ^k
004	RH	D	C	E
005	LU	Lu ^a	Lu ^b	Lu3
006	KEL	K	k	Kp ^a
007	LE	Le ^a	Le ^b	Le ^{ab}
008	FY	Fy ^a	Fy ^b	Fy3
009	JK	Jk ^a	Jk ^b	Jk3
010	DI	Di ^a	Di ^b	Wr ^a
011	YT	Yt ^a	Yt ^b	YTEG
012	XG	Xg ^a	CD99	
013	SC	Sc1	Sc2	Sc3
014	DO	Do ^a	Do ^b	Gy ^a
015	CO	Co ^a	Co ^b	Co3
016	LW
017	CH/RG	Ch1	Ch2	Ch3
018	H	H		
019	XK	Kx		


Table of blood group antigens v.8.1_181111

System		Antigen number												Total in system
		001	002	003	004	005	006	007	008	009	010	011	012	
020	GE							An ^a	Dh ^a	GEIS	GEPL	GEAT	GETI	11
021	CROM							IFC	WES ^a	WES ^b	UMC	GUTI	SERF	20
022	KN							SI2	SI3	KCAM				9
023	IN													6
024	OK													3
025	RAPH													1
026	JMH													6
027	I													1
028	GLOB													2
029	GIL													1
030	RHAG													3
031	FORS													1
032	JR													1
033	LAN													1
034	VEL													1
035	CD59													1
036	AUG													4



Source: International Society for Blood Transfusion (ISBT); Accessed Jan 2019

Enzyme Classification

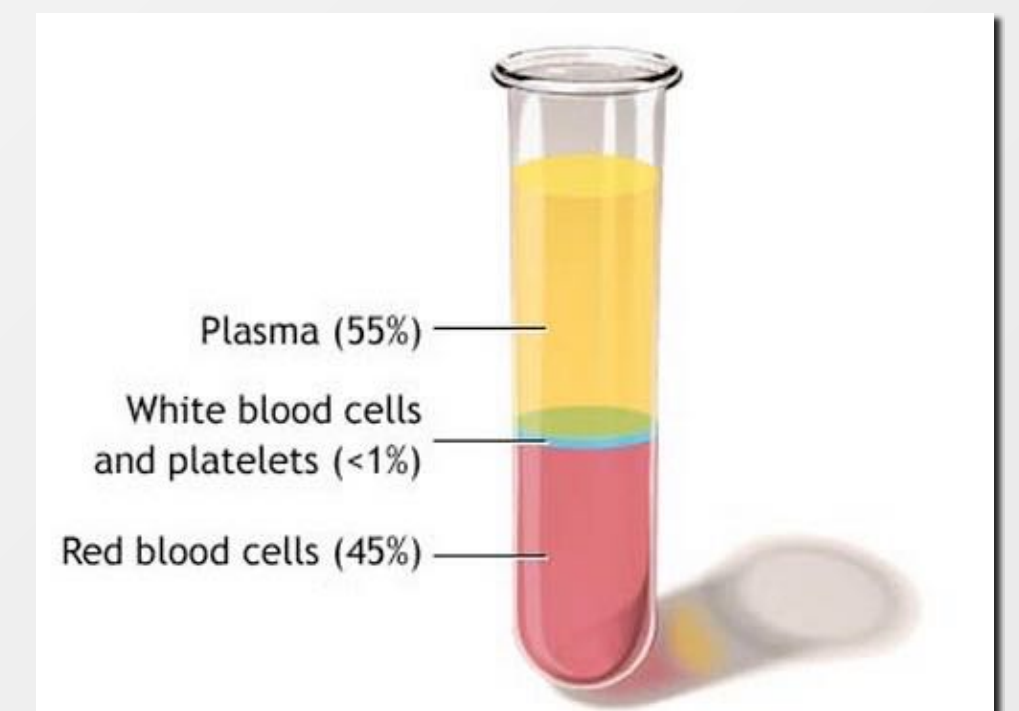
Enhanced	Decreased	Unaffected
<p data-bbox="509 793 1069 874">ABO-related</p> <ul data-bbox="559 906 1152 1333" style="list-style-type: none"><li data-bbox="559 906 902 986">-ABO/H<li data-bbox="559 1018 869 1099">-Lewis<li data-bbox="559 1131 626 1211">-I<li data-bbox="559 1243 1152 1324">-P1PK/GLOB <p data-bbox="509 1365 1002 1446">Rh System</p> <p data-bbox="509 1478 1092 1558">Kidd System</p>	<p data-bbox="1386 962 1992 1174">MNS System Duffy System</p>	 <p data-bbox="2212 1136 2752 1217">Kell System</p>

ABO-related Systems

- Type 1 chains

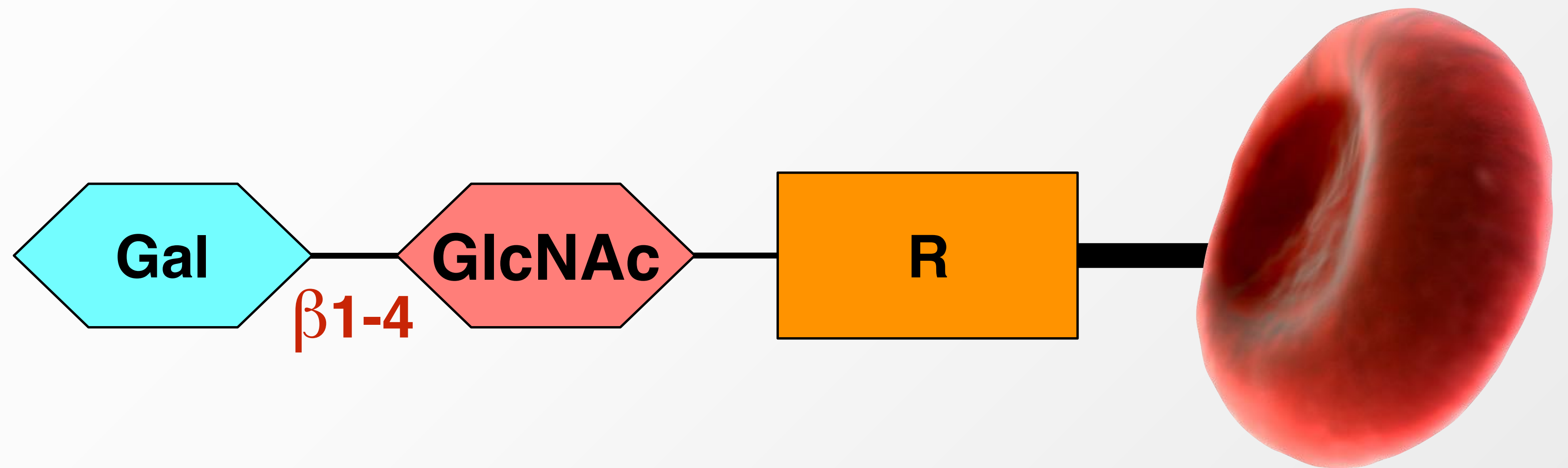


Secretions, primarily glycoprotein
Plasma, primarily glycolipid



ABO-related Systems

- Type 2 chains

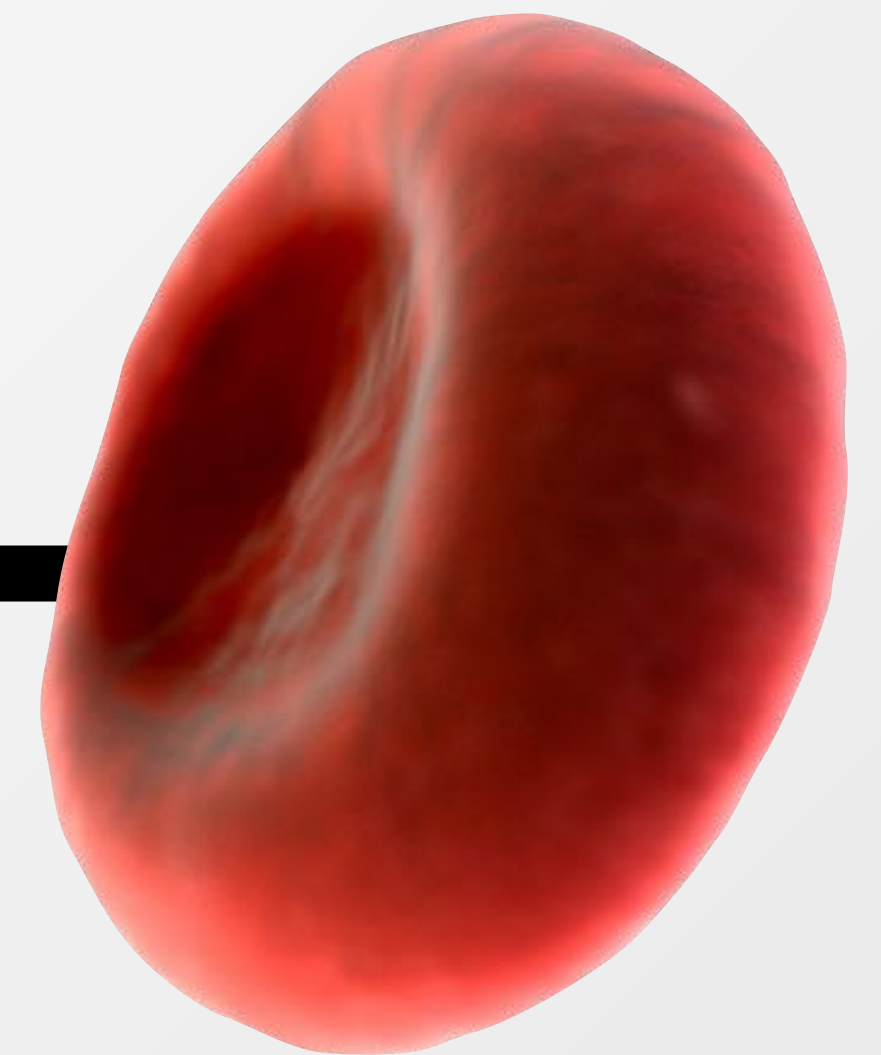
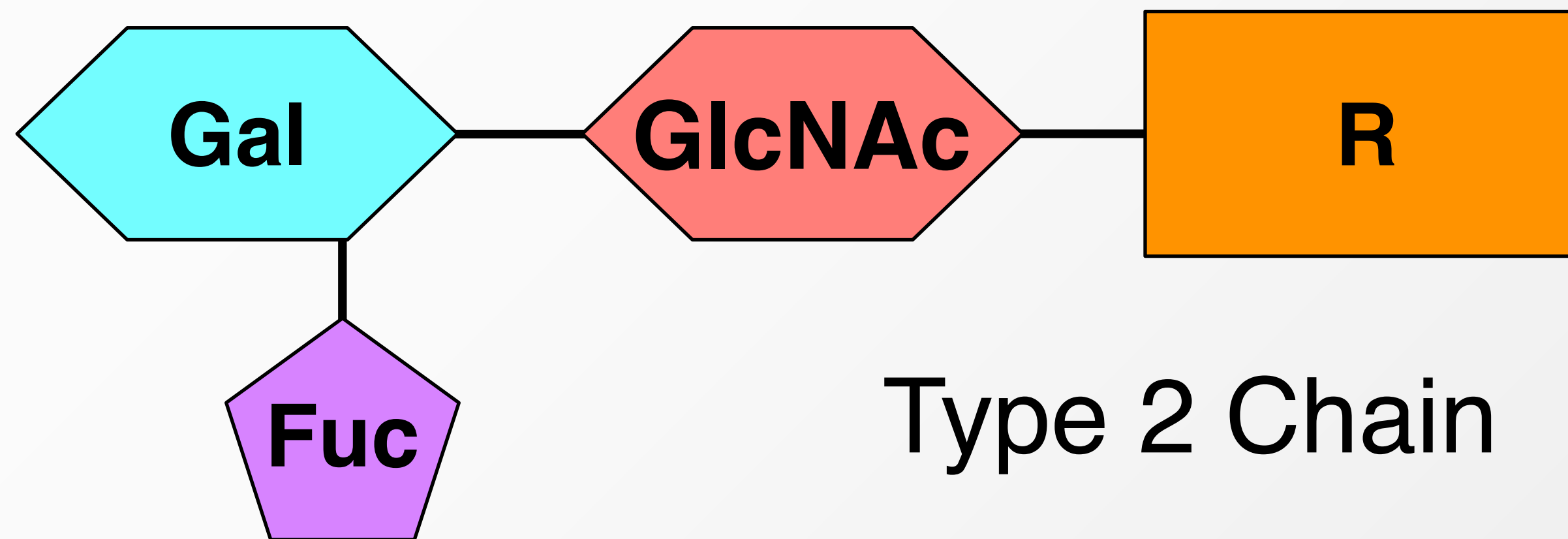


RBC Membranes, glycoprotein/glycolipid

H (FUT1)

- *H* and *h* alleles
- Fucosyltransferase enzyme
- Near 100% of us have at least one *H*

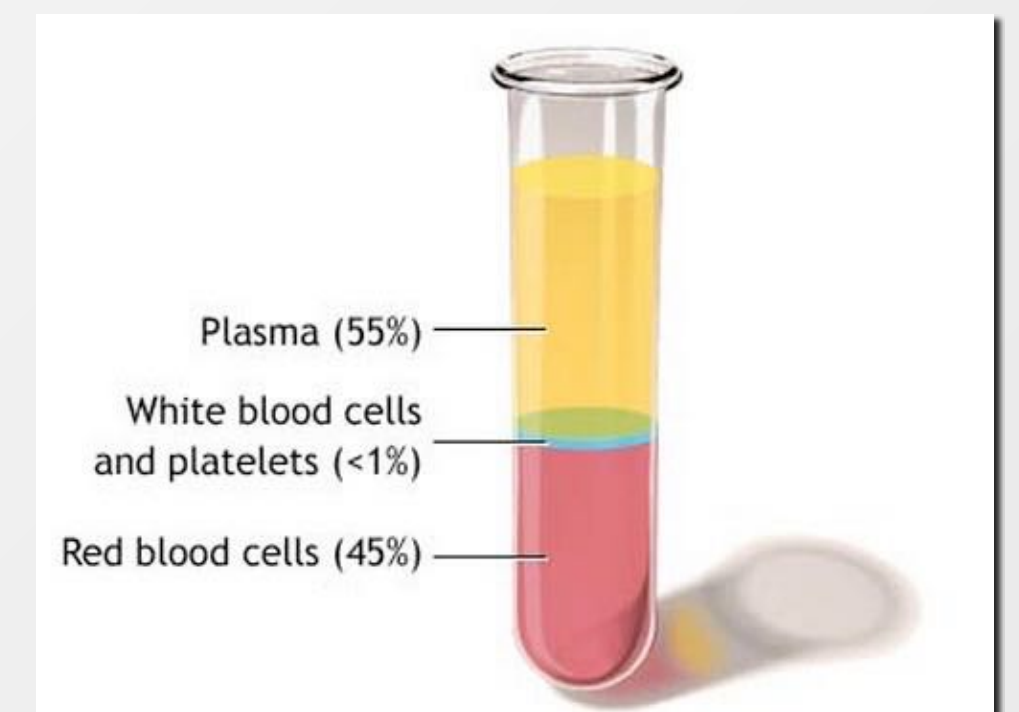
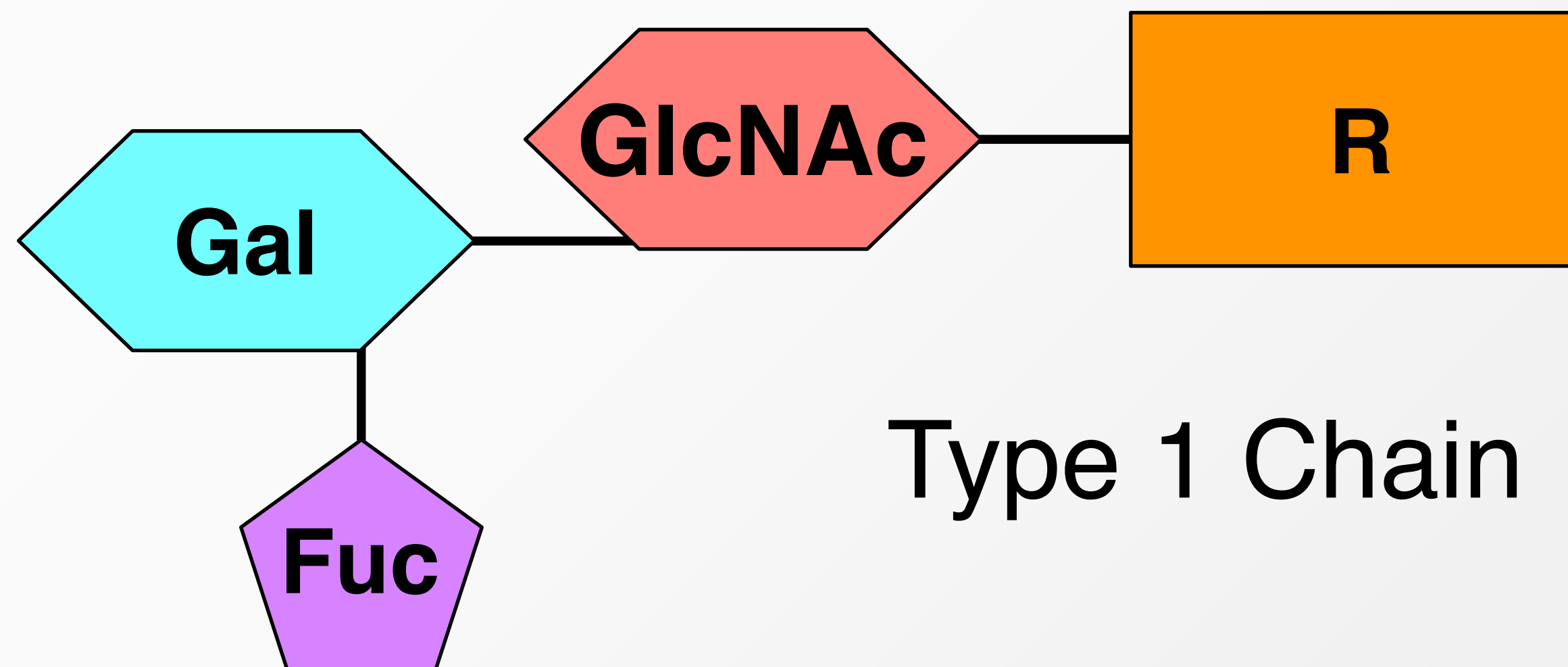
H antigen



Se (*FUT2*) - "Secretor"

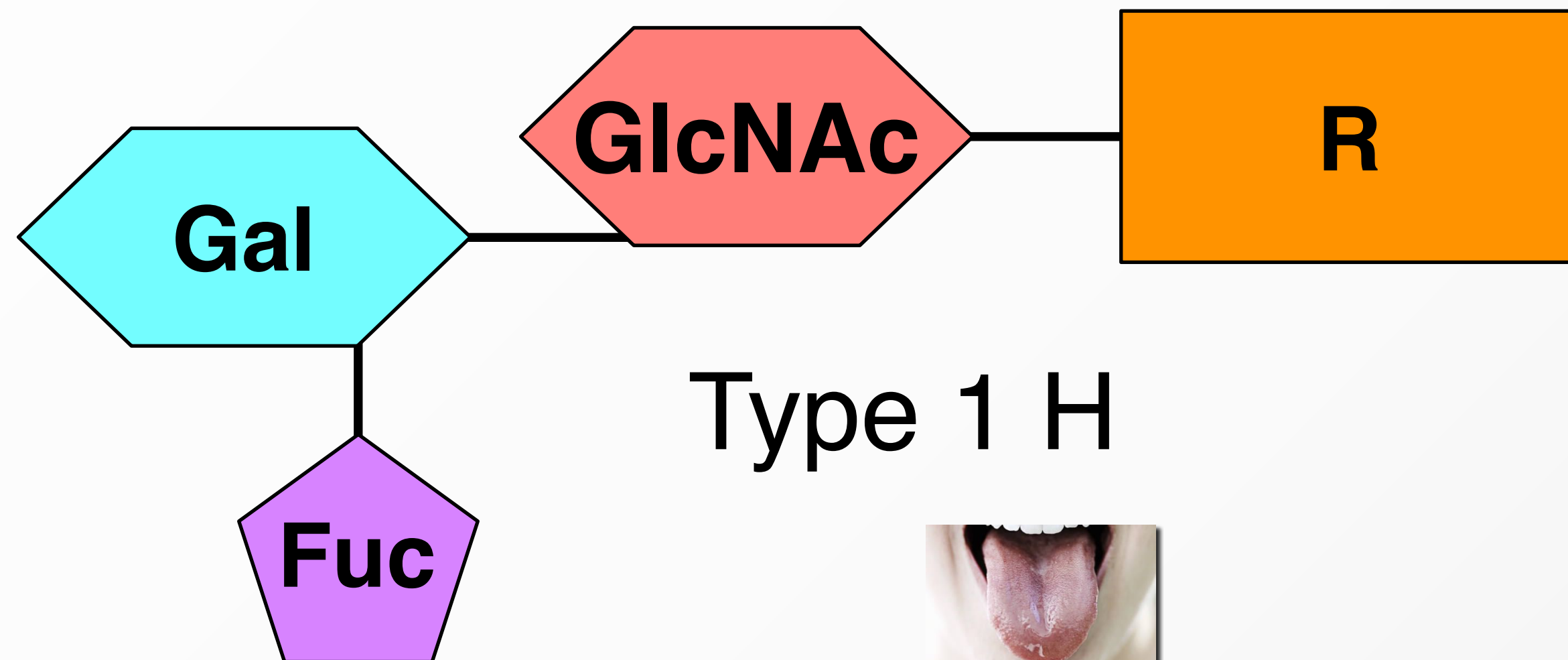
- *Se* and *se* alleles
- Fucosyltransferase enzyme
- 80% of us can make H in secretions

H antigen

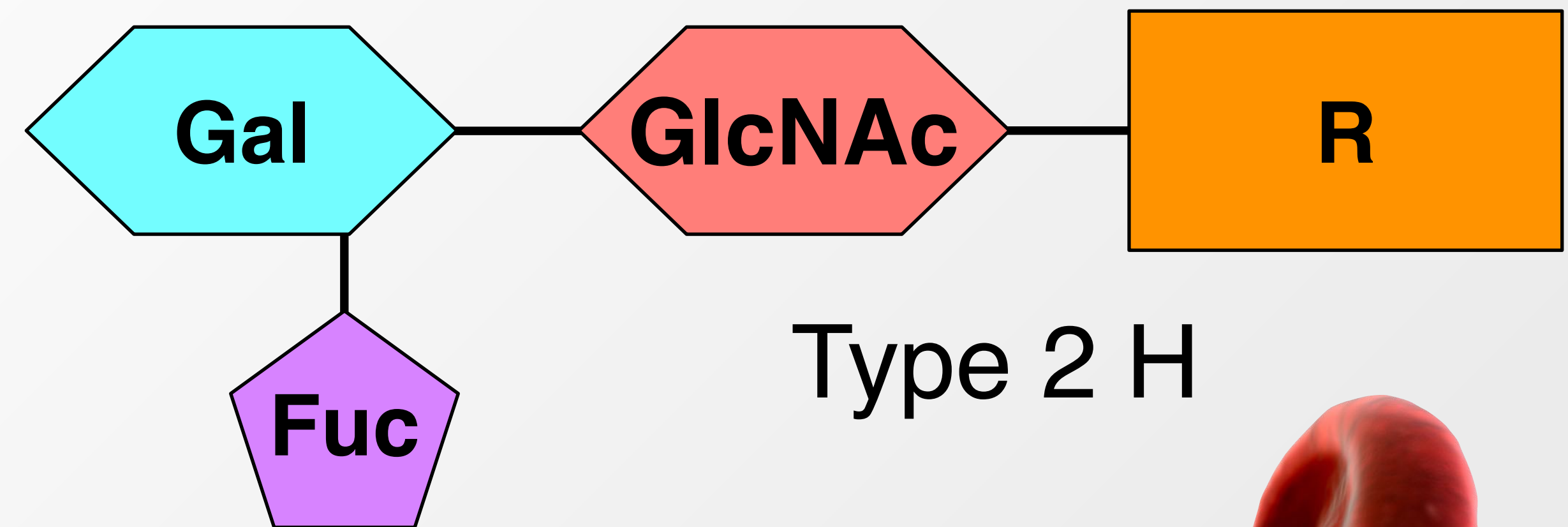
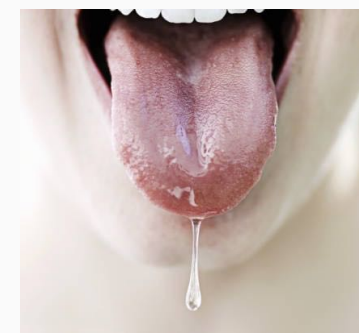


H Antigen

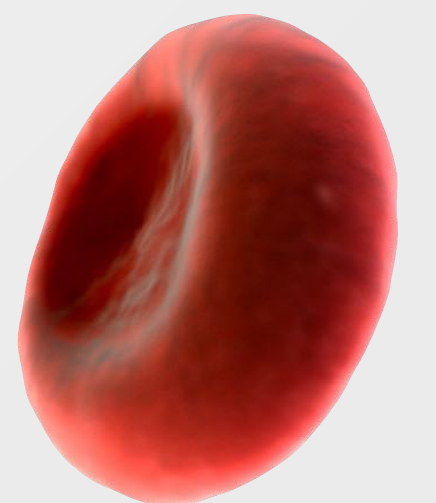
- Precursor to A or B - Just add sugar!



Type 1 H

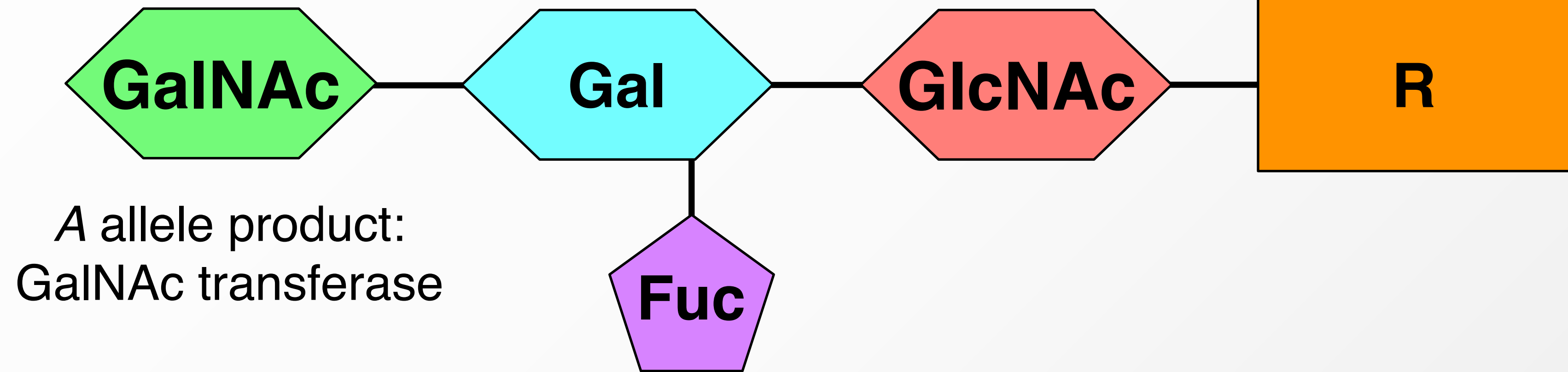


Type 2 H



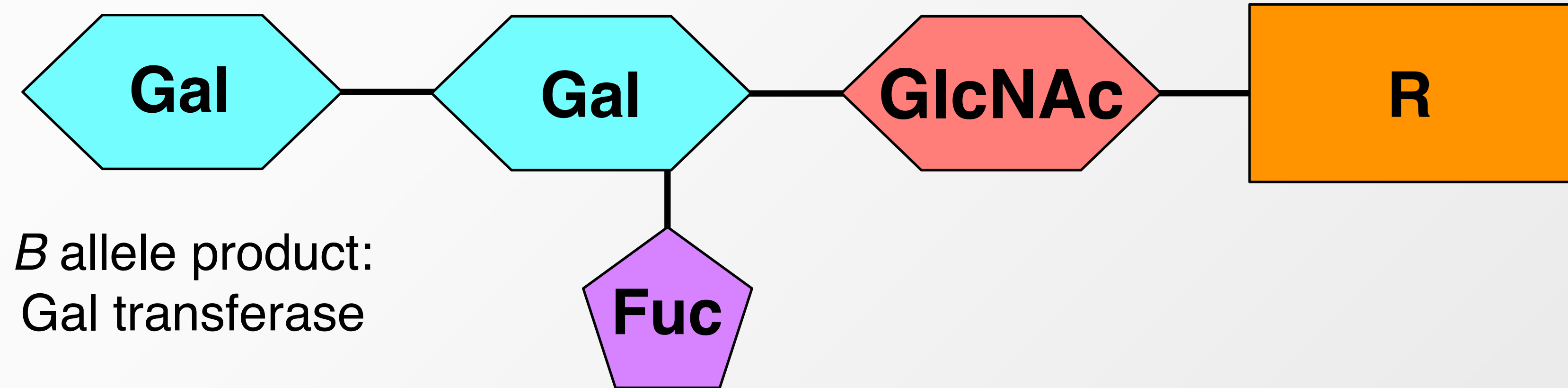
Blood Group A

A antigen



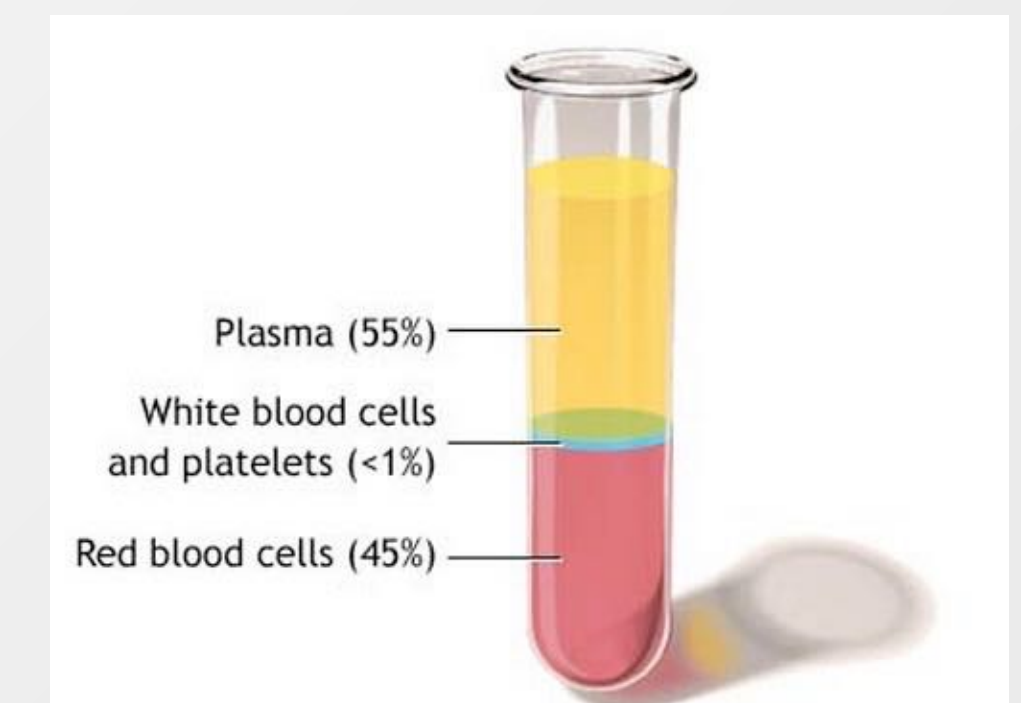
Blood Group B

B antigen



ABO Antigens

- Antigens start early (6 weeks EGA)
 - Still poorly formed at birth
 - Adult levels by age 4
- Antigens are not limited to RBCs
 - Platelets
 - Endothelial and epithelial cells
 - Lung, GI tract, heart, kidney, etc.
 - Plasma and secretions



ABO Antibodies

- Babies have only Mom's IgG
 - Best from Group O
- Production by 6 months of age
- Adult levels by age 10



“Landsteiner’s Law”

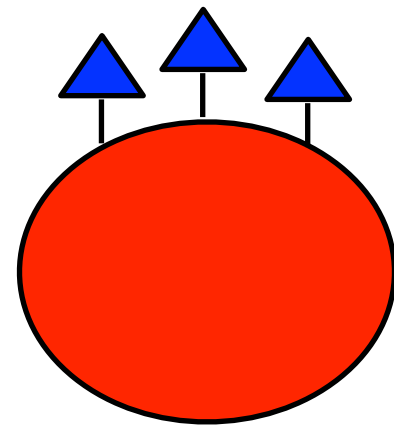
A

B

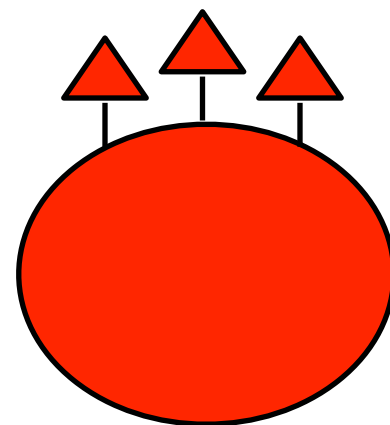
AB

O

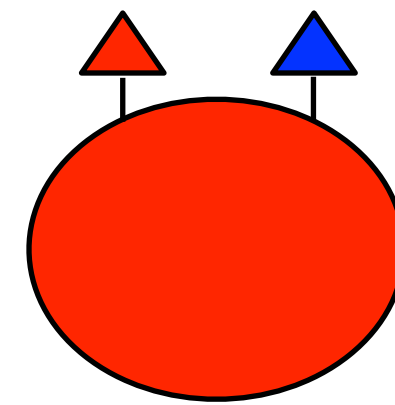
Antigens



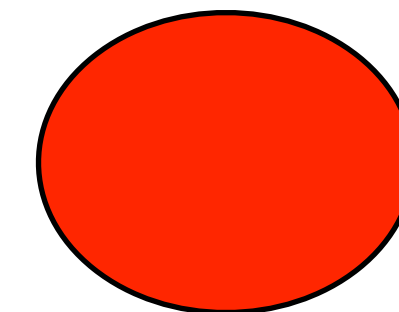
A antigen



B antigen

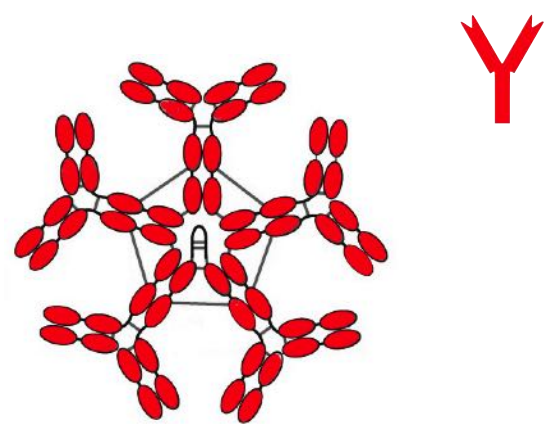


A, B antigens

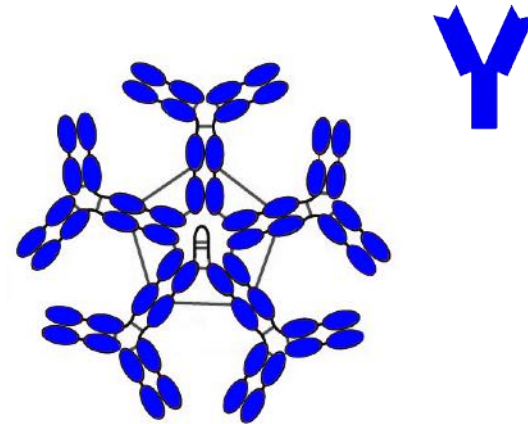


None

Antibodies

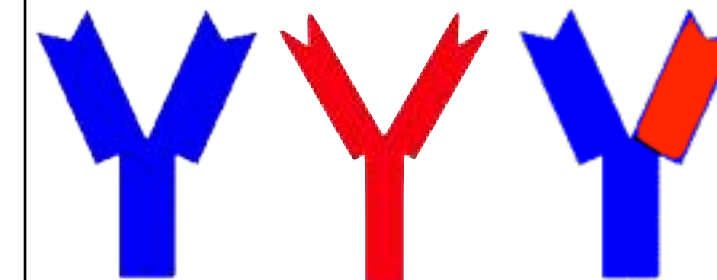


Anti-B



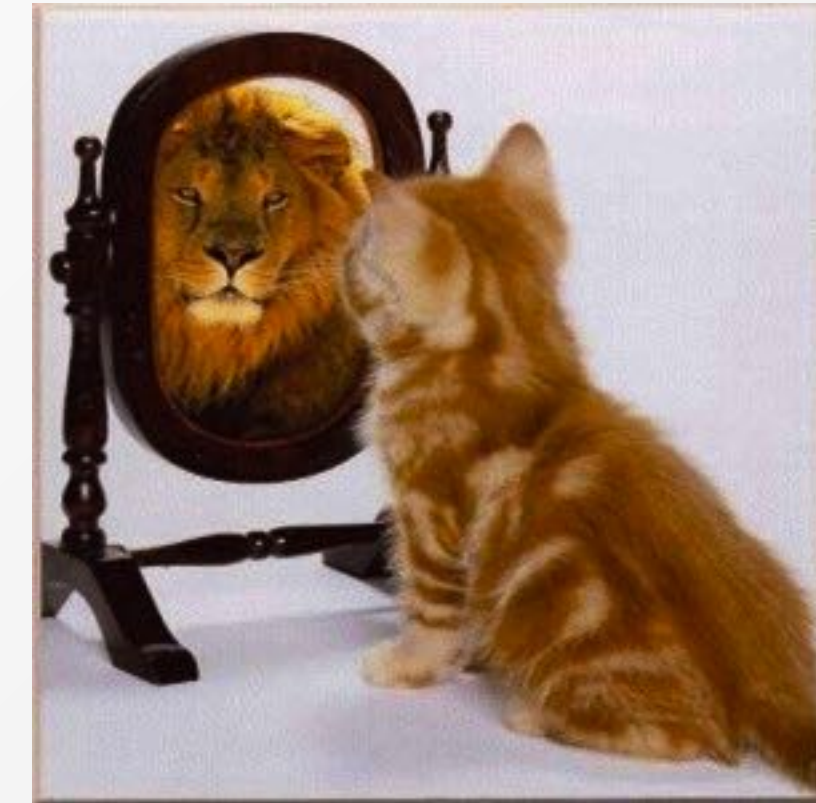
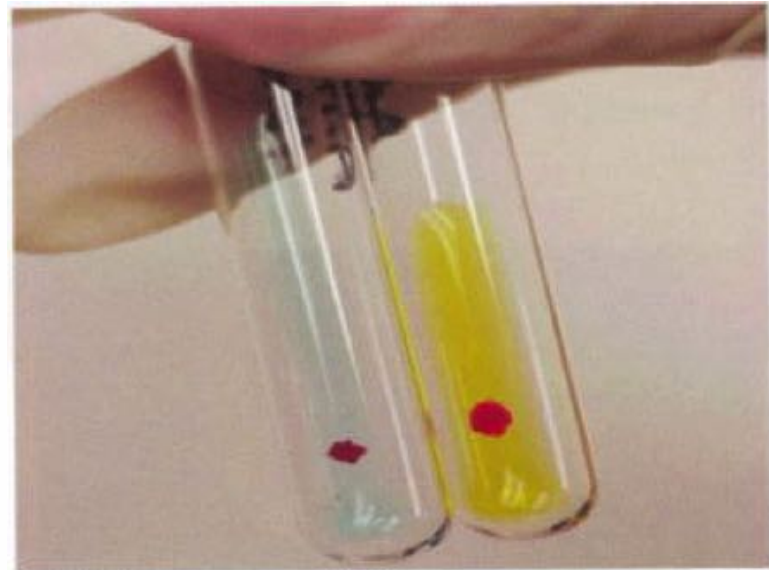
Anti-A

None



Anti-A
Anti-B
Anti-A,B

ABO Testing



Cell Group		Serum Group		ABO Interp.
Anti-A	Anti-B	A1 RBC	B RBC	
4+	0	0	4+	A
0	4+	4+	0	B
4+	4+	0	0	AB
0	0	4+	4+	O




Images: Harmening D "Modern Blood Banking & Transfusion Practices"

ABO Types by Race

Type	Whites	Blacks	Asians	Native Americans
O	45%	49%	40%	79%
A	40%	27%	28%	16%
B	11%	20%	27%	4%
AB	4%	4%	5%	<1%

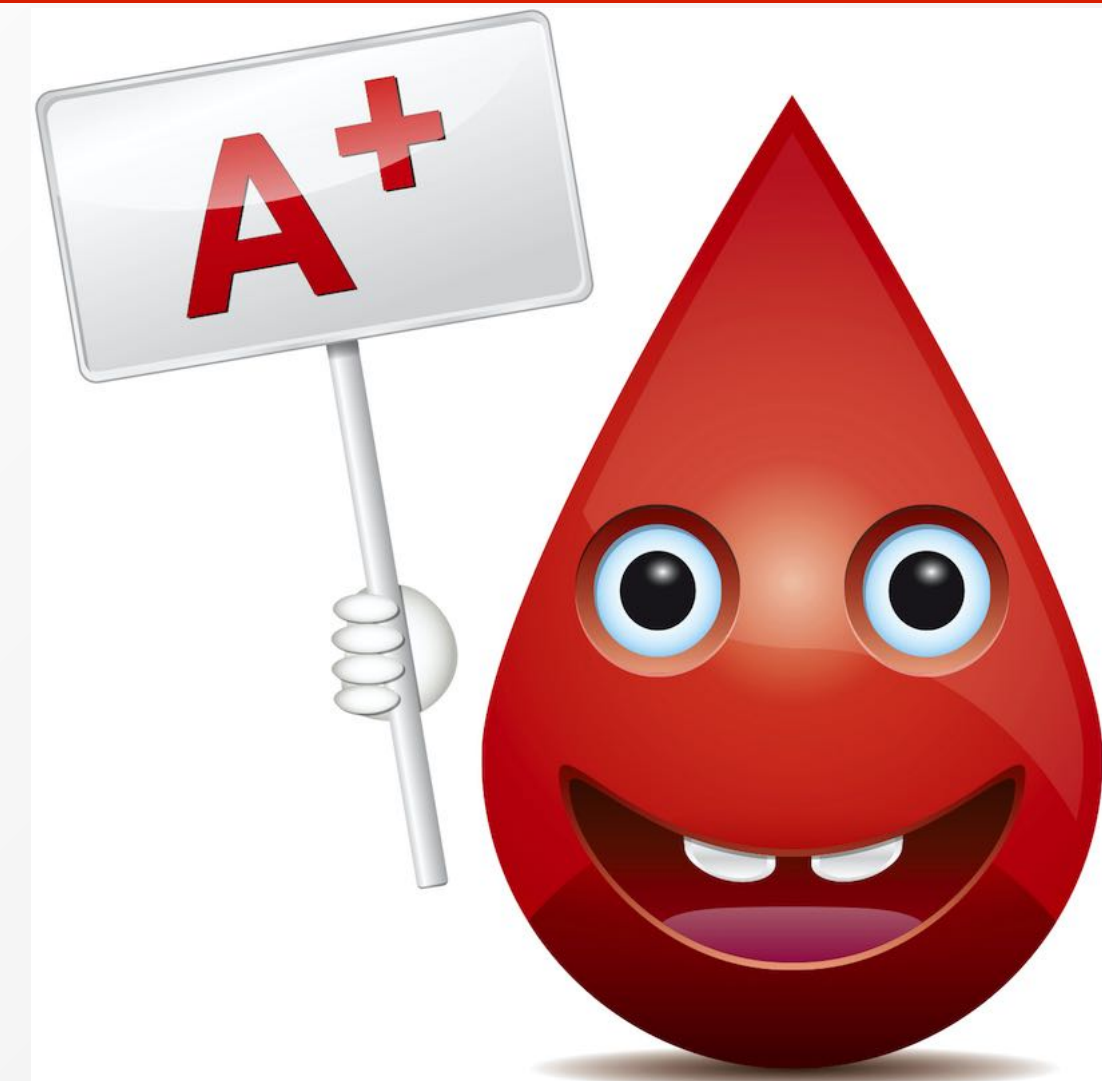
Group O

- Most common across racial lines
- Antigen = H
 - *Ulex europaeus* lectin
- 3 mostly IgG antibodies = anti-A, anti-B, anti-A,B
 - Most common form of HDFN 
 - Antibodies tend to be stronger than grp A or B



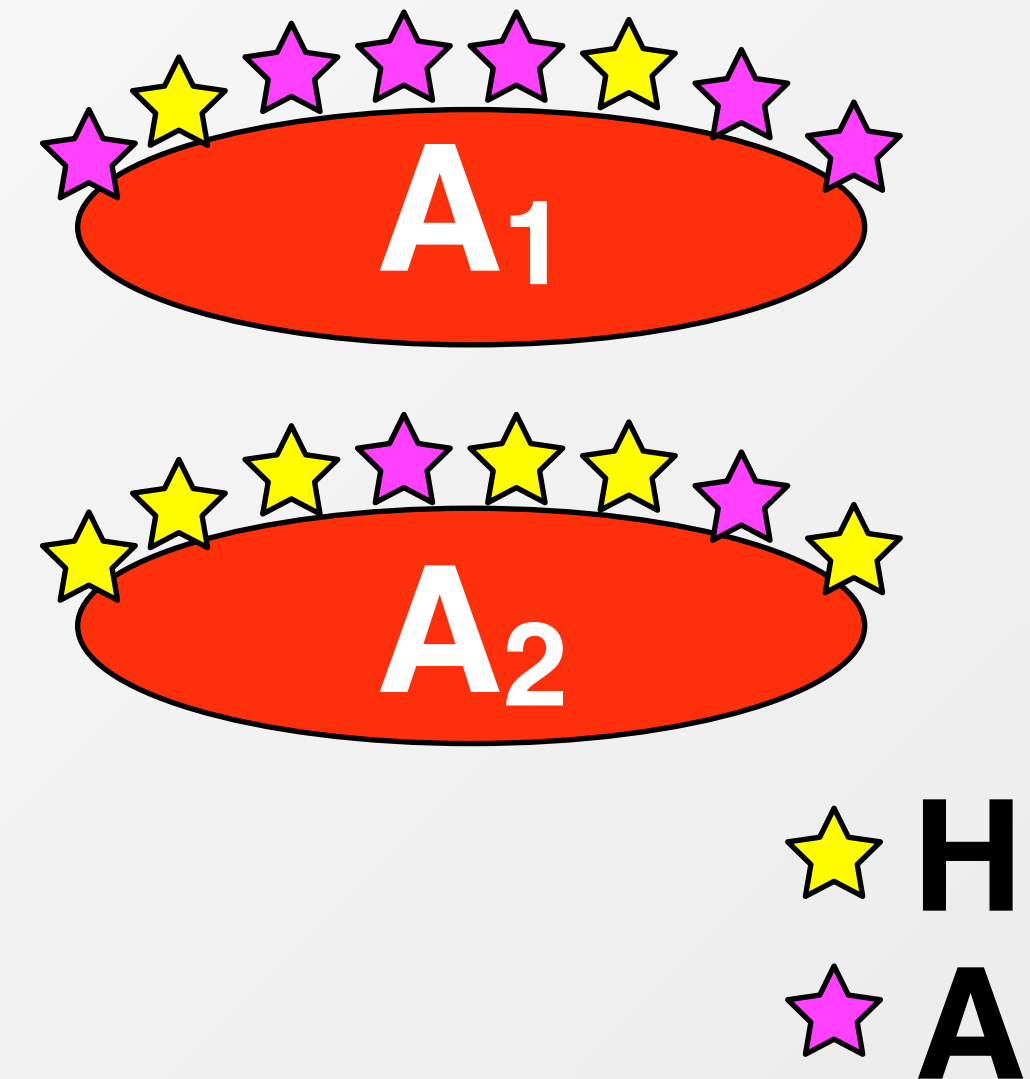
Group A

- Antigens = A, H
 - Varying amounts depending on subgroup
- Antibody = anti-B
 - Naturally occurring IgM



Group A Subgroups

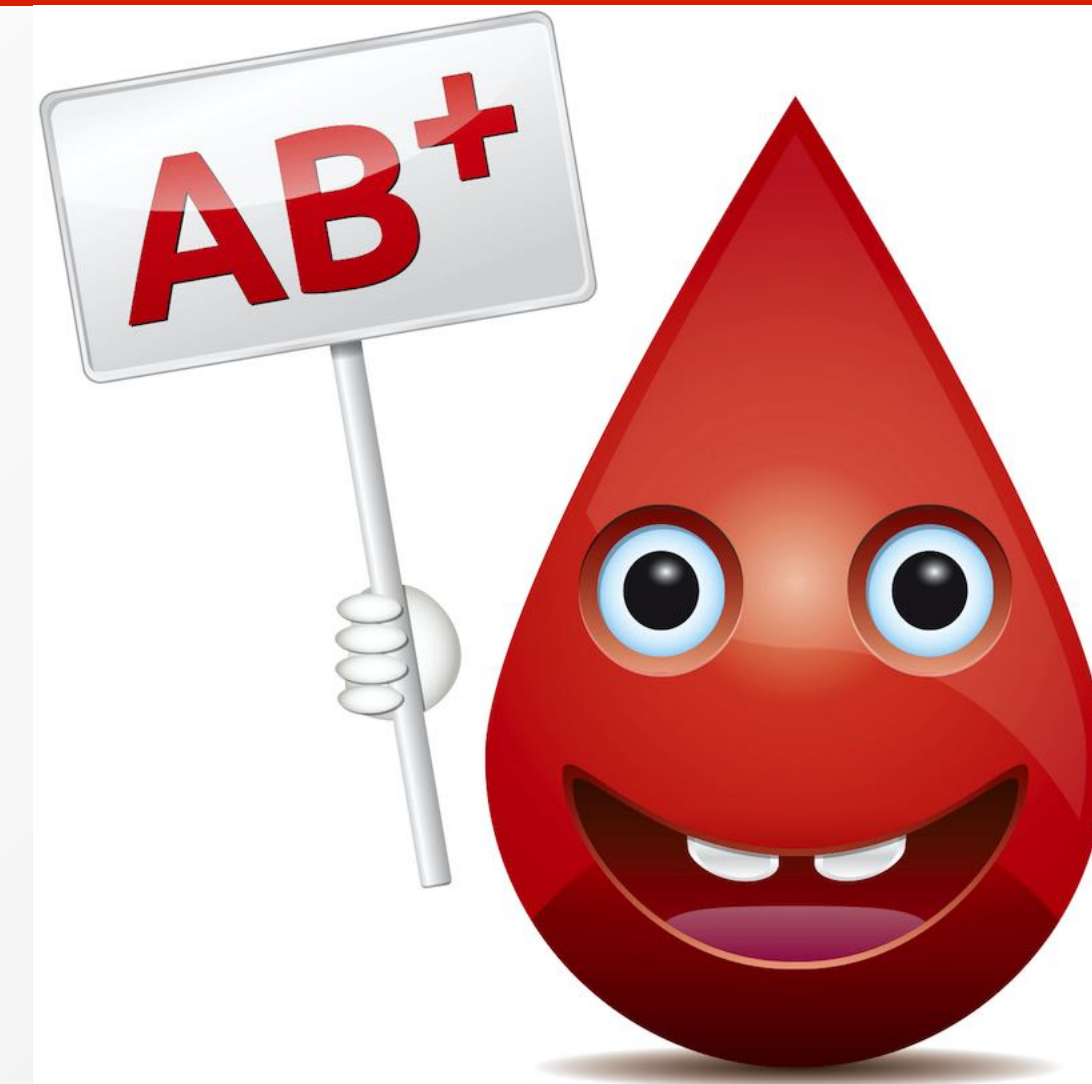
- **A₁** (80%) and **A₂** (~20%)
 - A₁ has 5x more A antigen than A₂
 - 1-8% A₂, 25% A₂B form **anti-A₁**
 - ✓ Insignificant unless at 37 C
 - *Dolichos biflorus* lectin + with A₁ not A₂



Cell Group		Serum Group	
Anti-A	Anti-B	A1 RBC	B RBC
4+	0	1+	4+

Group AB

- Least frequent across all racial lines
 - 4%
- Antigens = A, B (little to no H)
 - Subgroups of A (A₁B, A₂B, etc.)
- Antibodies: NONE
 - “Universal recipient”



ABO Discrepancies

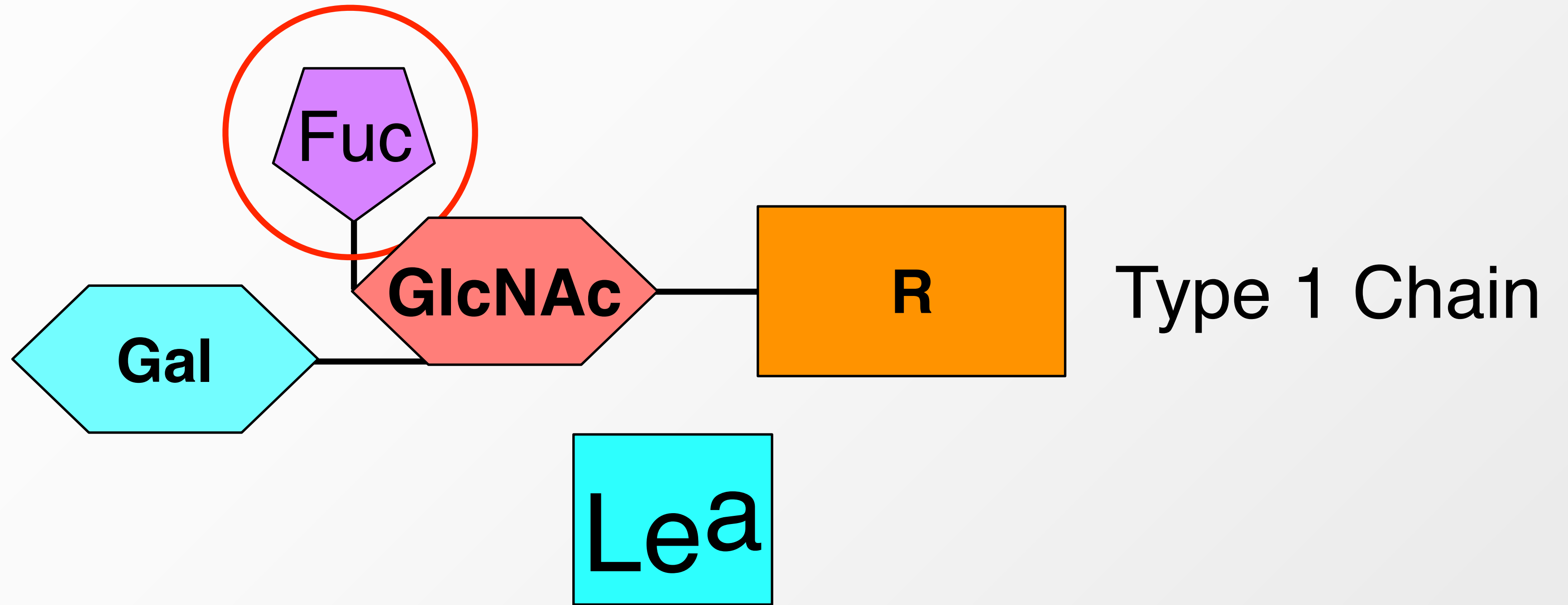
- Red cell grouping \neq serum grouping
 - Something's wrong with antigen testing
 - Something's wrong with antibody testing
 - Somebody messed up the testing
-
- Bottom line: **Until you KNOW, give Group O!**





Lewis System

- *Le* allele

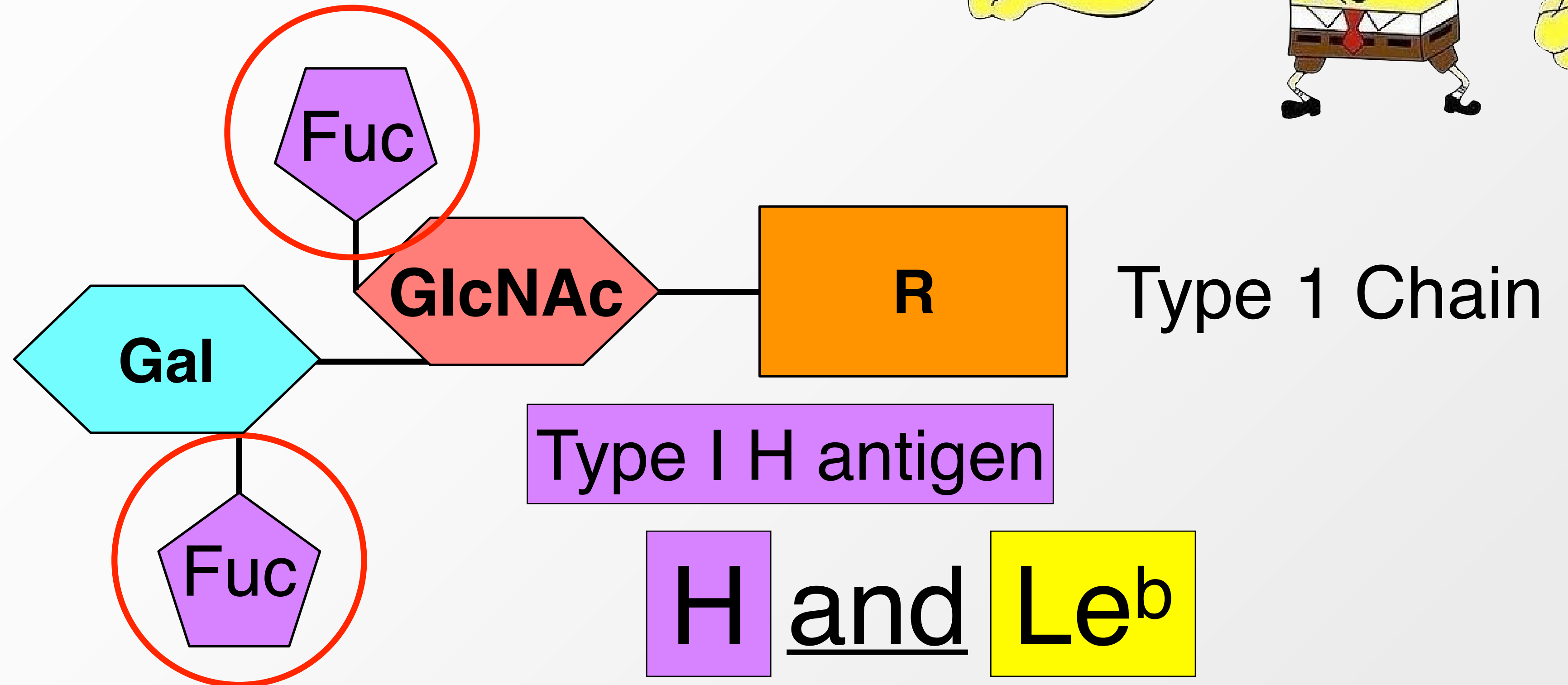




Lewis System

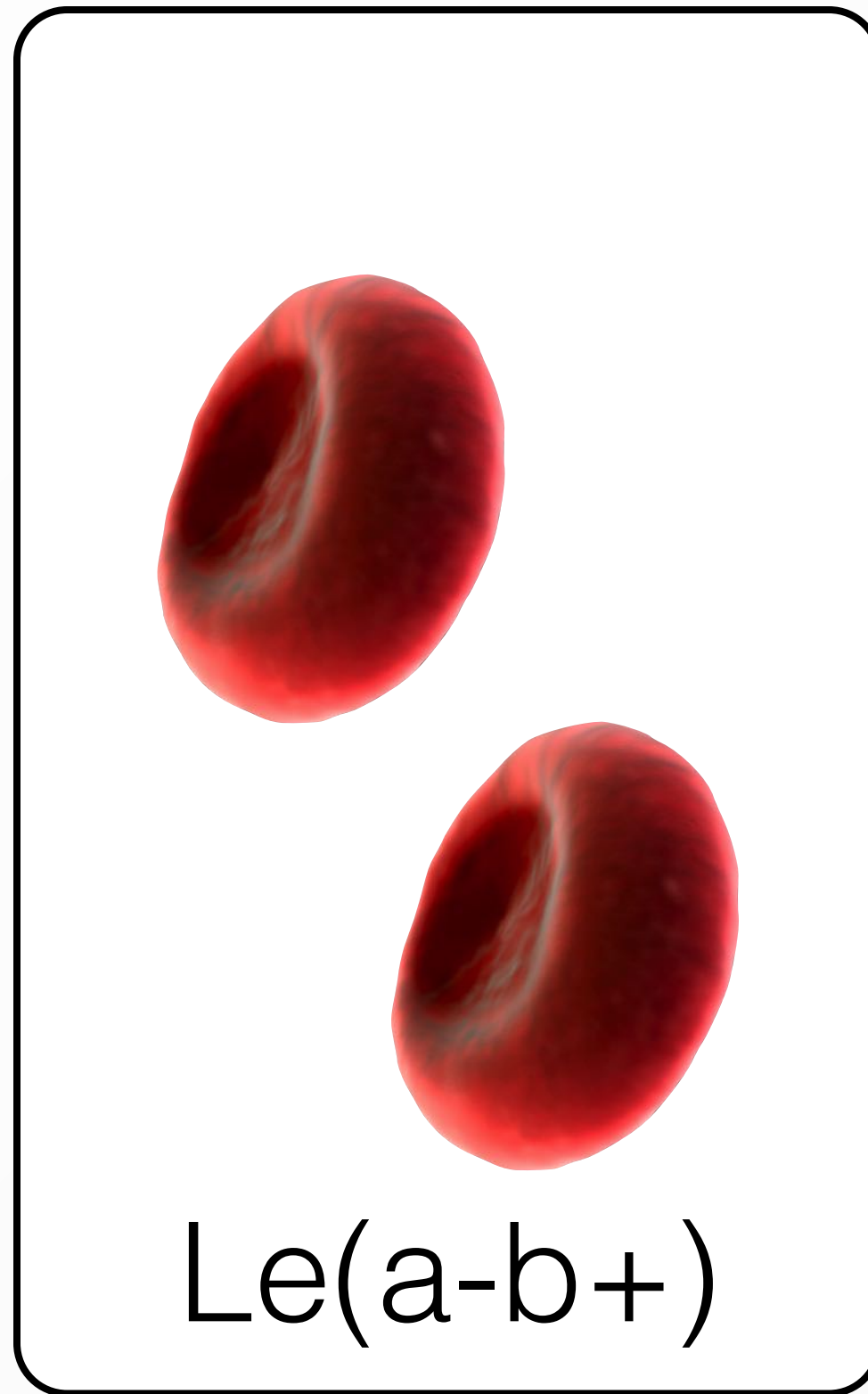


- Wait, *Se* works here, too!

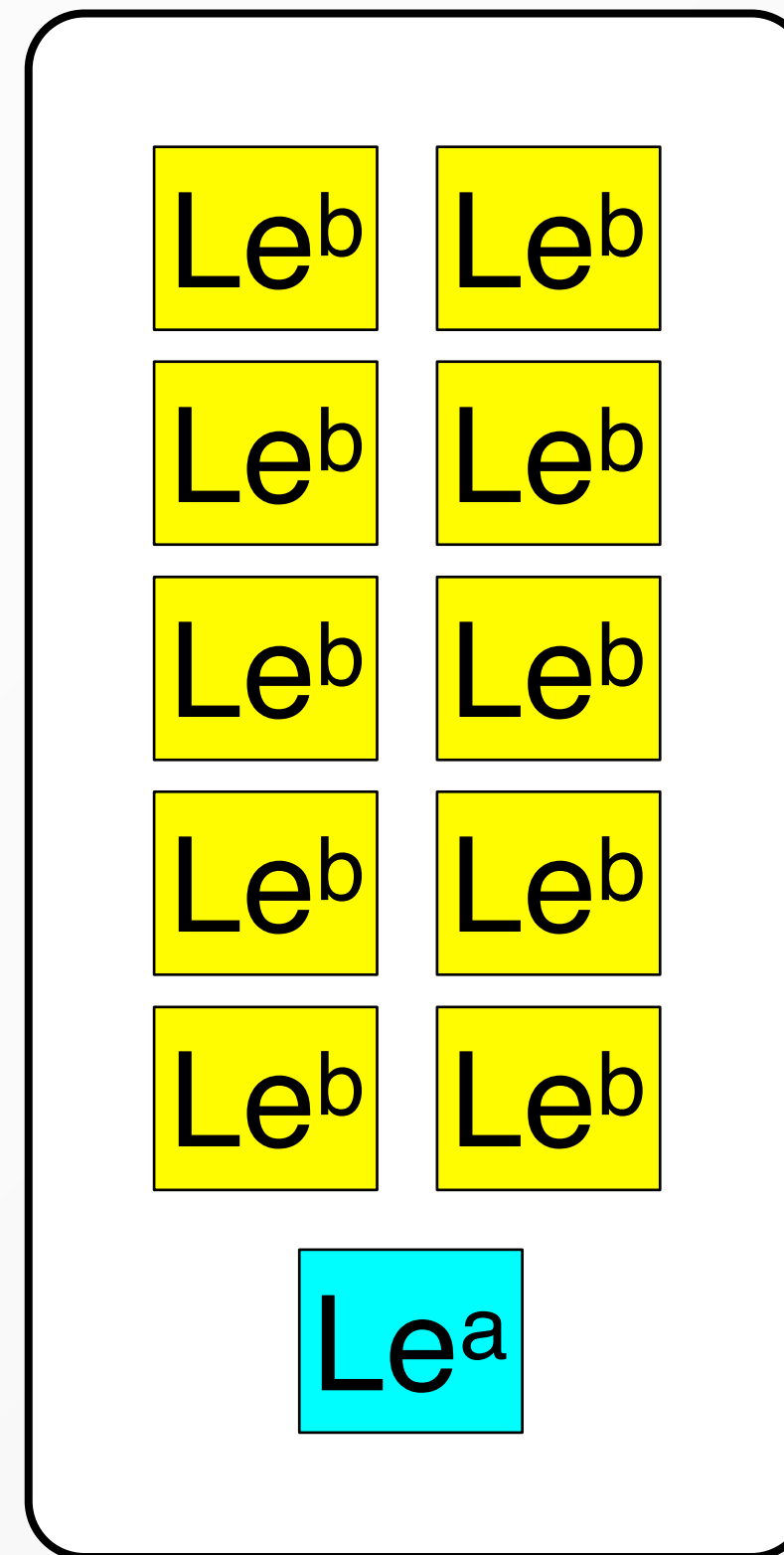
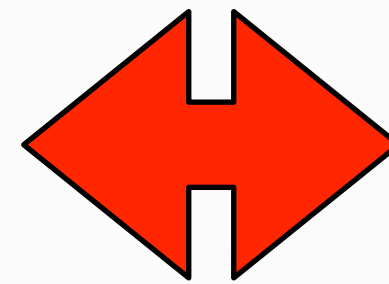




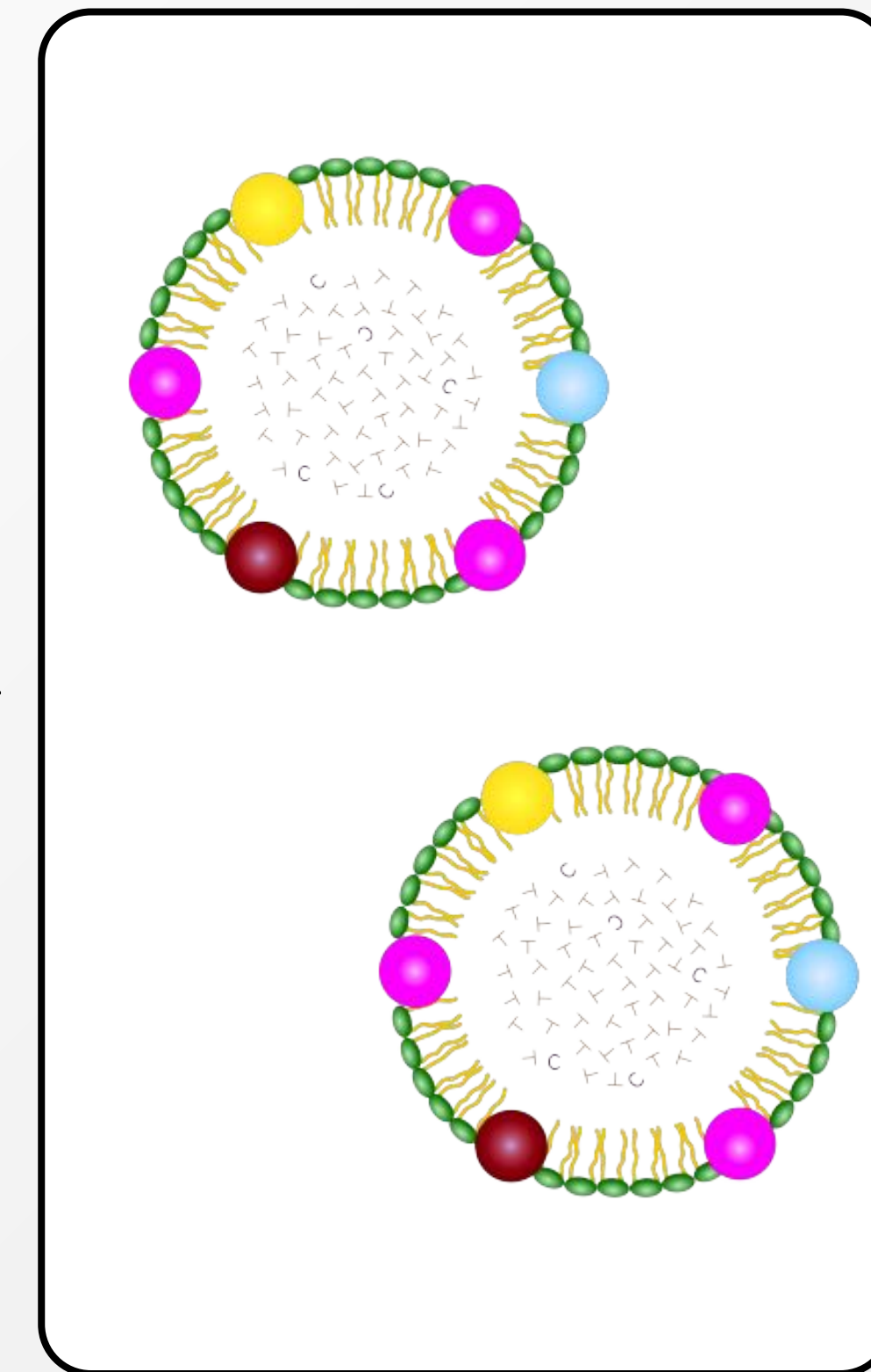
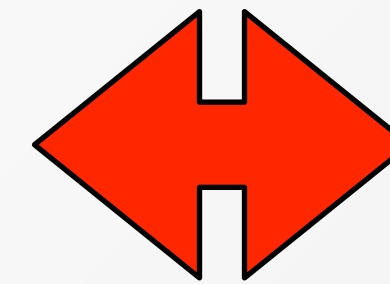
Lewis Antigens



RBCs



Plasma
Glycolipids



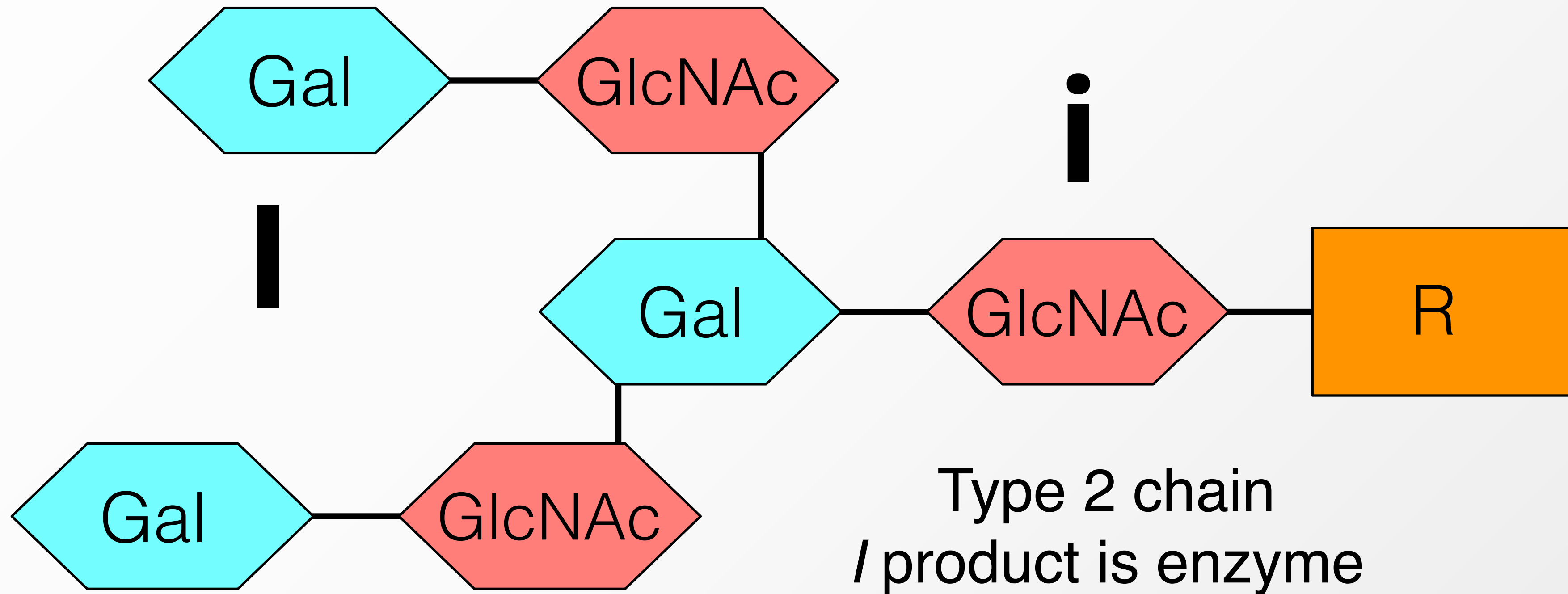
Lipoproteins



Mismatch

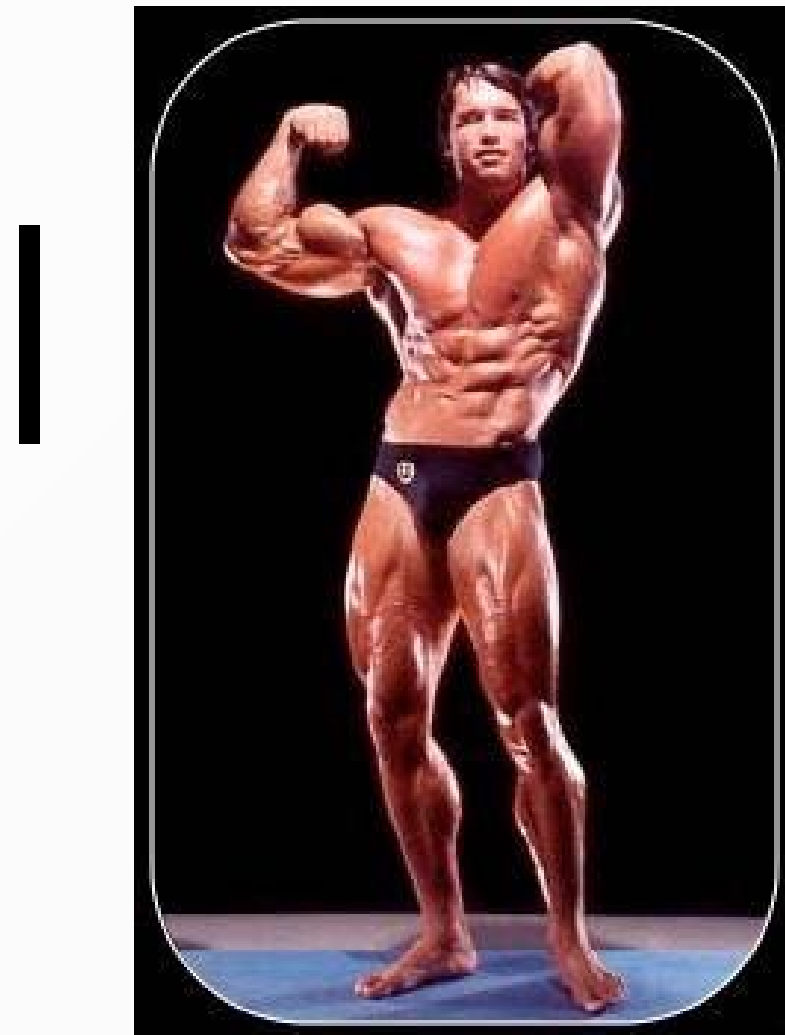
- Antibodies are insignificant (cold IgM)
- HTR's are rare (anti-Le^a)
- HDFN not seen
 - IgM antibodies
 - Fetal RBCs lack Le antigens
 - Cord blood is Le[a-b-]

I System





ABO antigens get stronger in parallel with I

I System



“Big I in big people, little i in little people”

Classic Associations

- Auto-anti-I
 - *Mycoplasma pneumoniae* 
 - Cold Agglutinin Disease
 - ✓ CLL, NHL, Waldenstroms
- Auto-anti-i
 - Infectious mononucleosis 
 - Cold Agglutinin Disease



P1 PK/GLOB Systems

- The weirdest blood group around
- Three historic antigens:
 - P1 and P^k in P1PK system
 - P now a globoside (“GLOB”) antigen
 - Missing all 3: “p phenotype”
- P1 famous: Hydatid cysts and pigeon eggs!
- P: Parvovirus point of entry



P1PK Antibodies

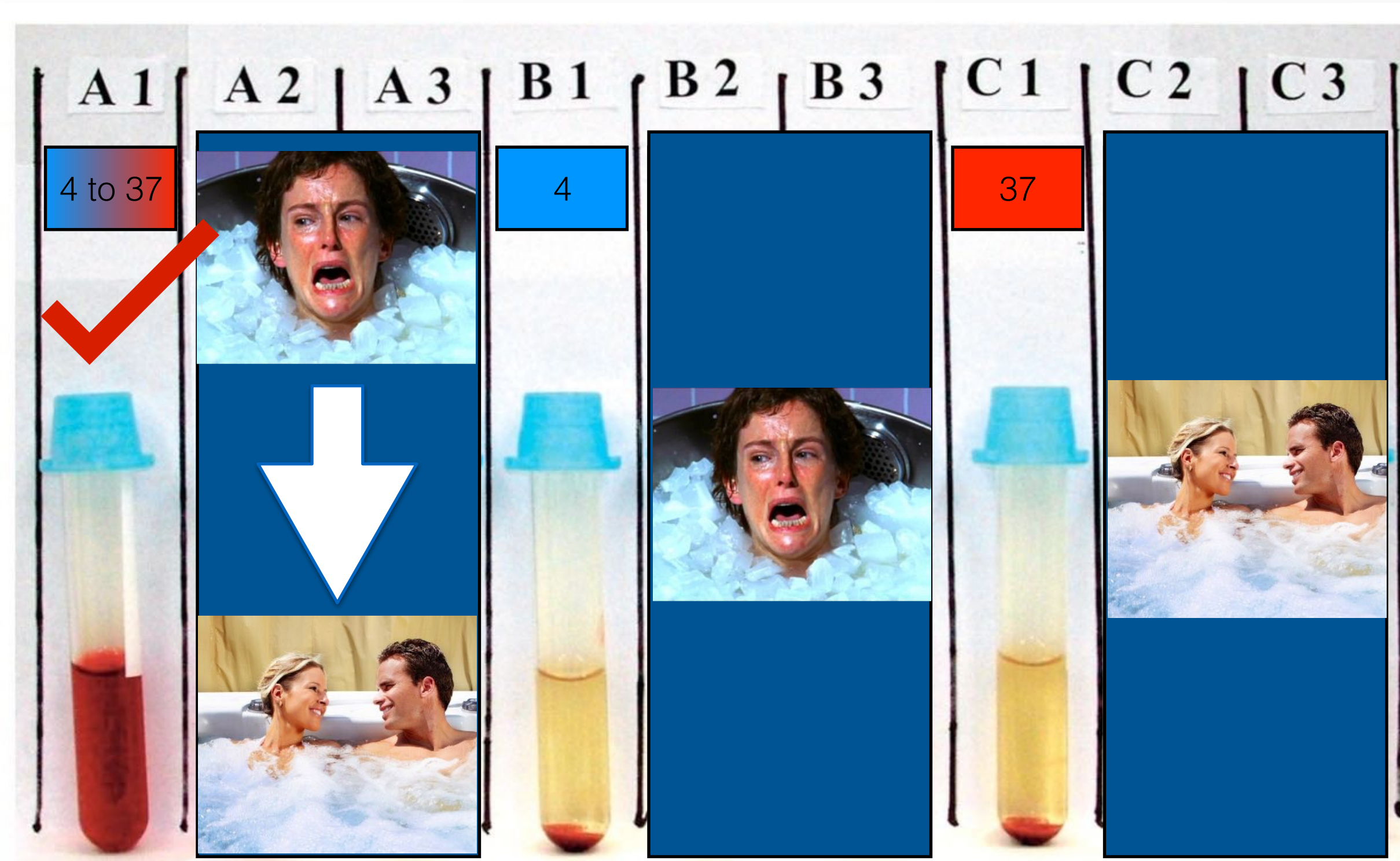
- Antibodies usually cold, insignificant IgMs
- Auto-anti-P: “Biphasic IgG hemolysin” (next)
- p phenotype antibodies:
 - Rare anti-PP1Pk
 - ✓ Acute HTRs
 - ✓ Spontaneous abortions (placenta)

P1PK Antibodies

- Paroxysmal Cold Hemoglobinuria
 - Biphasic IgG autoanti-P (Donath-Landsteiner)
 - ✓ *Clings when it's cold, hurts when it's hot*
 - Seen after viral infection in children



Donath-Landsteiner Test



Sanford KW and Roseff SD_Detection and significance of Donath-Landsteiner antibodies in a 5 year old female presenting with hemolytic anemia_Lab Medicine_0410

A: 4C to 37C

B: 4C only

C: 37C only

New Plan

- 1/22 (today!): Finish Immunohematology I
- 2/5: Immunohematology II (Antibody ID, cases)
- 3/5: Blood Components
- 3/26: Transfusion Reactions

- Don't forget: BBGuy.org/LLU is your page!
 - (PW: LLUPathology)
 - Notes, slides, new stuff!

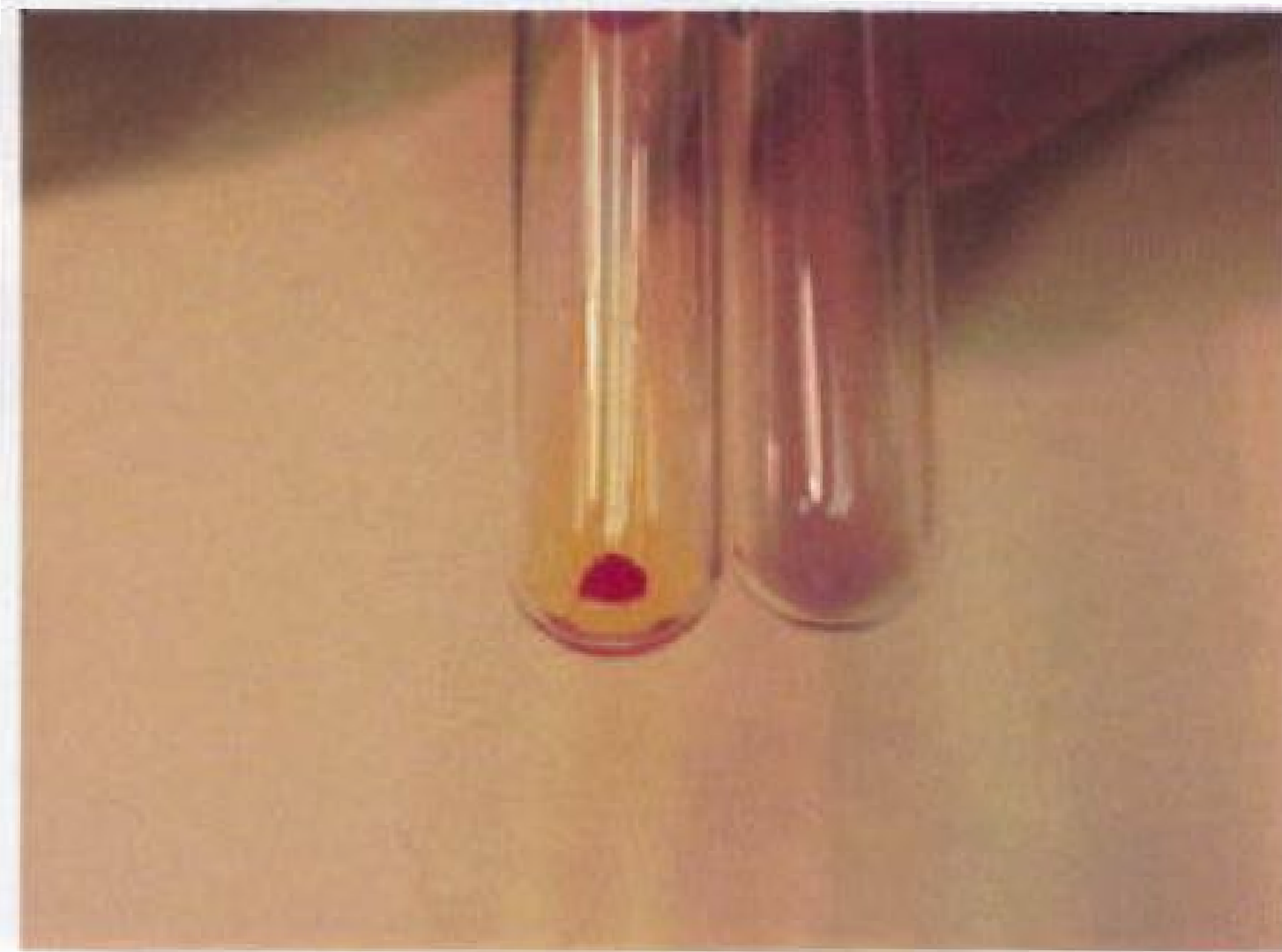
Enzyme Classification

Enhanced	Decreased	Unaffected
<p>ABO-related</p> <ul style="list-style-type: none">-ABO/H-Lewis-I-P1PK/GLOB <p>Rh System Kidd System</p>	<p>MNS System Duffy System</p>	<p>Kell System</p>

Interpret ABO Testing



Forward



Interp: Group B

Reverse



L: A1 RBCs, R: B RBCs

Interp: Group B



Which association is correct?

Auto-anti-I:
Mycoplasma pneumonia

Anti-i: Paroxysmal Cold
Hemoglobinuria

Auto-anti-P: Infectious
mononucleosis

Most common HDFN:
Blood group A mother

Total Results: 0



A 23 year old new mother has the genotype *hh, sese*. What ABO type will she be, and what ABO type will her newborn be?

Mom: Any type;
Baby: O only

Mom: Either A or B;
Baby: Either A or B

Mom: O; Baby:
Any type

Mom: Any type;
Baby: Any type

Total Results: 0

oll Everywhere

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

Bombay O_h Phenotype

- Genotype: *hh, sese*
- No H, A, or B due to no *H* or *Se*



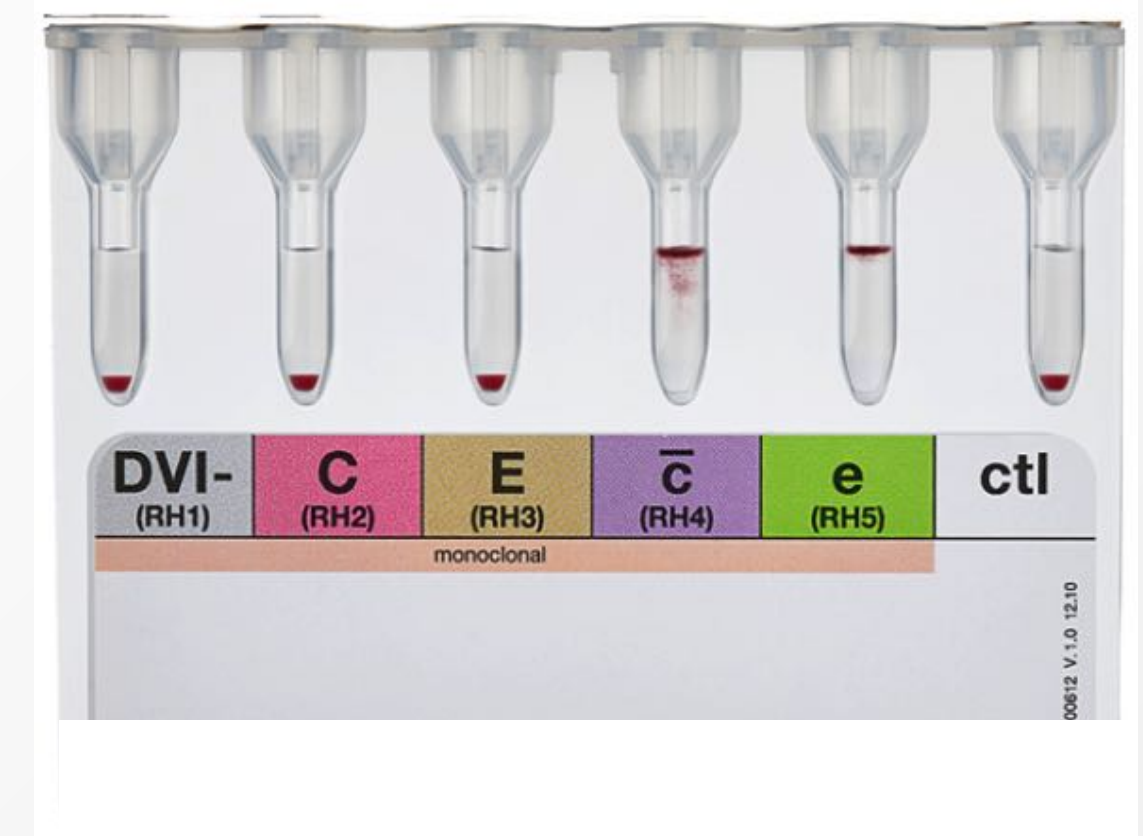
H lectin
(*Ulex europaeus*)

Red Cell		Serum		ABO Group
<u>Anti-A</u>	<u>Anti-B</u>	<u>A I RBCs</u>	<u>B RBCs</u>	
0	0	4+	4+	O

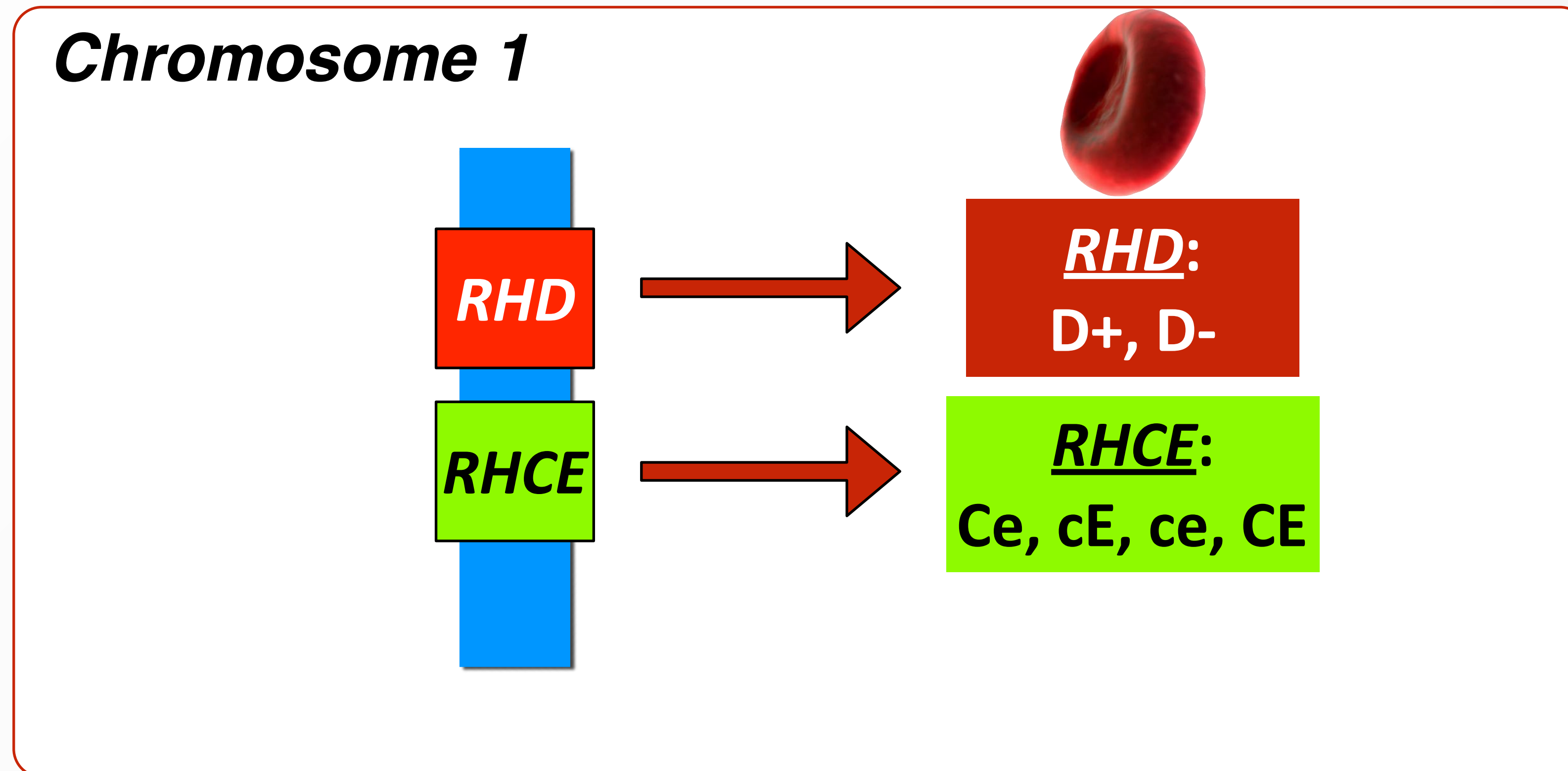


Rh System

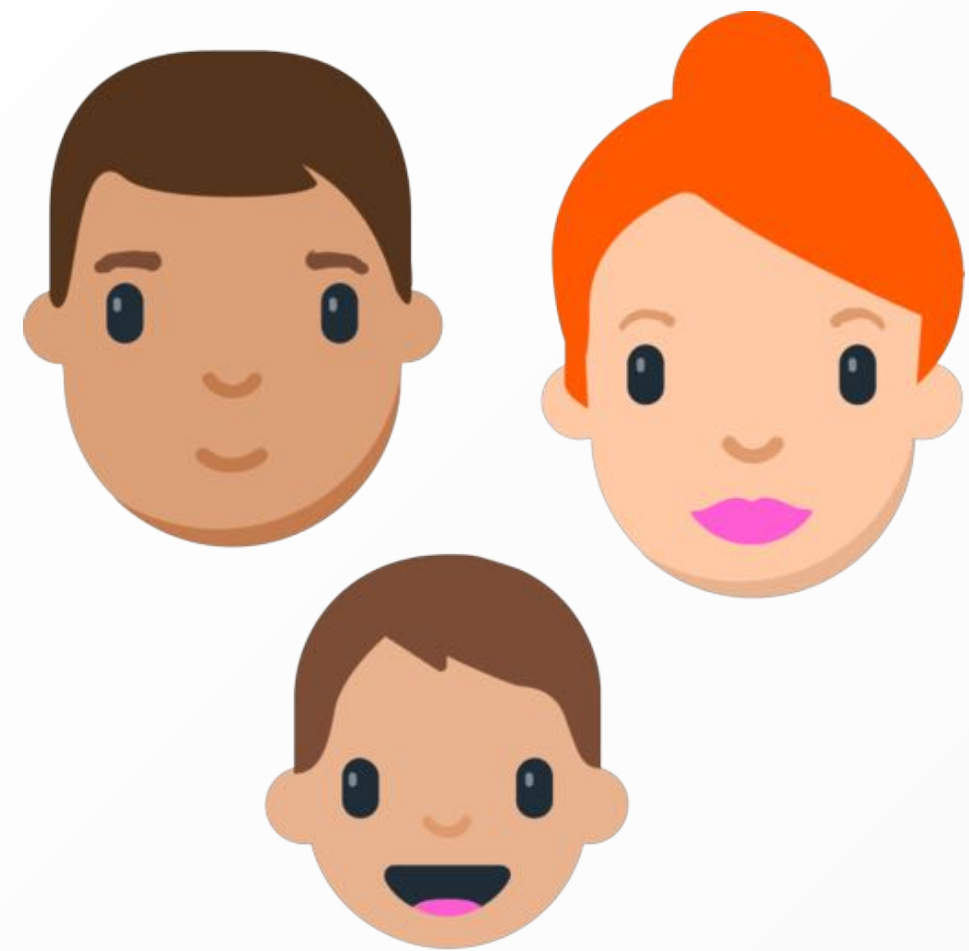
- Five main antigens (50+ overall)
 - D, C, E, c, e
 - “Rh+” means “D+”
 - Rh- described as “d”



Rh System Genetics



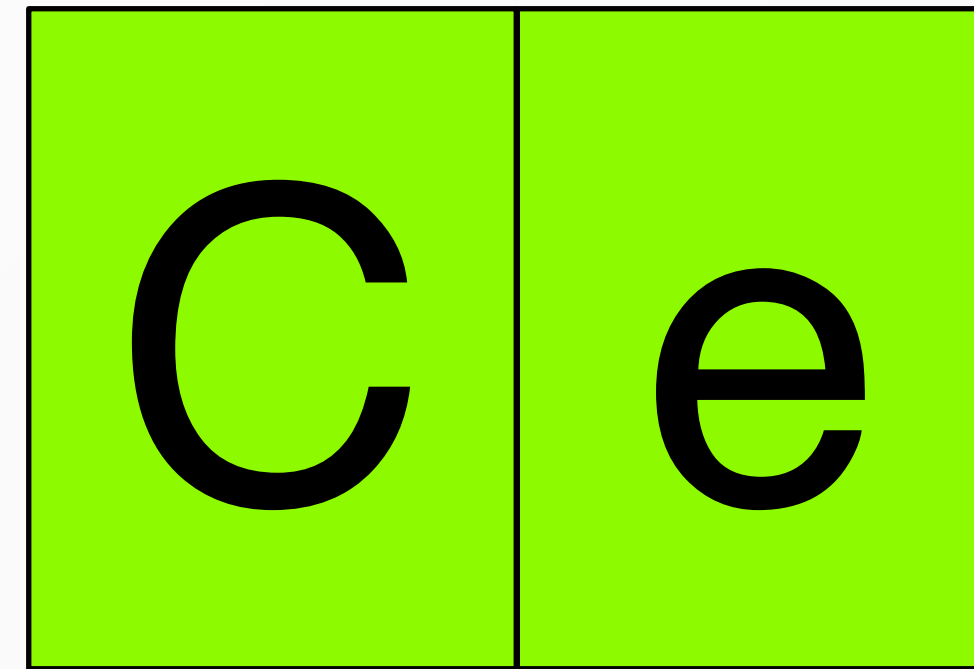
Rh System



Mom



RHD



RHCE



“Haplotype”

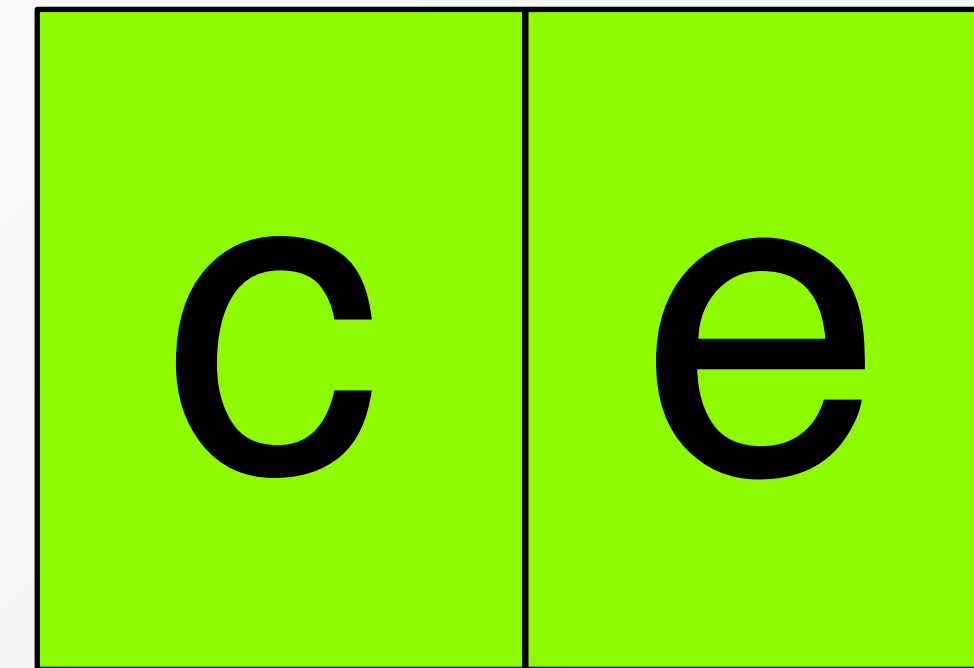
DCe = R₁

Dad



RHD

(Mutated/deleted)



RHCE



dce = r

R_1

r_y

R_z

r'

r''

R_0

r

R_2

R₁ = **D**

R₂ = **D**

R₀ = **D**

R_z = **D**

r' = **d**

r'' = **d**

r = **d**

ry = **d**

RHD Options

D **d**



R₁ = D Ce

R₂ = D cE

R₀ = D ce

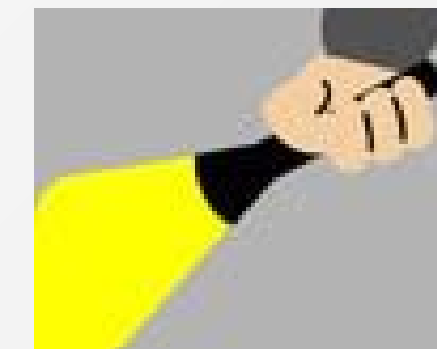
R_z = D CE

r' = d Ce

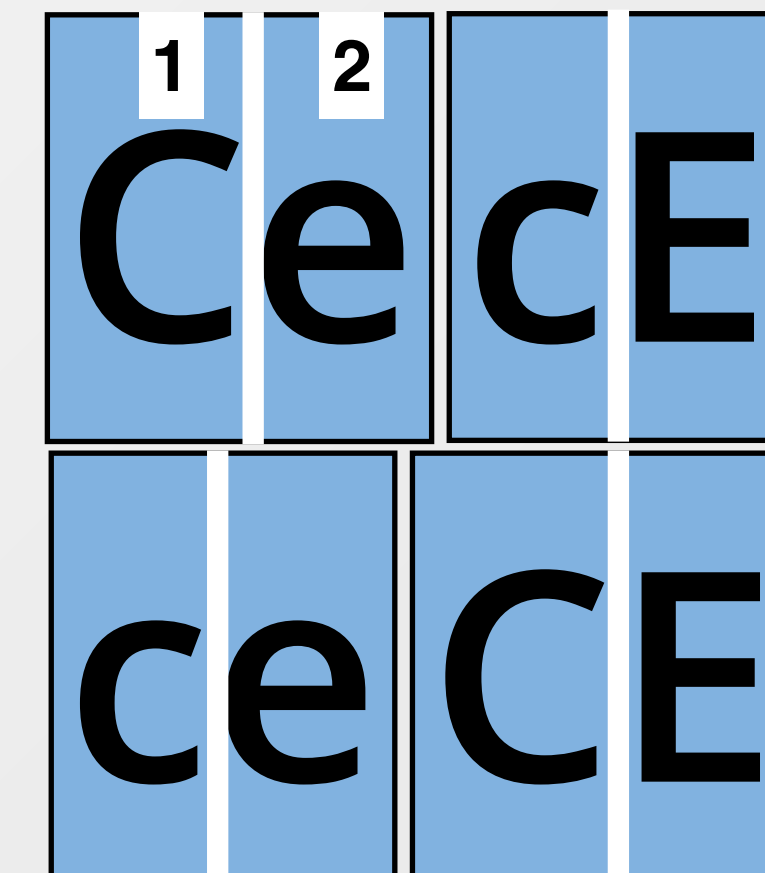
r'' = d cE

r = d ce

r^y = d CE



RHCE Options



$R_1 = D Ce$

$R_2 = D cE$

$R_0 = D ce$

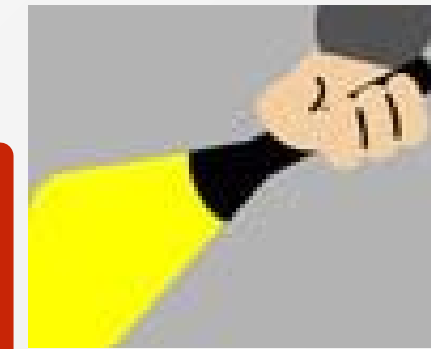
$R_z = D CE$

$r' = d Ce$

$r'' = d cE$

$r = d ce$

$ry = d CE$



The “Fantastic Four”



- $R_1, R_2, R_0,$ and r (97%)

Whites	R_1	r	R_2	R_0
Blacks	R_0	r	R_1	R_2

1. R_0 1st in blacks, last in whites

2. r always second

3. $R_1 > R_2$

The “Fantastic Four”

- $R_1, R_2, R_0,$ and r (97%)



Whites $R_1 > r > R_2 > R_0$

Blacks $R_0 > r > R_1 > R_2$

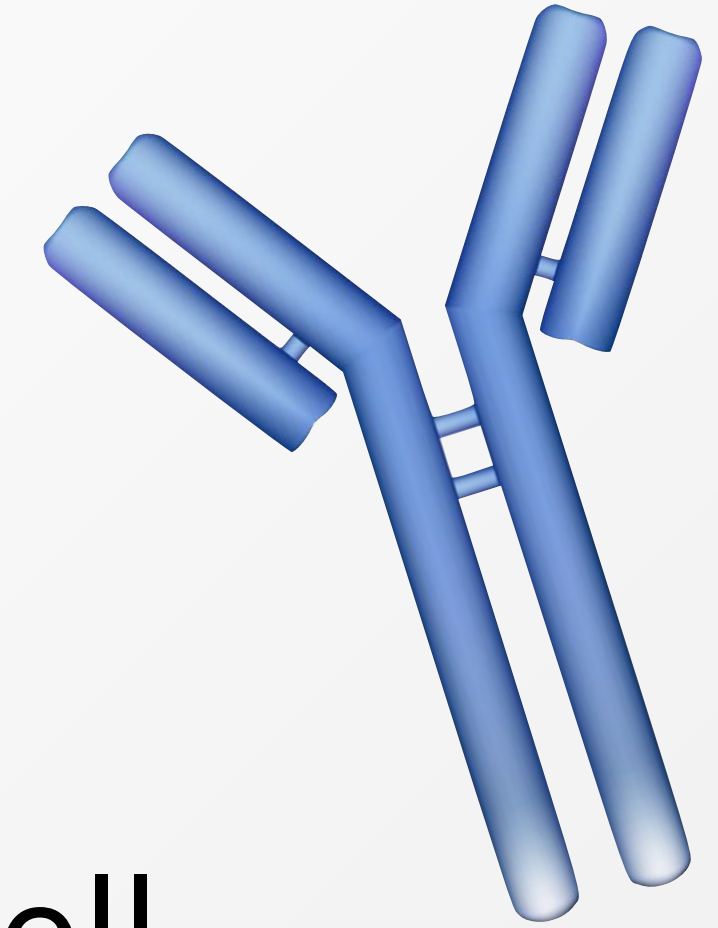
Asians $R_1 > R_2 > R_0 = r$

RhD-negative

- Mutations and deletions, not *d*
- Caucasians most likely D-negative
- Asians RARELY D-negative

Caucasians (15%)	African-Americans (3-5%)	Asians (<0.1%)
Deleted <i>RHD</i>	Deleted <i>RHD</i> “Psi” pseudogene	Mutated <i>RHD</i> DEL

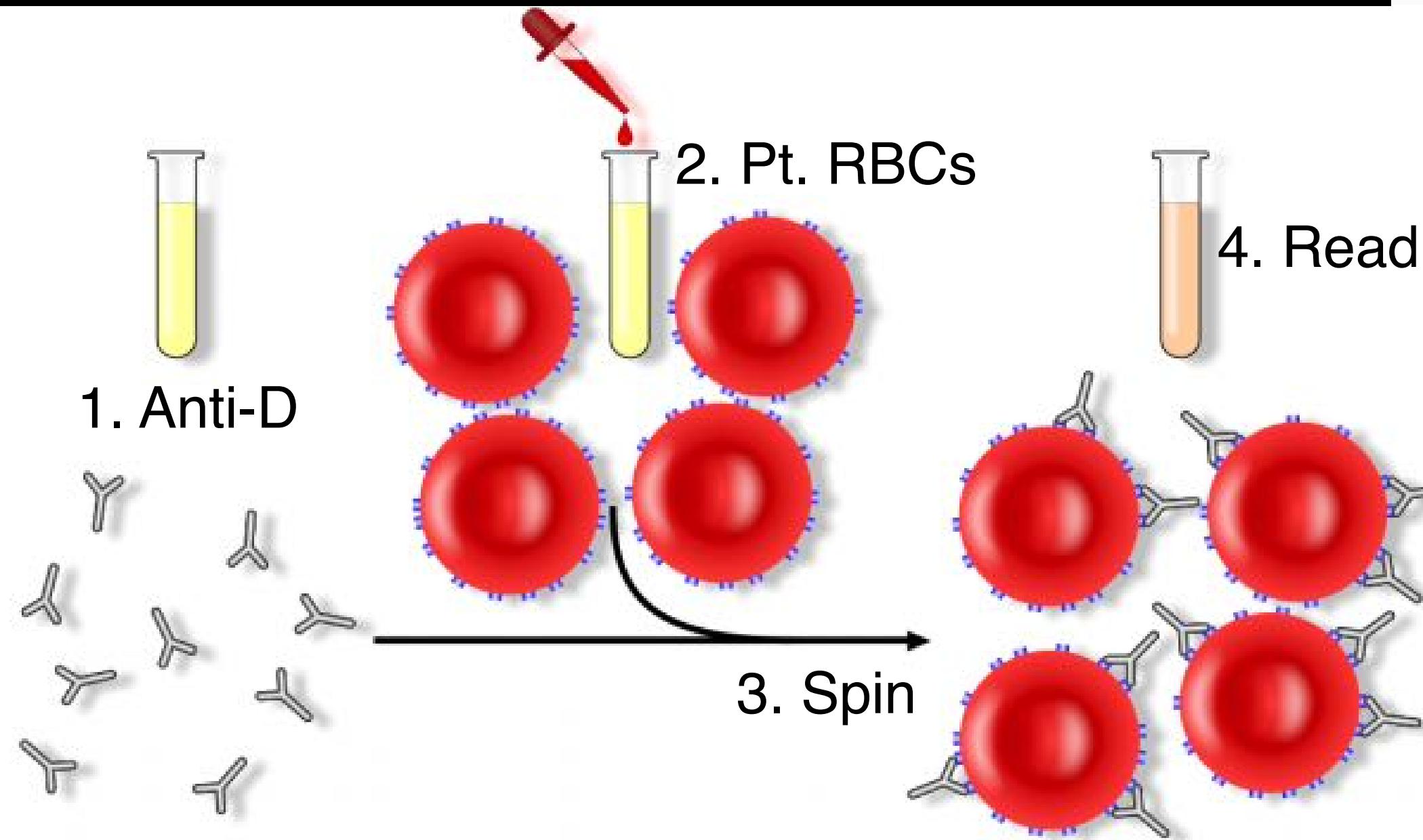
Rh Antibodies



- Exposure-requiring warm IgG
- Rh antigens (esp. D) stimulate antibodies well
 - Old: 80% of D- make anti-D
 - New: 22% of D- hospital pts make anti-D
- Consequences:
 - HTRs, primarily extravascular
 - Prototypical HDFN with anti-D
 - ✓ Anti-c: Severe HDFN, others mild

What's "Weak D?"

Routine D Testing (Steps 1-4)

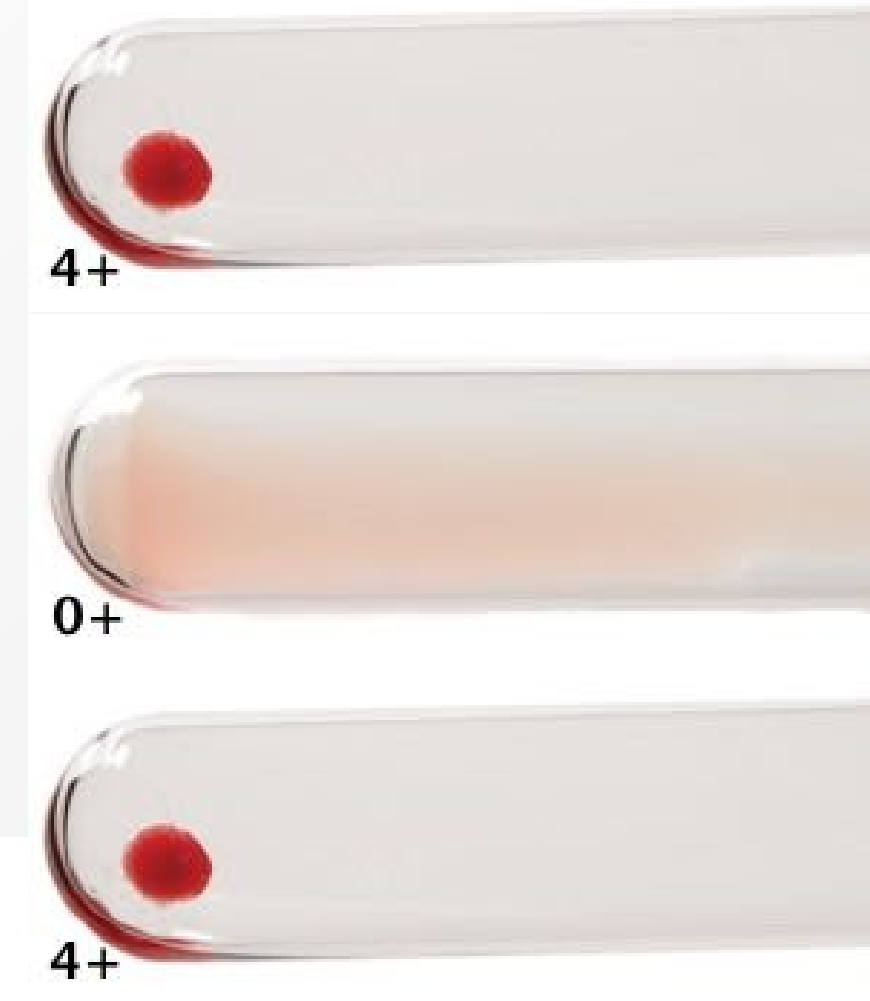


Mix of IgM/IgG


5. Incubate 15-30 min, spin

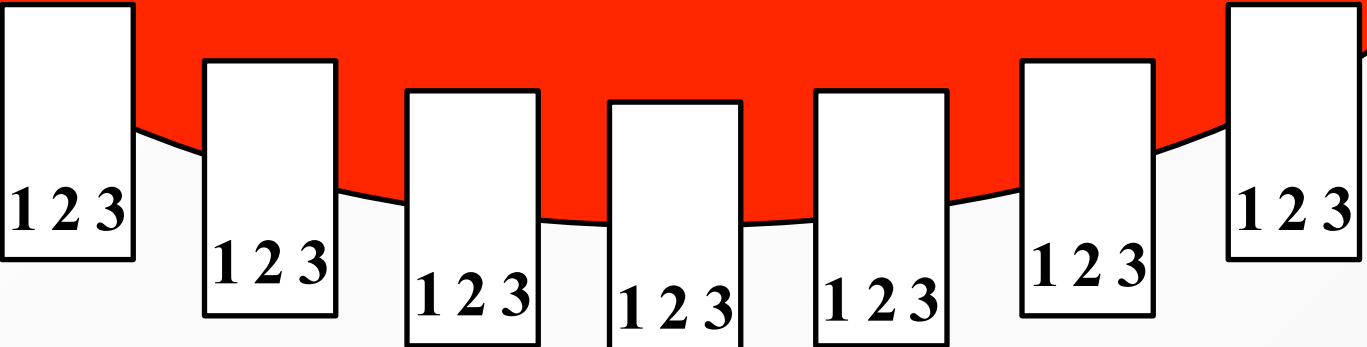
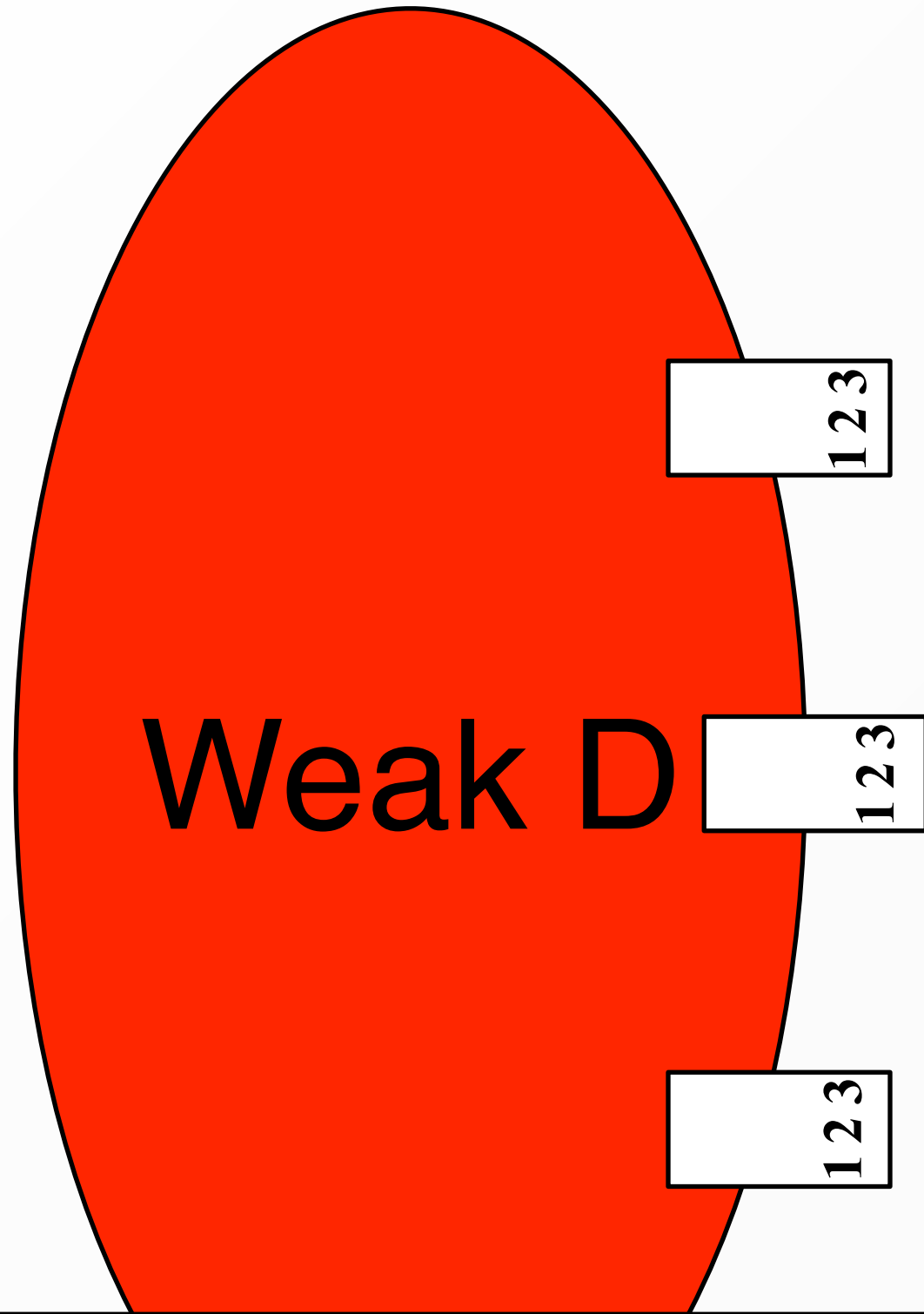
6. Wash, add **AHG**, spin

Weak D Test (Steps 5-6)



D-positive

 = RhD
1 2 3 = Epitopes



Typical D+



True Weak D



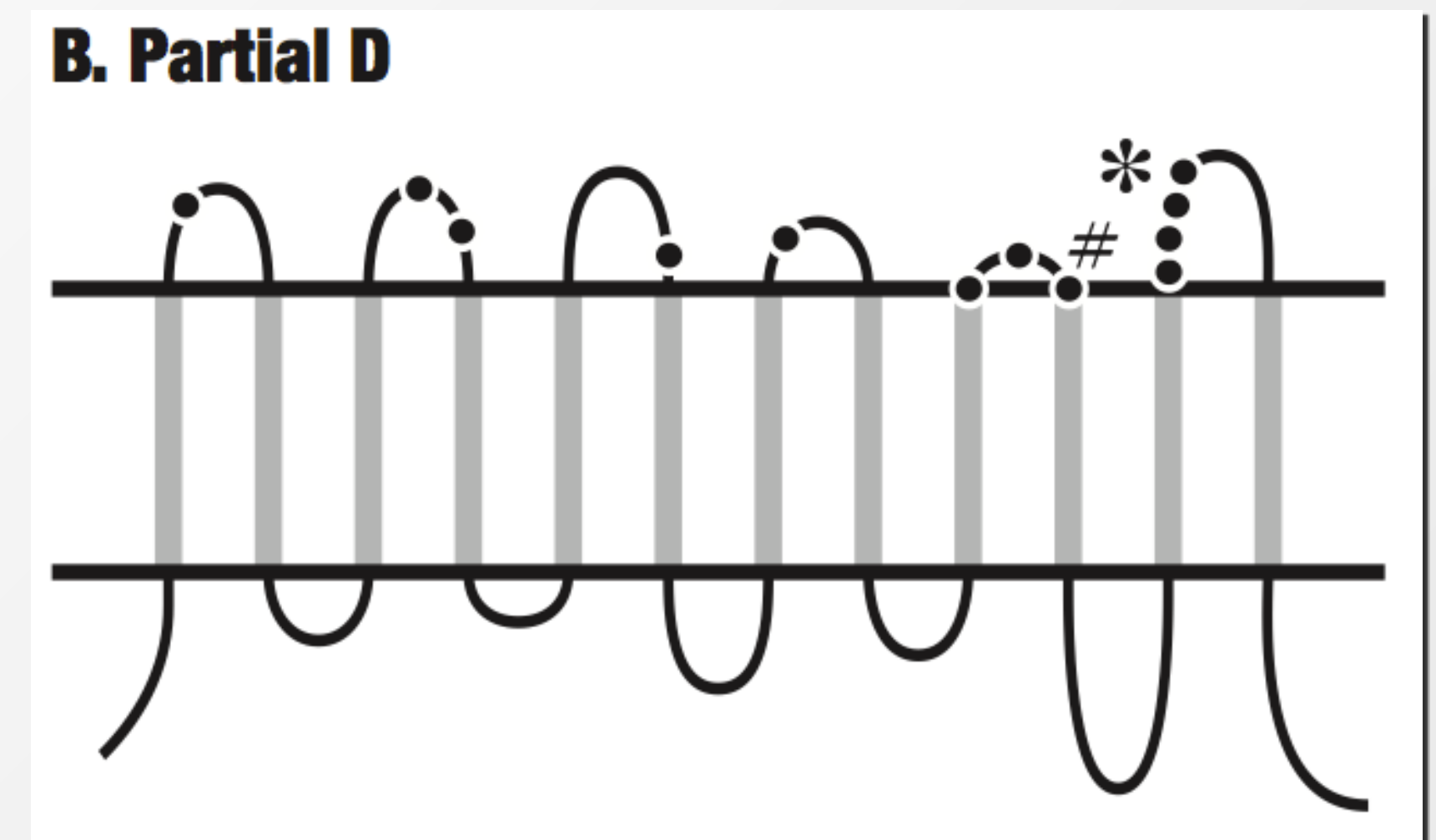
“Serologic Weak D”

Recipients: OK to call D neg
Donors: MUST NOT call D neg

Current AABB Recommendation:
Consider Rh genotyping with serologic weak D in Tx service
-Saves Rh neg supply
-Saves Rhlg injections for moms


Partial D

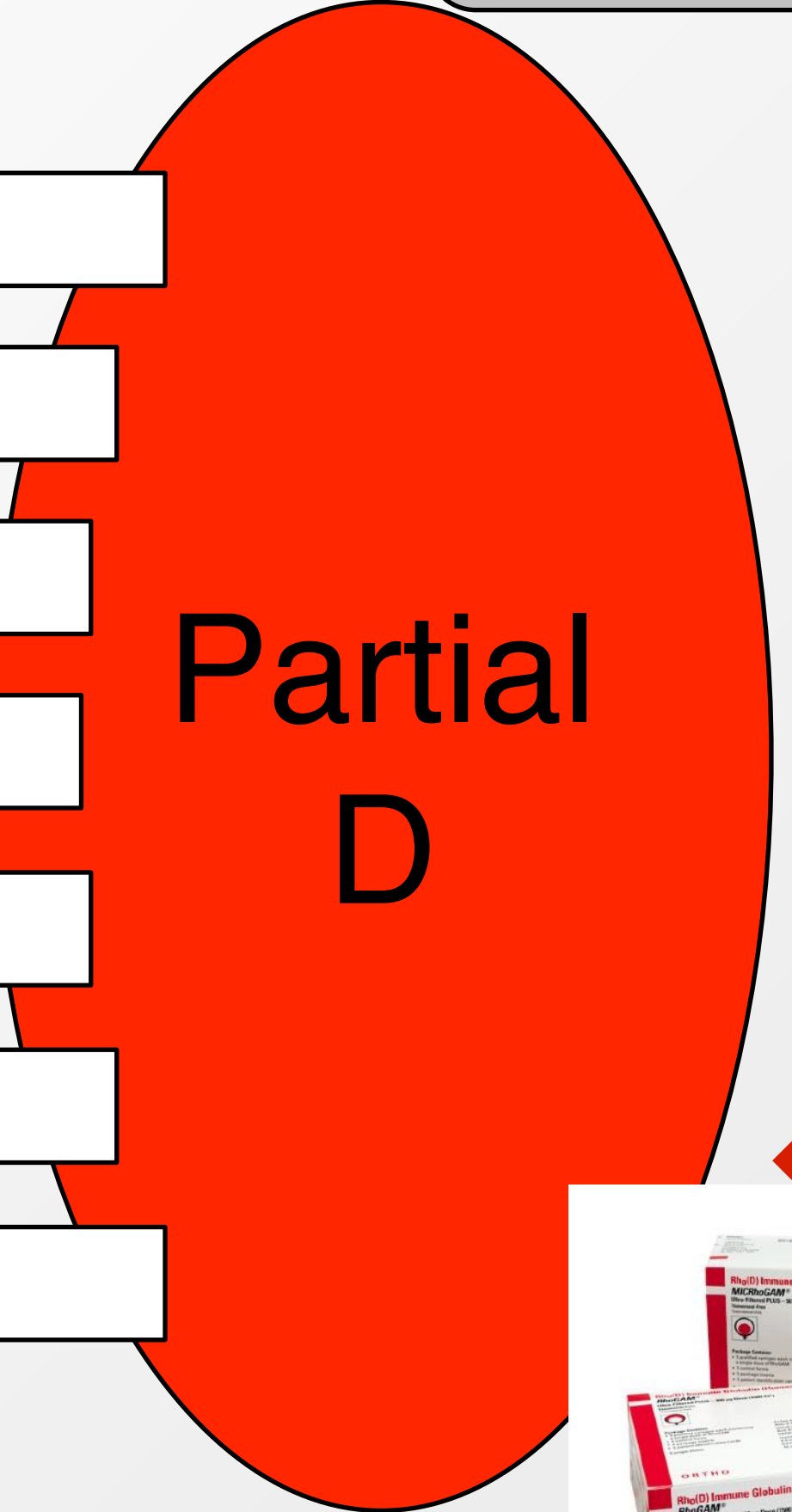
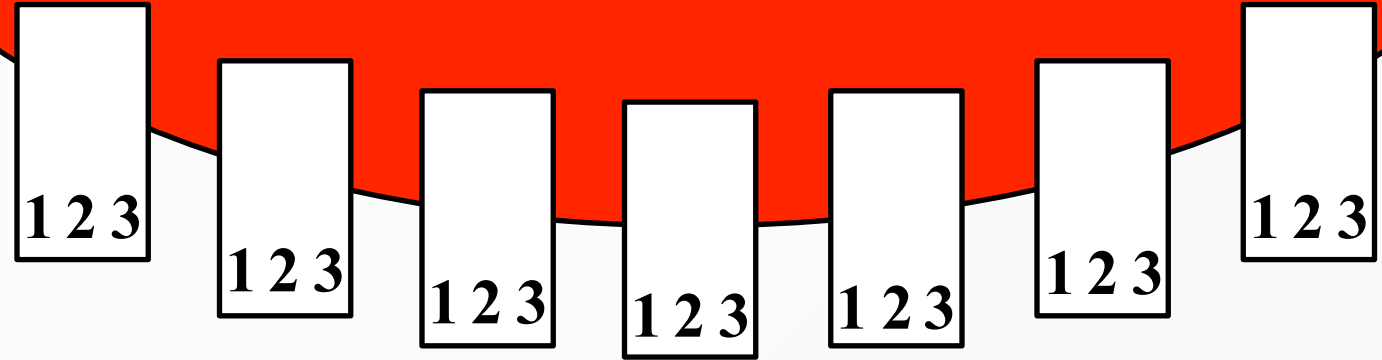
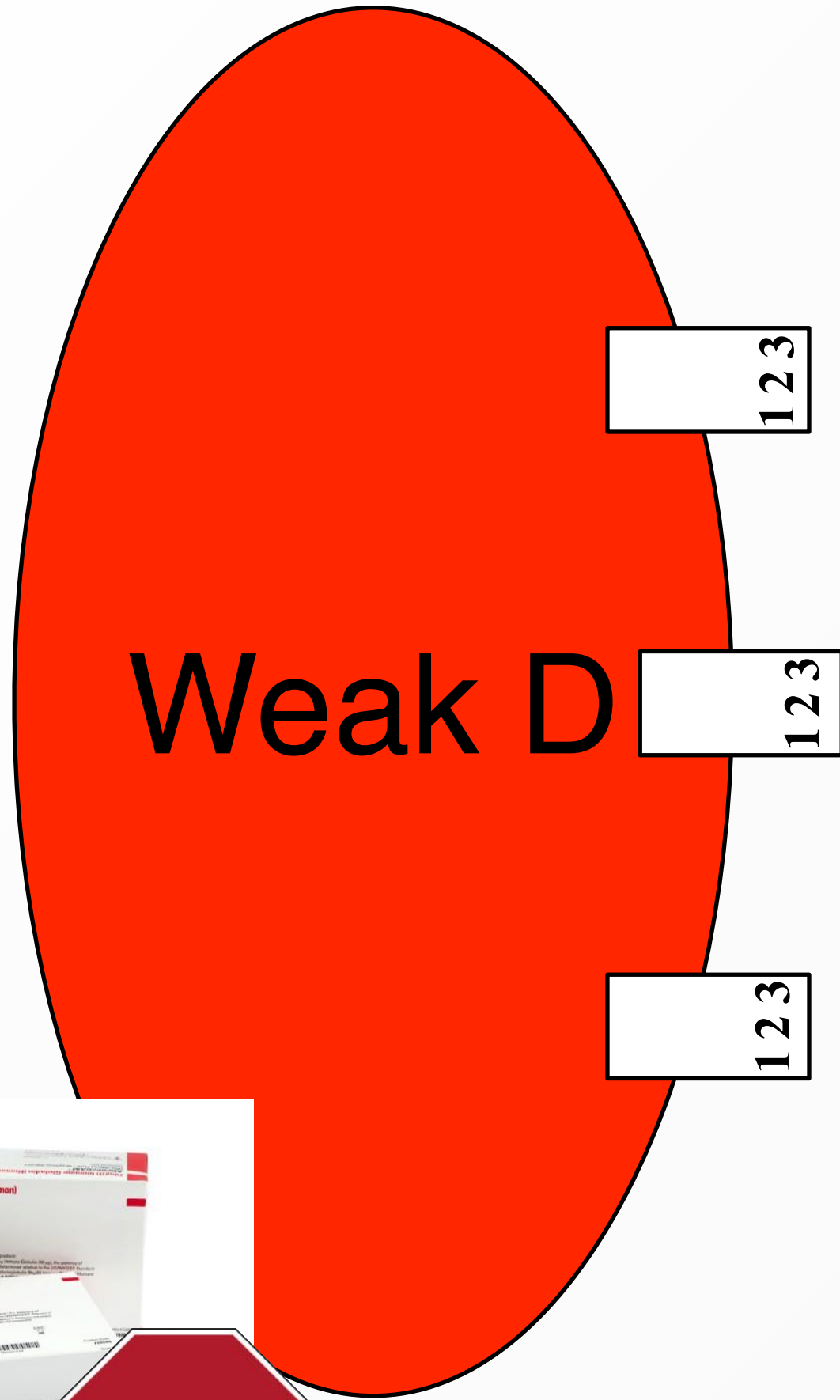
- Qualitative D defect
 - Parts of D on outside of RBC via *RHD* mutation
- Abs vs. missing parts ~ anti-D
 - Classic: Anti-D in a D+ person



Westhoff CM, Review: the Rh blood group D antigen...dominant, diverse and difficult. *Immunohematology* 2005;21(4):155-6.

D-positive

 = RhD
1 2 3 = Epitopes



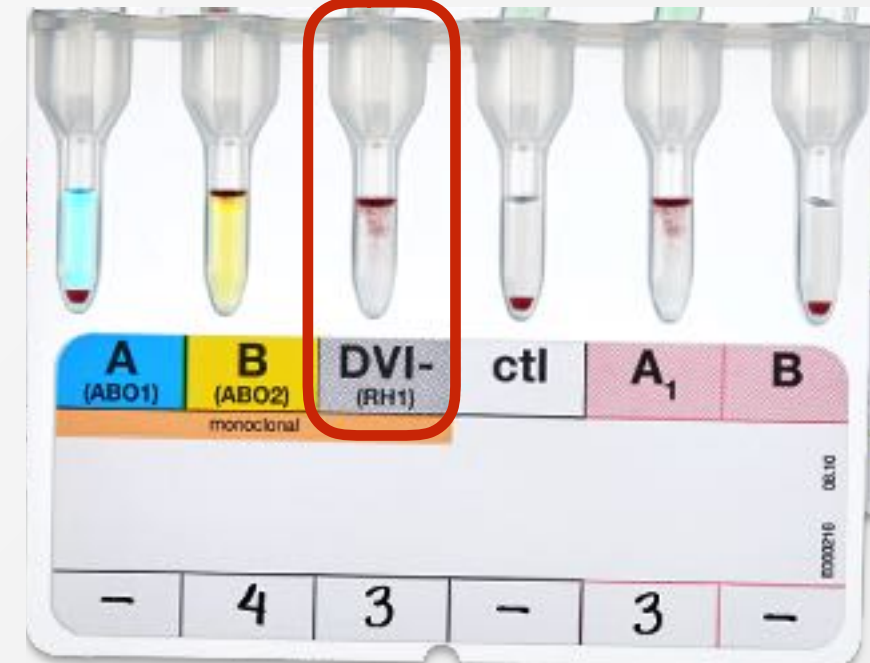
D+ and many Partial D




"anti-D"



Partial DVI
"D Six"



Weird Stuff

- Rh_{null}
 - Mutation in *RHAG* gene (3rd Rh gene)
 - ✓ Structural problem
 - No Rh antigens
 - Stomatocytic hemolytic anemia 

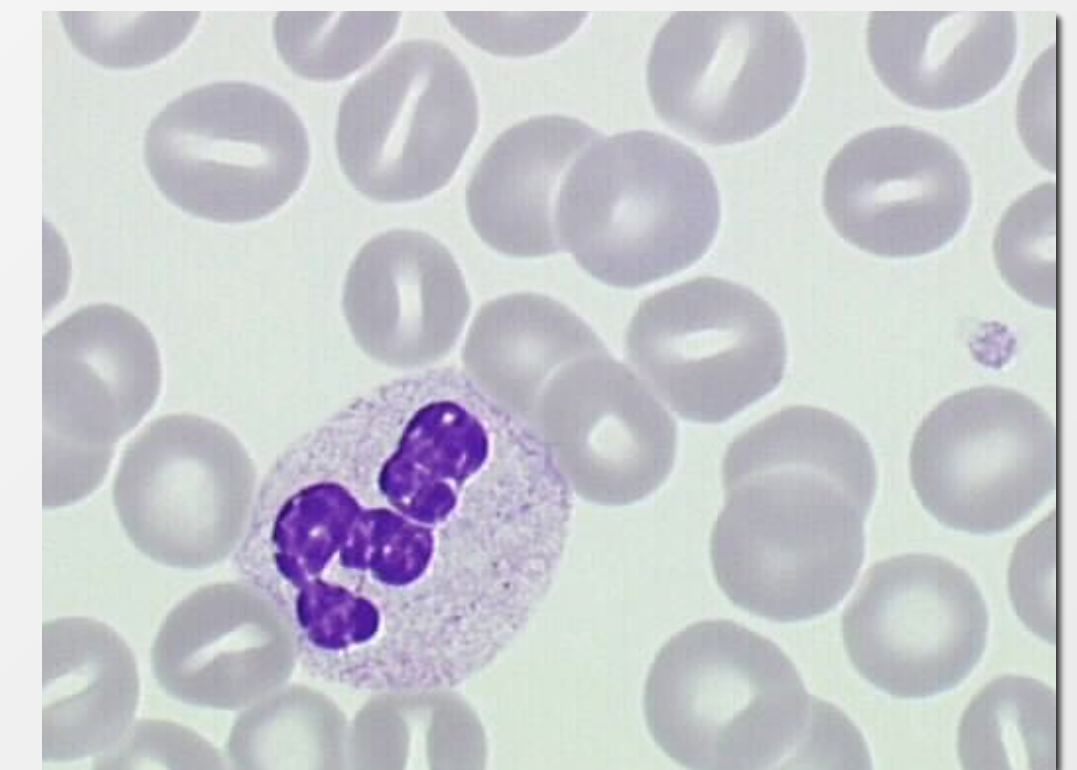
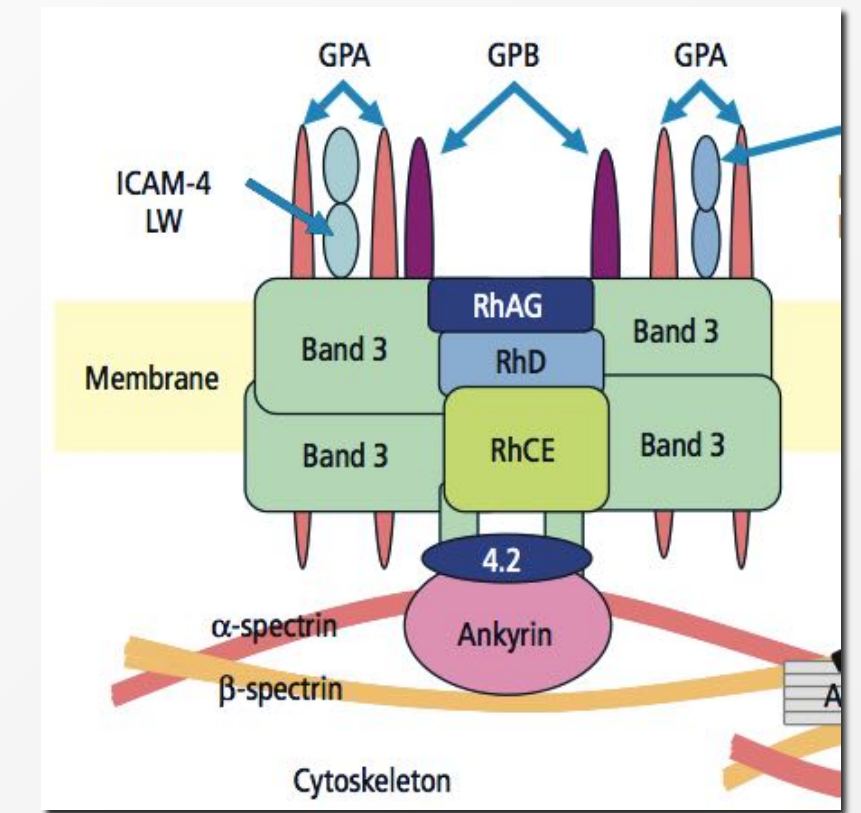
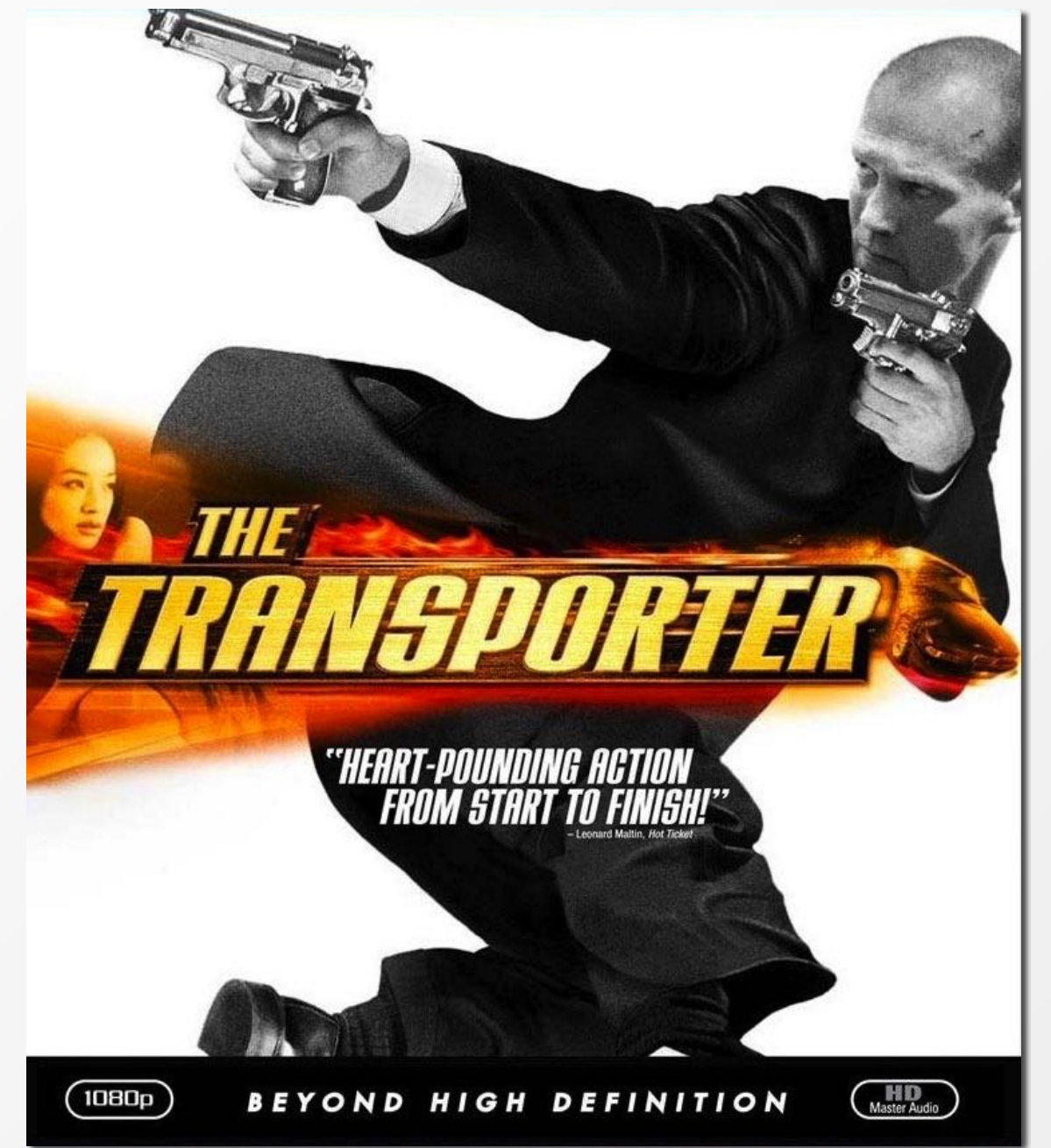


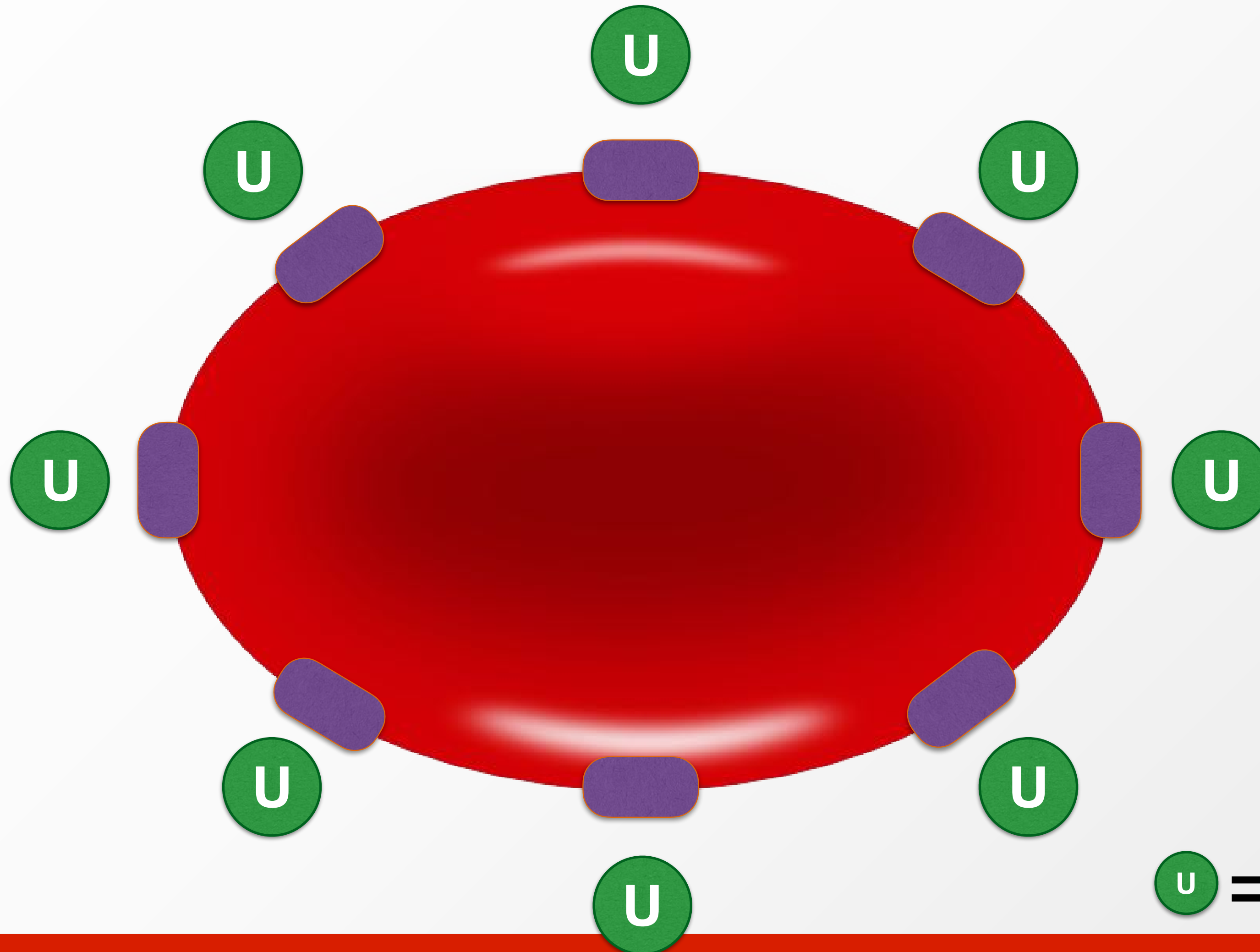
Image: <http://i212.photobucket.com>

Kidd System

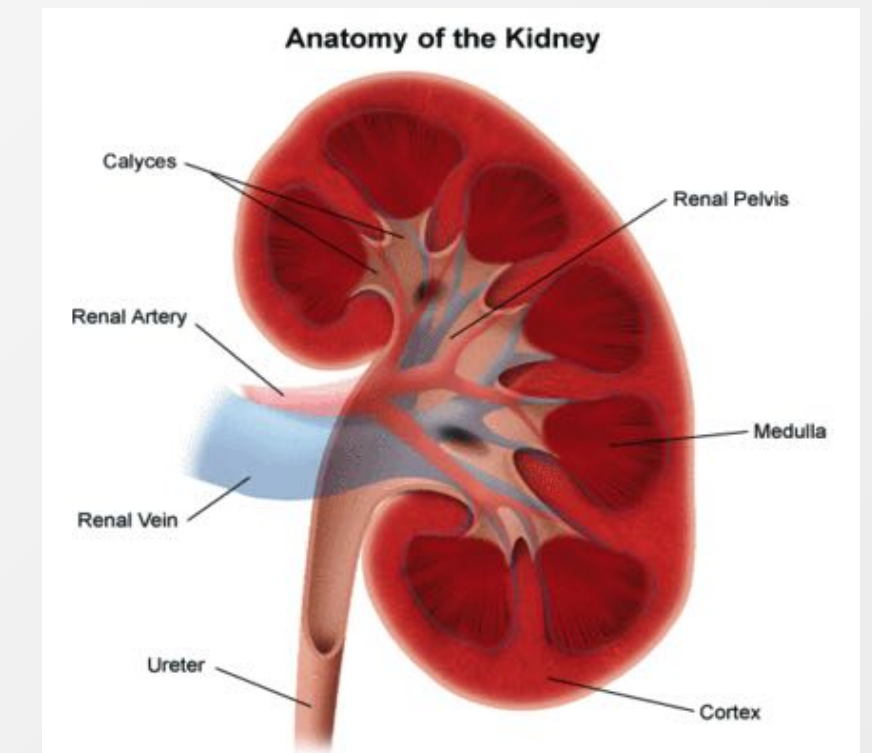
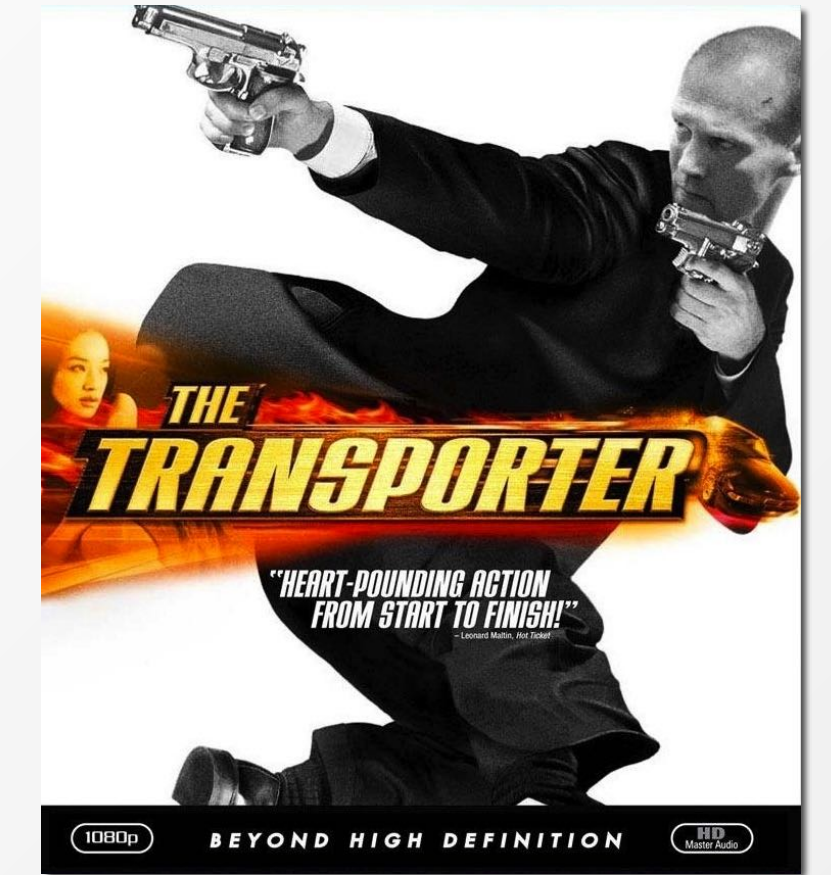
- Antigens:
 - Jk^a and Jk^b
 - ✓ Jk³: Absent in Jk(a-b-)
 - Urea transport antigen
 - ✓ Jk(a-b-) resistant to 2M urea



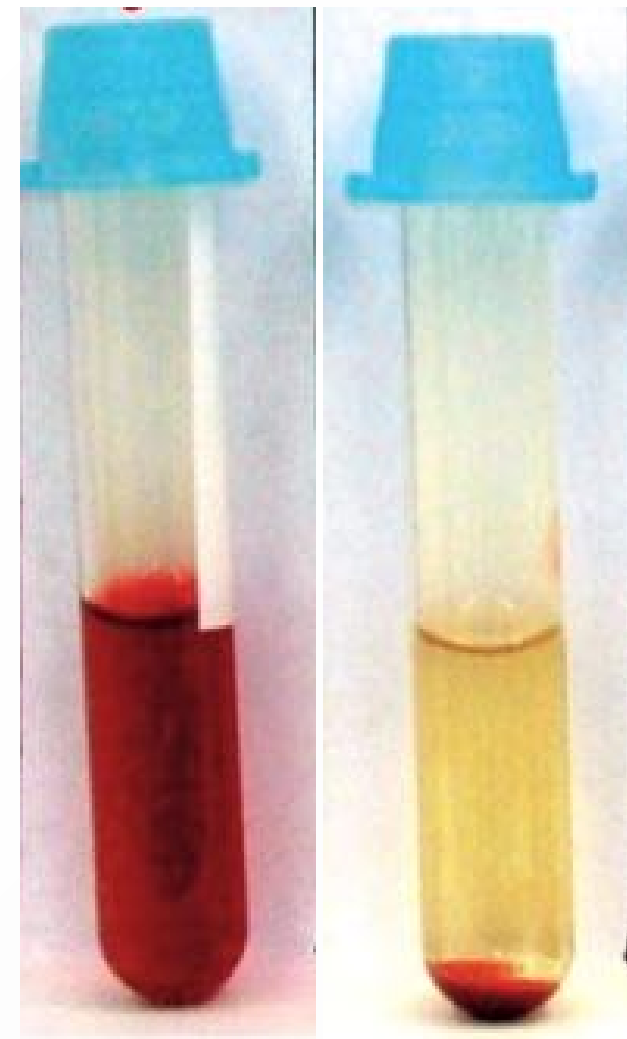
Urea Transport



U = Urea



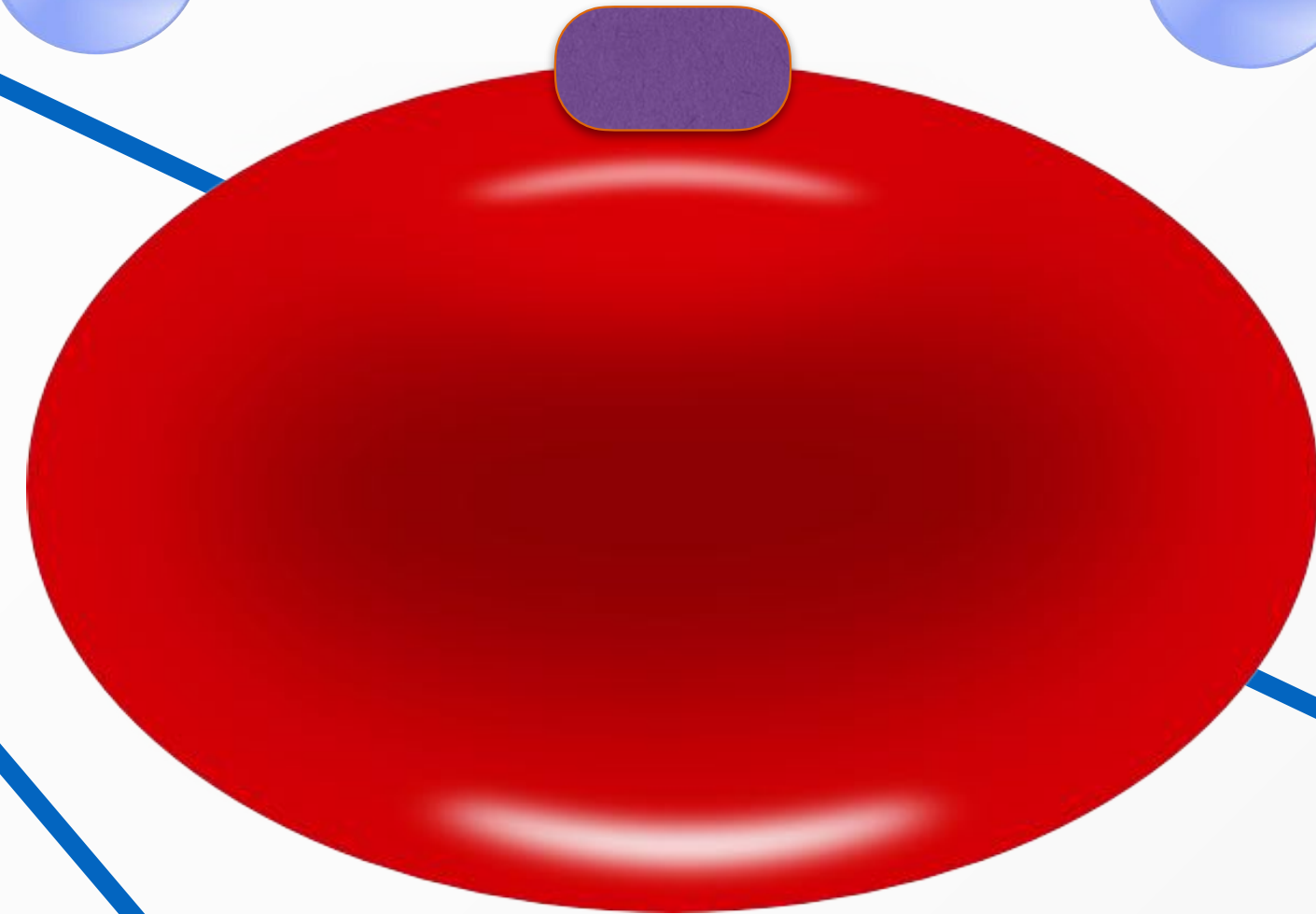
Screen for Jk(a-b-)



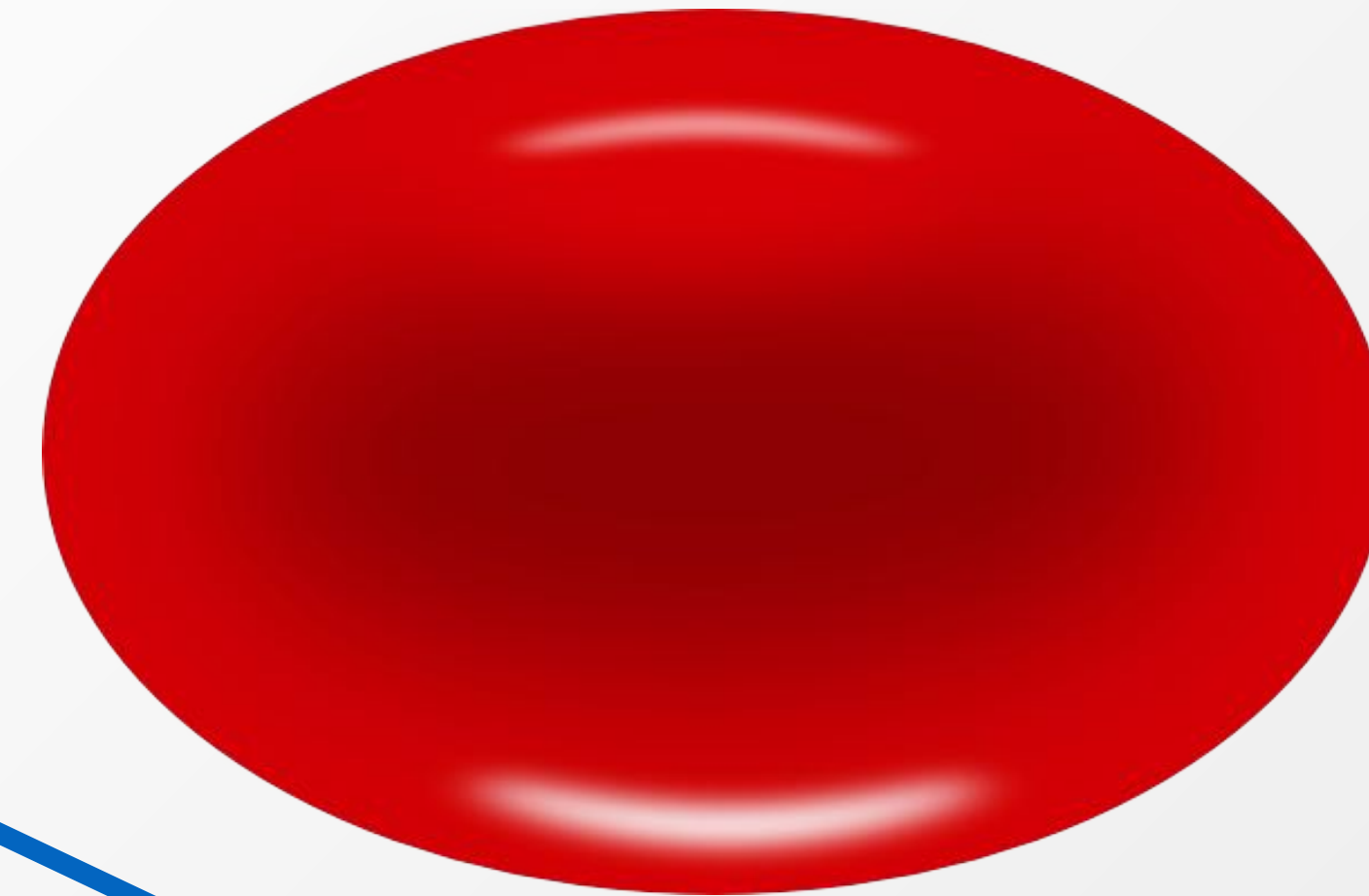
2M Urea



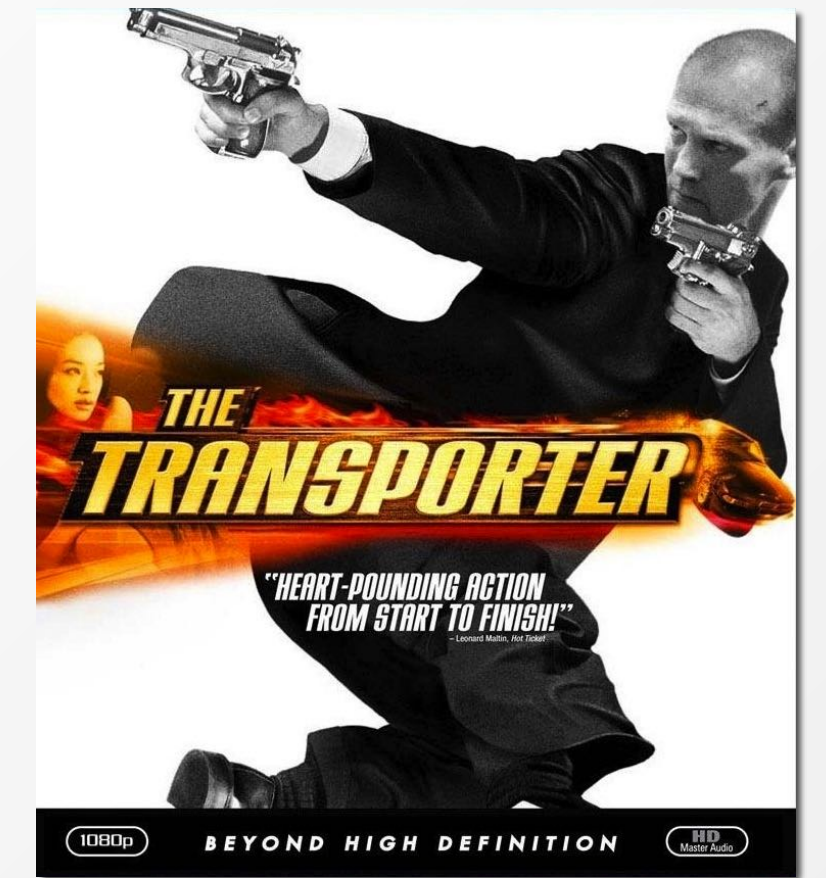
2M Urea



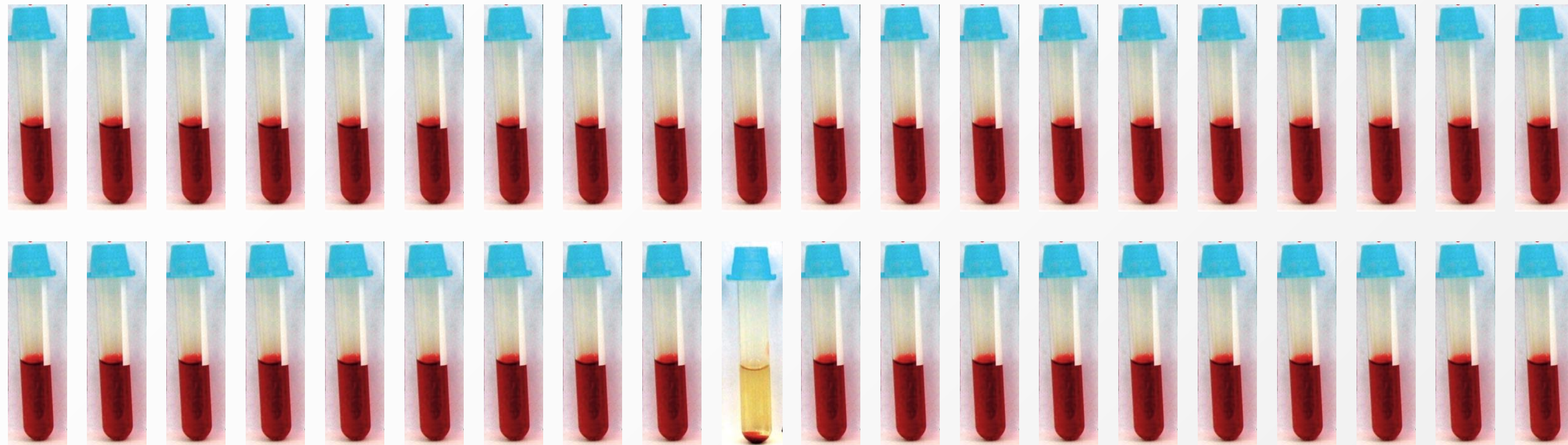
Jk(a+) or Jk(b+)



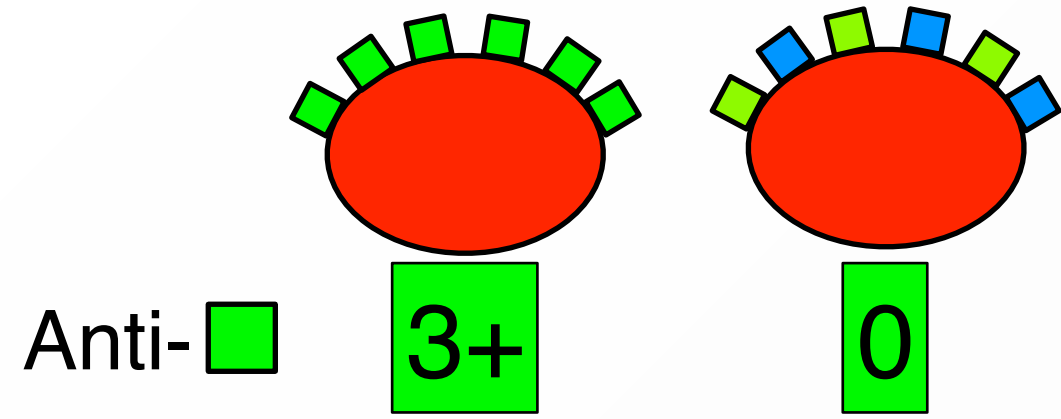
Jk(a-b-)/Jk3-



Screen for Jk(a-b-)






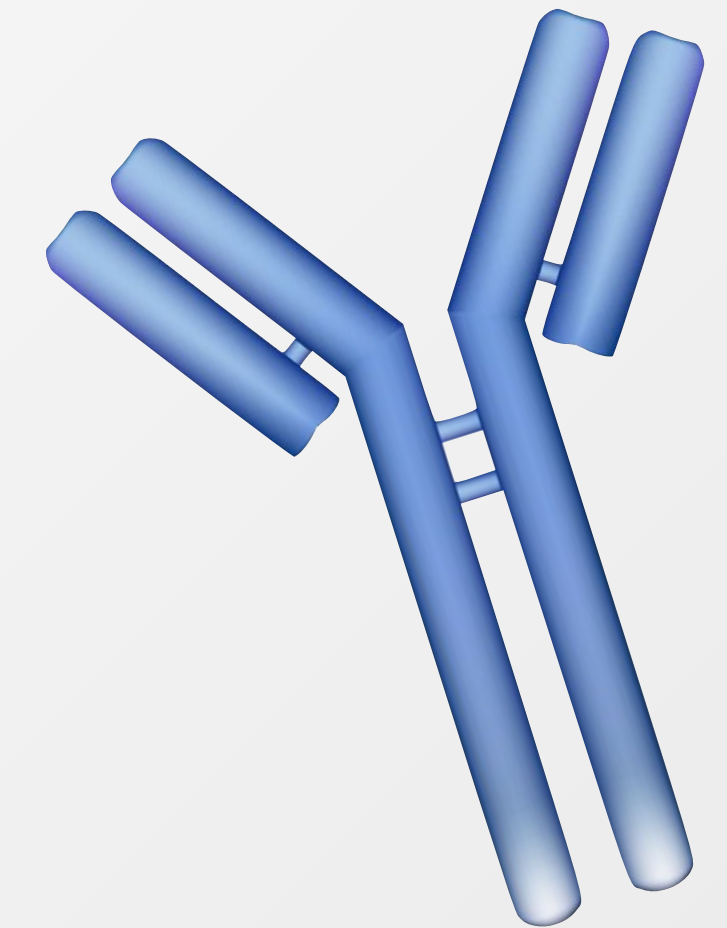
Hi, there!




Kidd Antibodies



- Warm IgG (+/- with IgM component)
 - May fix complement
- Rarely found alone
- Marked dosage 
- Disappear over time 
 - “Hide and seek”
- **Delayed** (or immediate) hemolytic reactions 
 - Undetectable antibody that comes roaring back

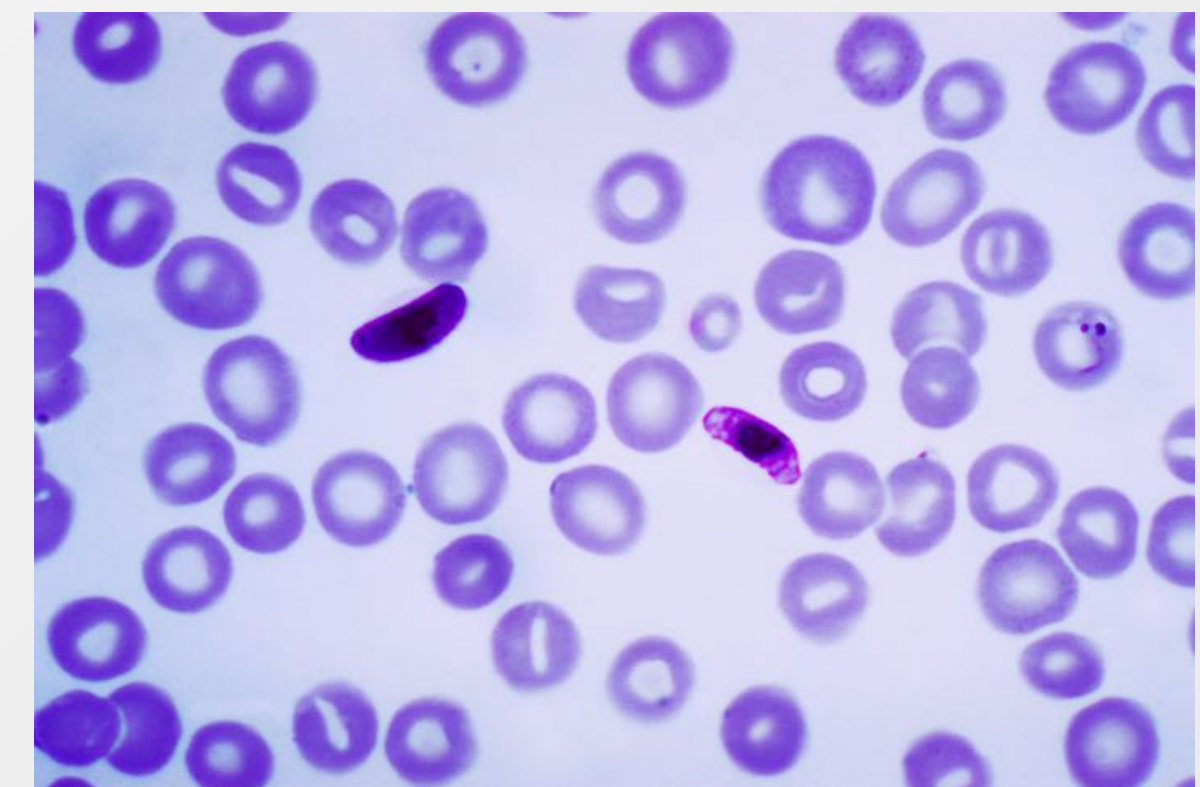


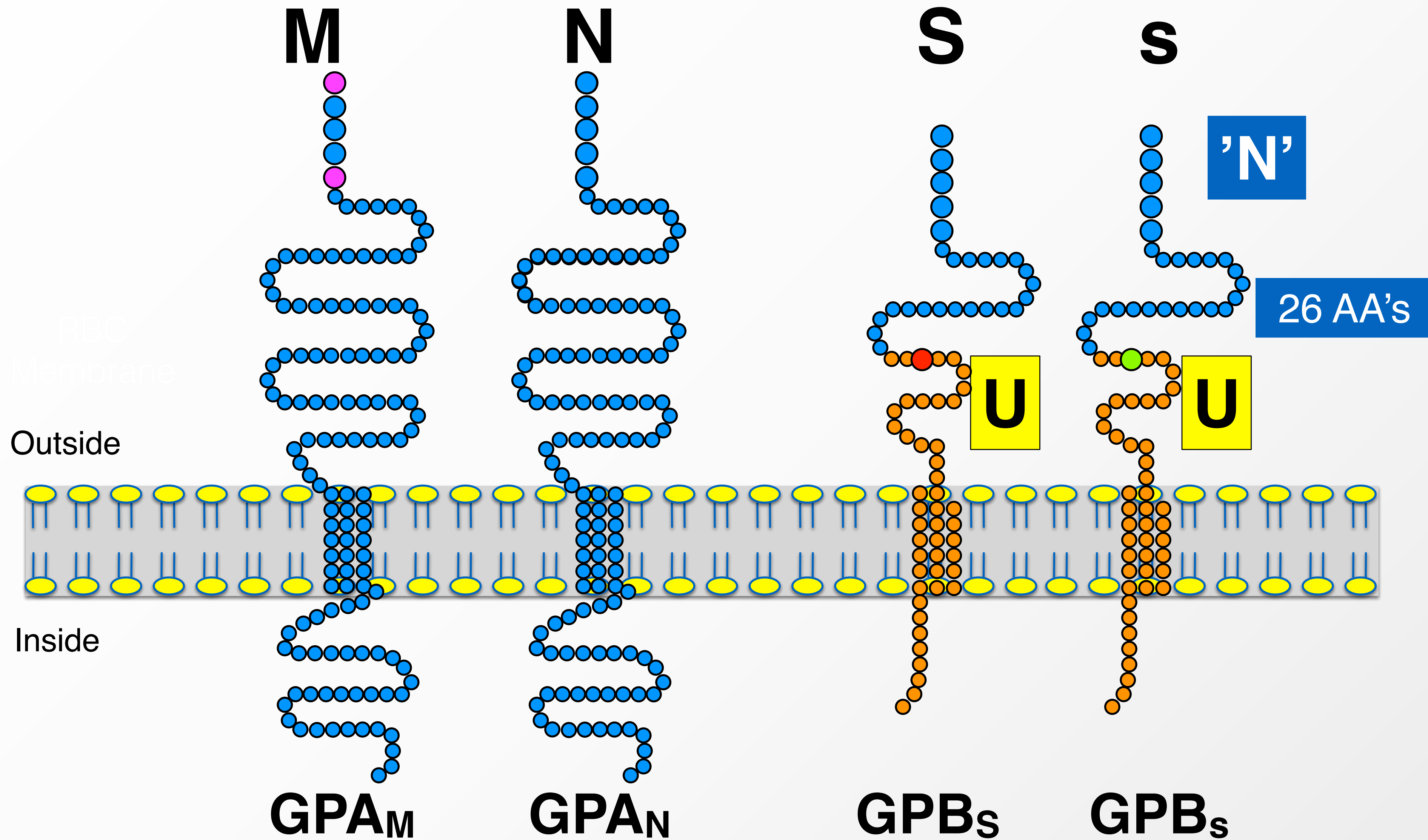
Enzyme Classification

Enhanced	Decreased	Unaffected
<p data-bbox="509 789 1149 1572">ABO-related -ABO/H -Lewis -I -P1PK/GLOB Rh System Kidd System</p>	<p data-bbox="1386 962 1992 1172">MNS System Duffy System</p>	 <p data-bbox="2212 1134 2752 1228">Kell System</p>

MNS System

- 49 recognized antigens; 5 are most important
- **Glycophorin A and B**
 - Glycophorin A carries M and N
 - Glycophorin B carries S, s, and U
 - Both are receptors for malaria parasite
 - ✓ *P. falciparum* attaches here





Ser ↔ 1 ↔ Leu
 Gly ↔ 5 ↔ Glu

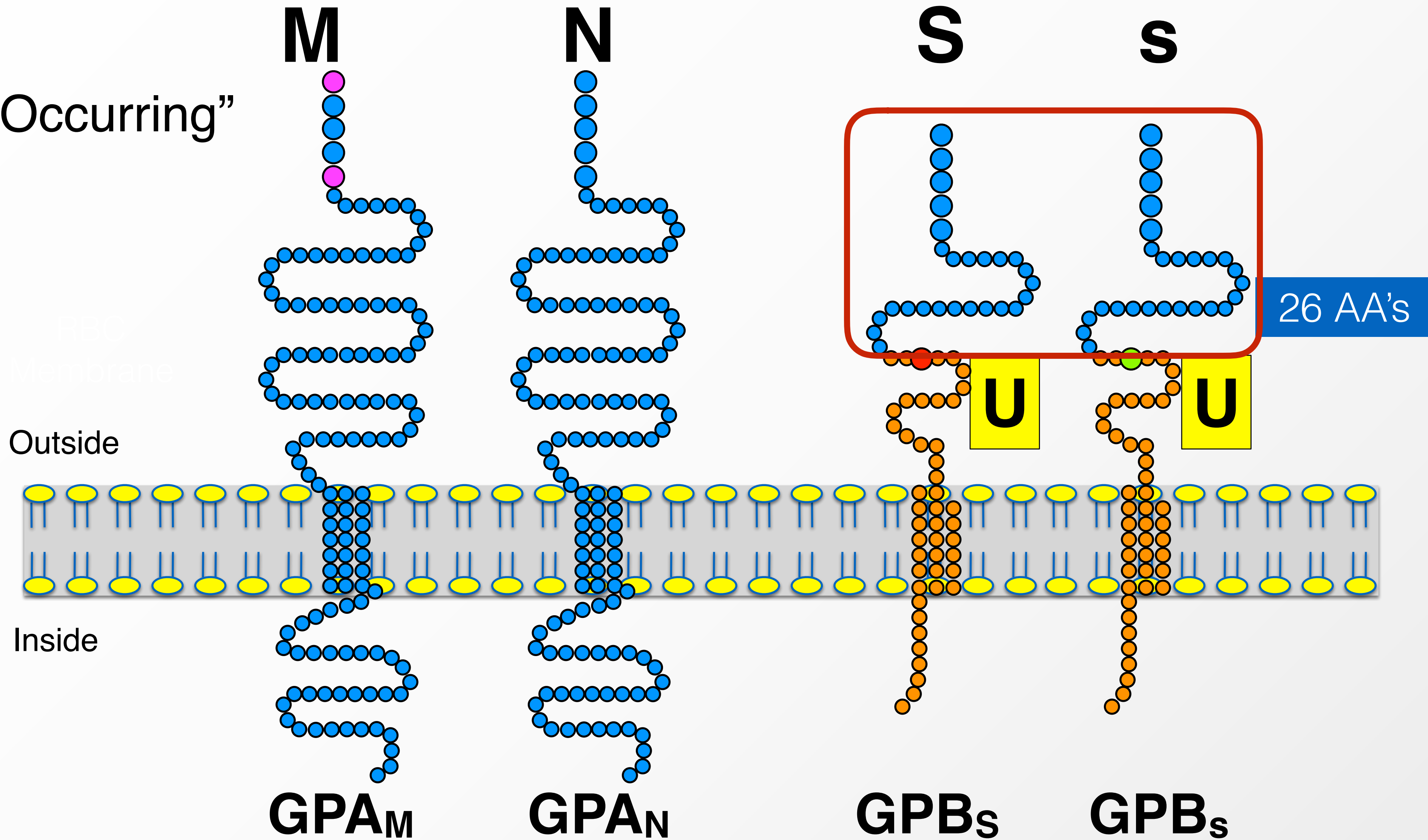
Met ↔ 29 ↔ Thr

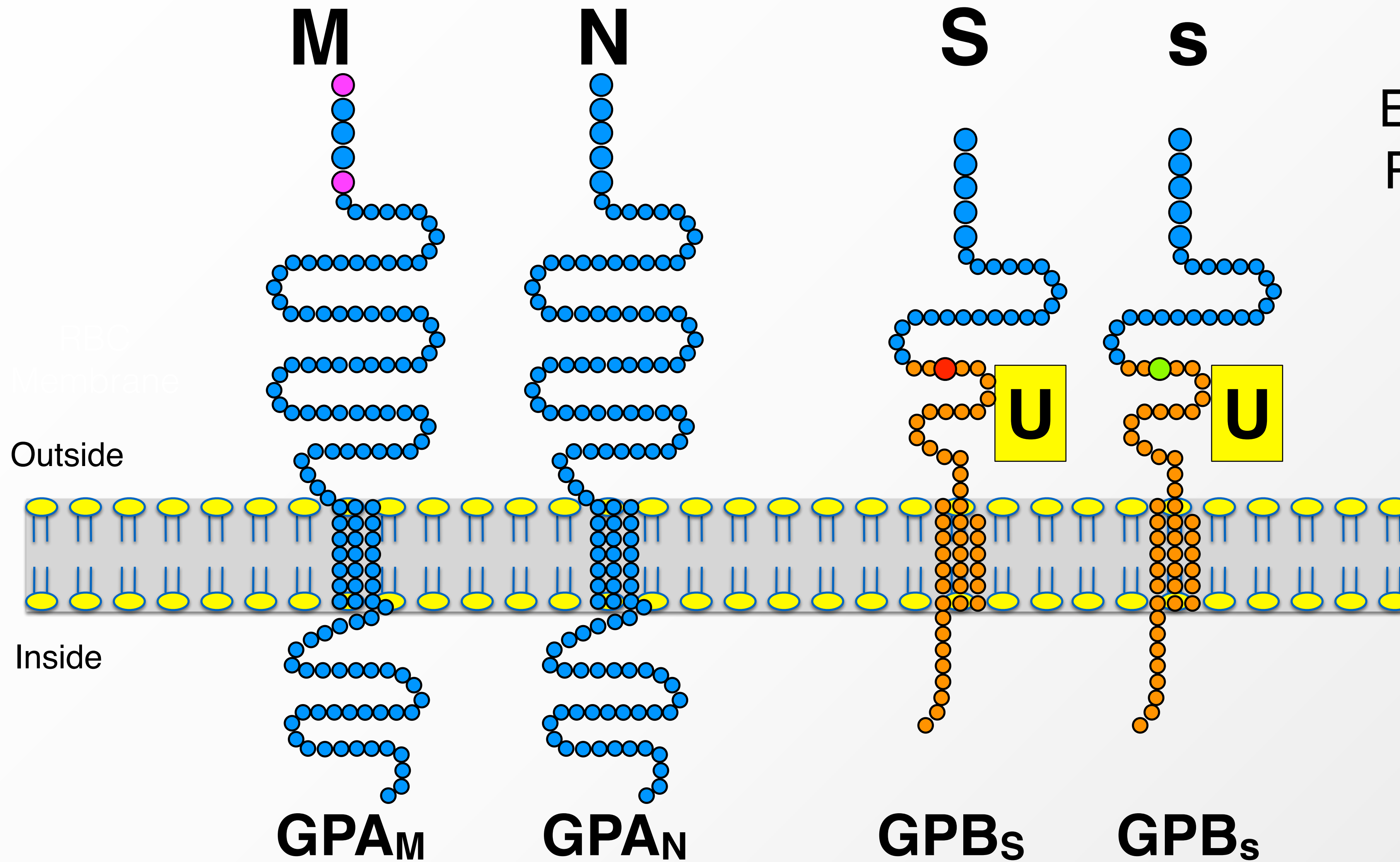
MNS Antibodies

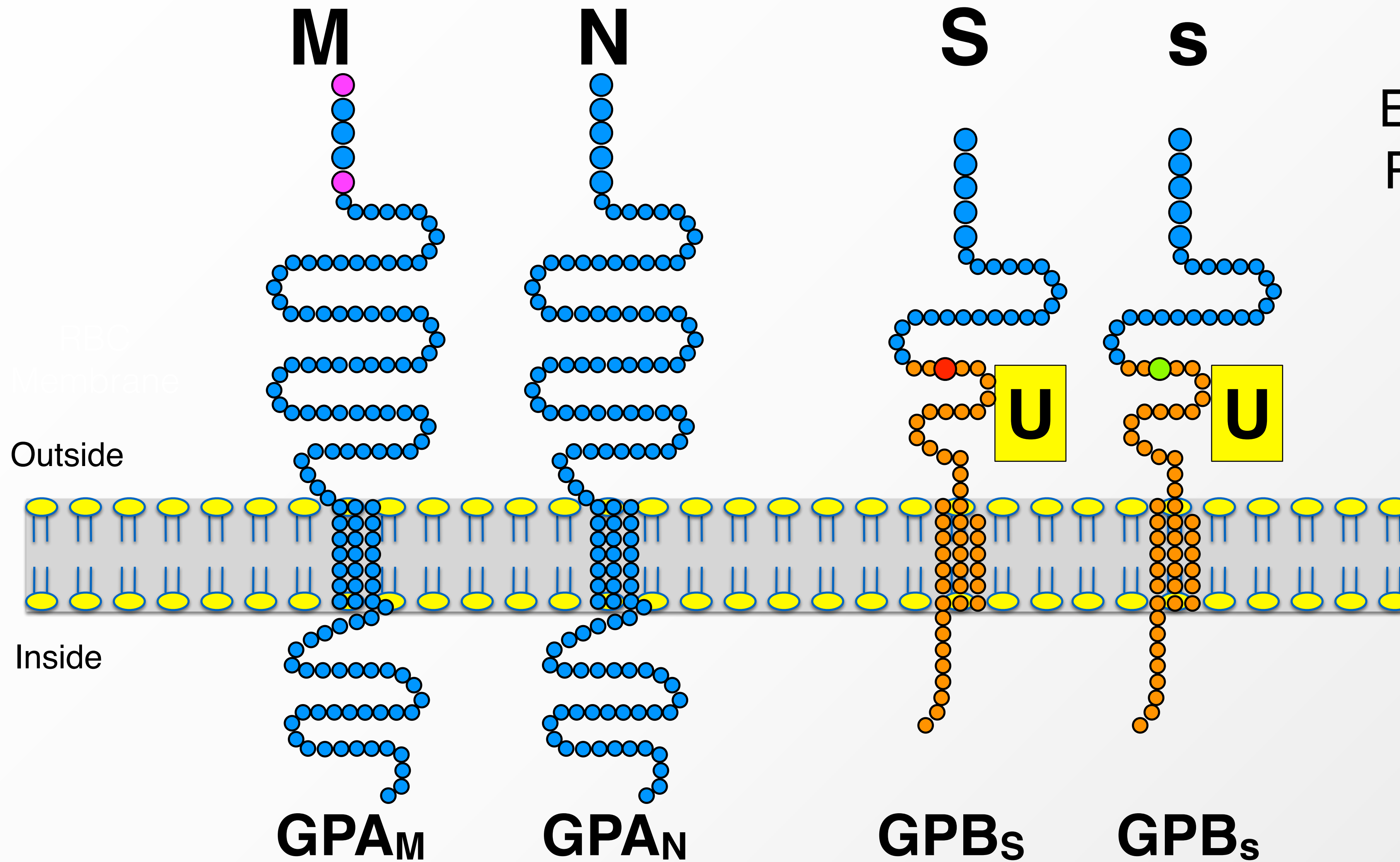
Anti-M and -N	Anti-S, -s, & -U
“Natural”	Exposure
IgM/IgG	IgG
Cold-reactive	37 and AHG
Us. Insignificant	Significant

Occasional
anti-M at 37C ←

“Naturally Occurring”






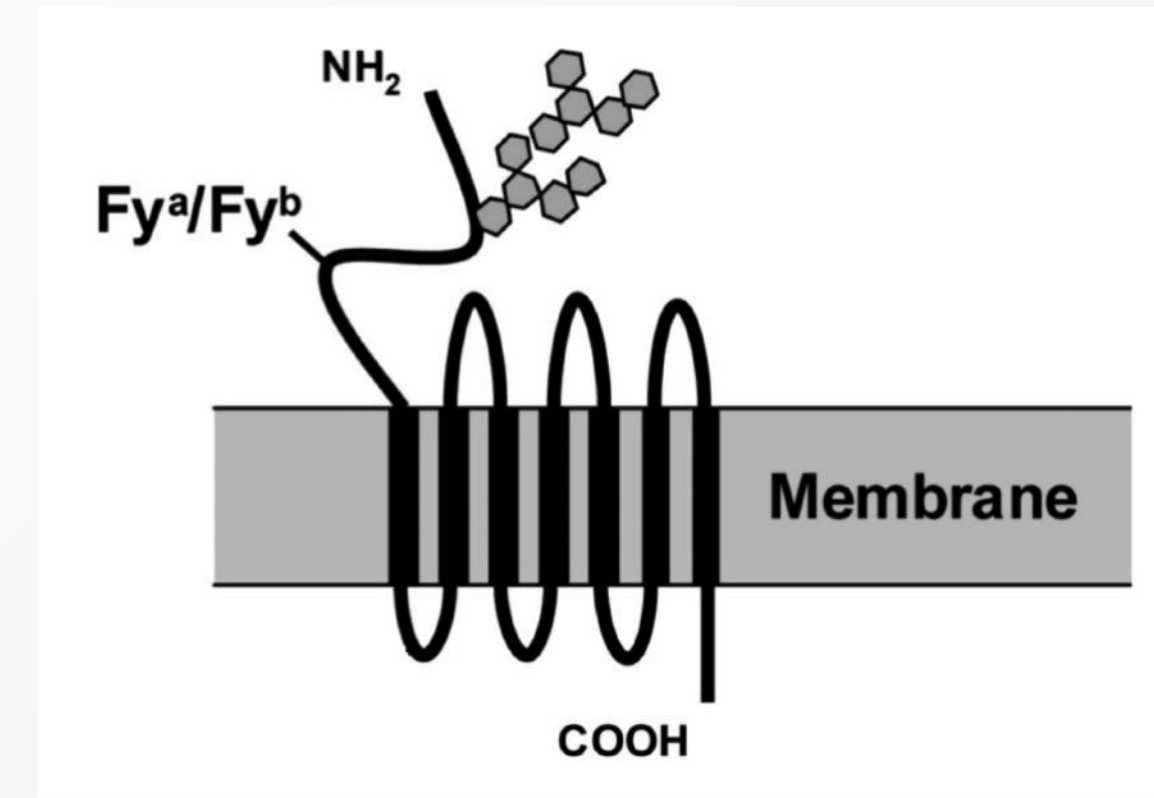


Exposure
Required

MNS Antigens

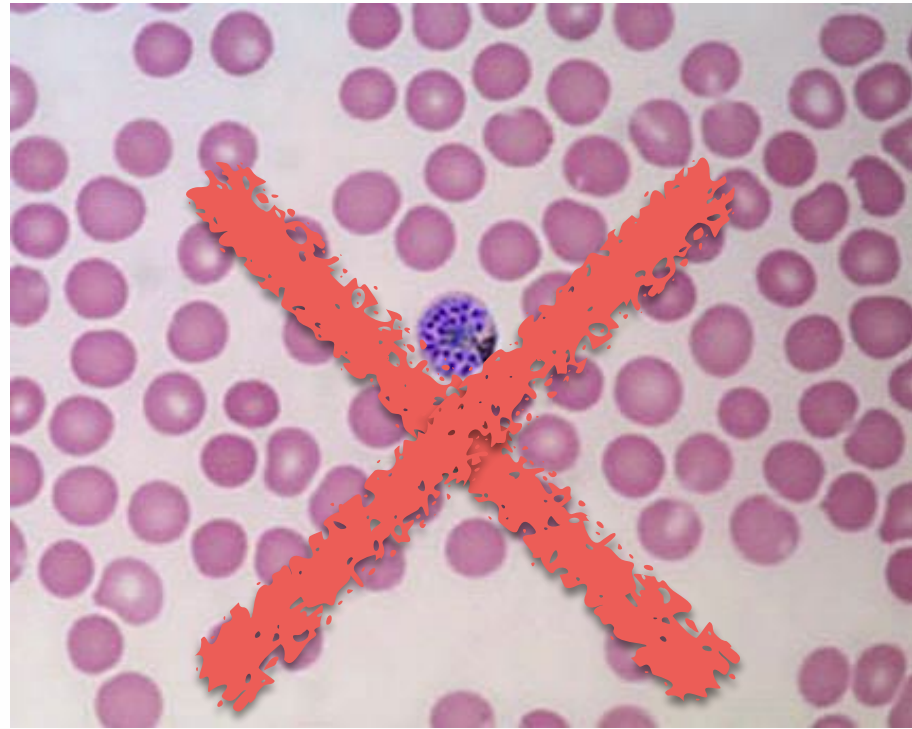
- S-s-U-
 - 1% of African-Americans, never in Caucasians 
 - Anti-U is significant risk
 - ✓ Can cause HTR and HDFN

Duffy System

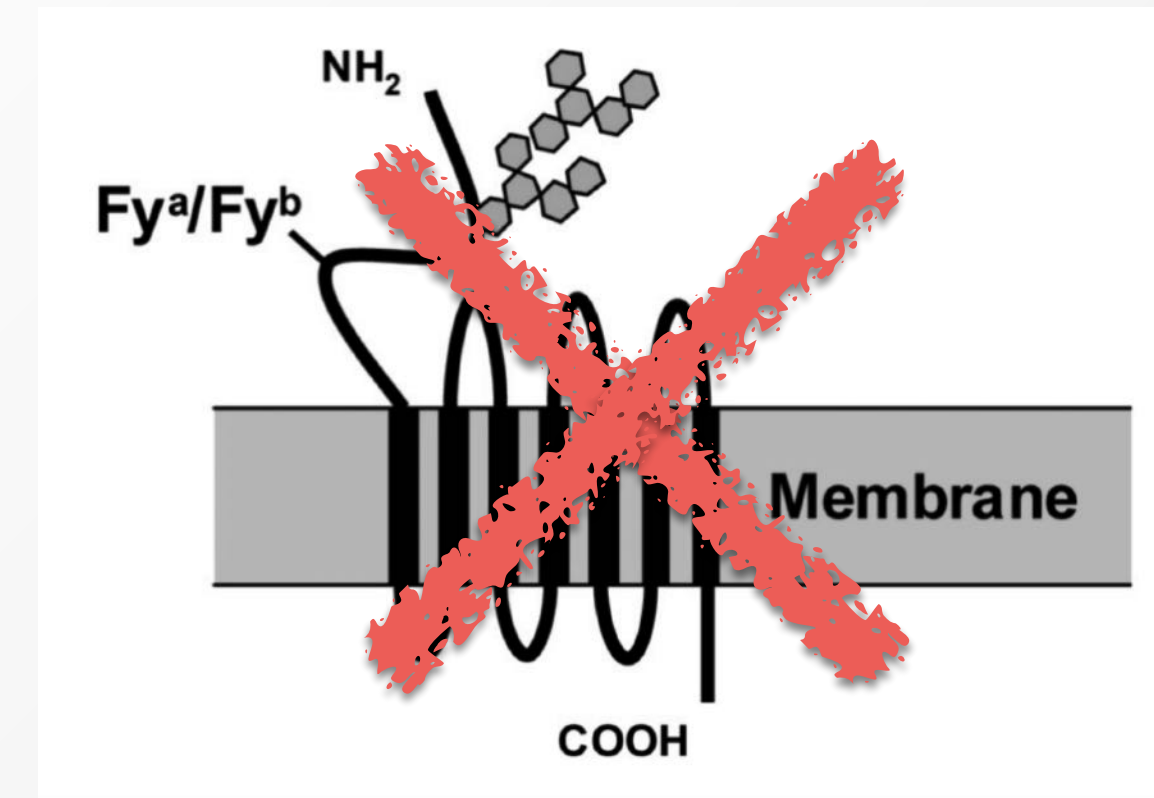


- **Fy^a, Fy^b** main antigens (*FY^{*A}, FY^{*B}* alleles)
 - Carried on RBC membrane protein (ACKR1)
 - Also on endothelial cells of:
 - Heart, lung, kidney, spleen, GI tract
- *FY^{*B}* is commonly mutated in African-Americans
 - This mutation impacts Fy^b expression ON RBCs
 - BUT NOT everywhere else!

Image: AABB Technical Manual, 19th ed, p 331



Fy(a-b-)



	C	AA
Fy(a+b-)	17	9
Fy(a+b+)	49	1
Fy(a-b+)	34	22
Fy(a-b-)	rare	68






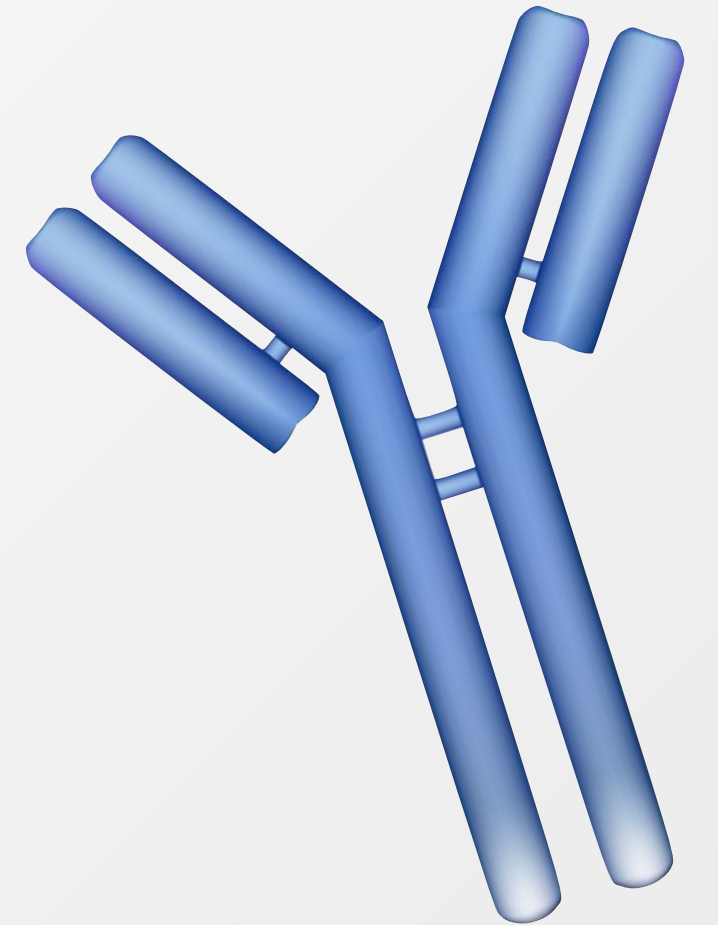
Fy(a-b-) individuals of African descent rarely make anti-Fy^b

Fy(a-b-) individuals of African descent are resistant to *P. vivax*


Image: AABB Technical Manual, 19th ed, p 331

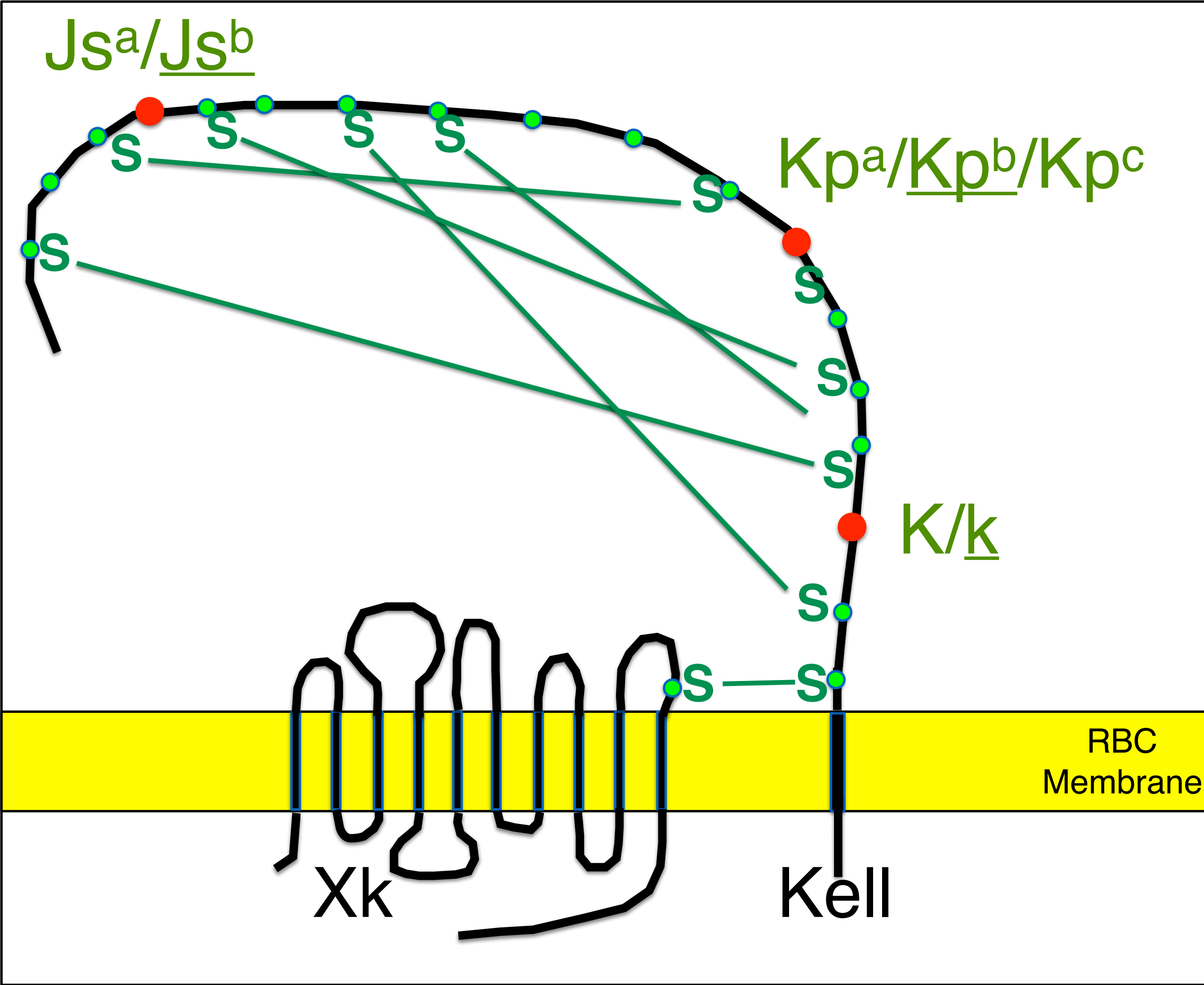
Duffy Antibodies

- Exposure-requiring warm IgG
 - Marked dosage (like Kidd) 
 - Can disappear (like Kidd) 
 - Delayed HTRs (like Kidd) 
 - Anti-Fya >> anti-Fyb



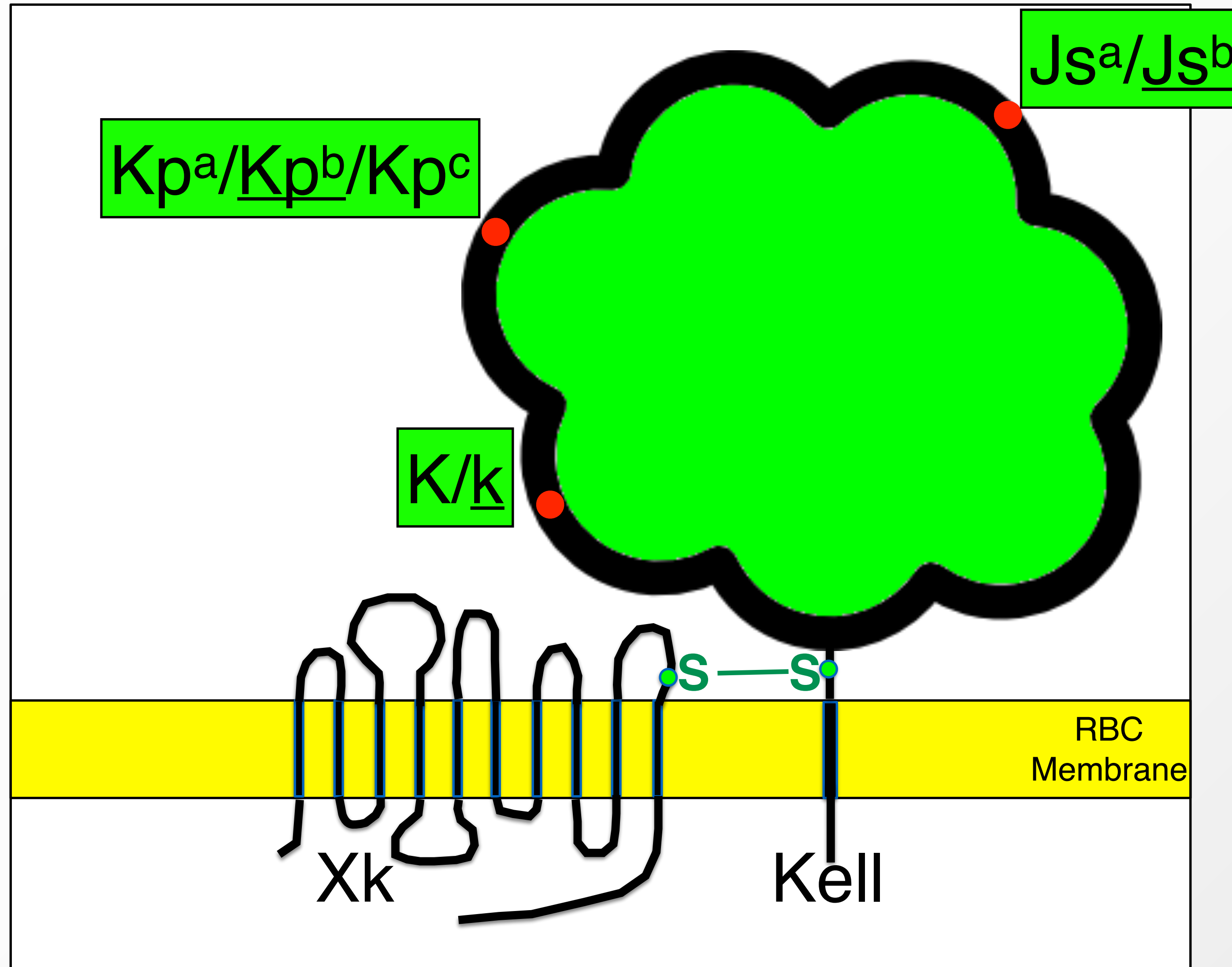
Enzyme Classification

Enhanced	Decreased	Unaffected
<p data-bbox="513 795 1069 870">ABO-related</p> <ul data-bbox="559 907 1152 1564" style="list-style-type: none"><li data-bbox="559 907 902 983">-ABO/H<li data-bbox="559 1020 869 1095">-Lewis<li data-bbox="559 1133 626 1208">-I<li data-bbox="559 1245 1152 1320">-P1PK/GLOB<li data-bbox="513 1358 1012 1433">Rh System<li data-bbox="513 1470 1092 1564">Kidd System	<p data-bbox="1392 964 1992 1170">MNS System Duffy System</p>	 <p data-bbox="2212 1133 2745 1226">Kell System</p>






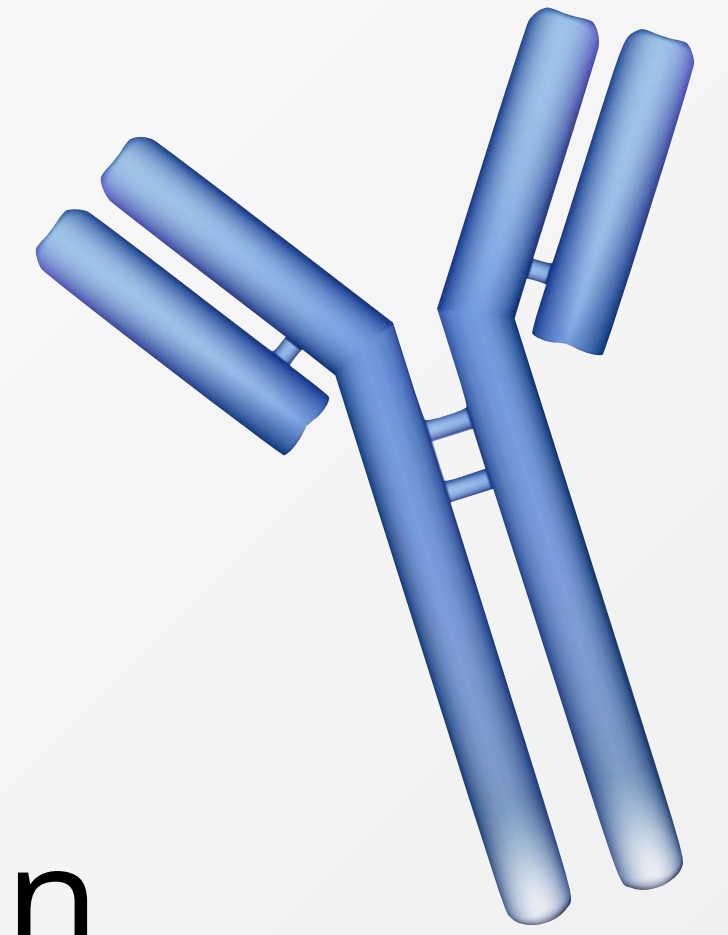
Dithiothreitol (DTT)




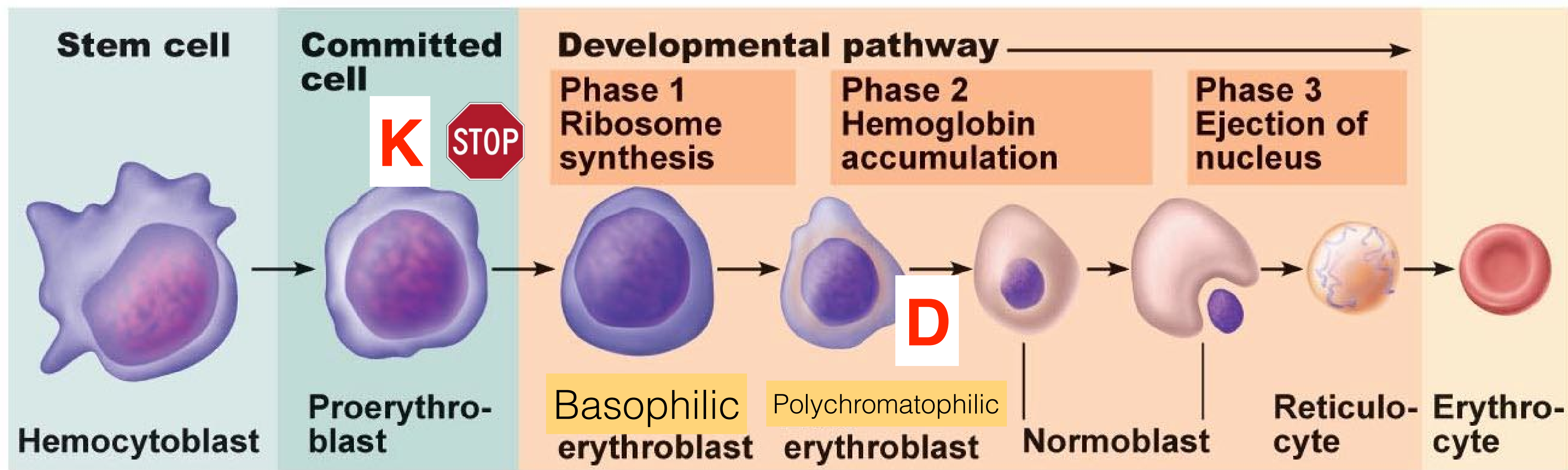
Kell Antigens

- 36 antigens!
- Most important: **K** (aka KEL1, NOT “Kell”)
 - 9% Caucasians, 2% African-Americans 
- High frequency:
 - k (aka KEL2, “Cellano”); 99.8%
 - Js^b, Kp^b


Kell Antibodies



- Anti-K
 - After D, most immunogenic non-ABO antigen
 - ✓ 1/3 of non-Rh antibodies!
 - Exposure-requiring warm IgG
 - Severe HTRs
 - Severe HDFN* 
- Anti-k
 - Like anti-K, just very uncommon




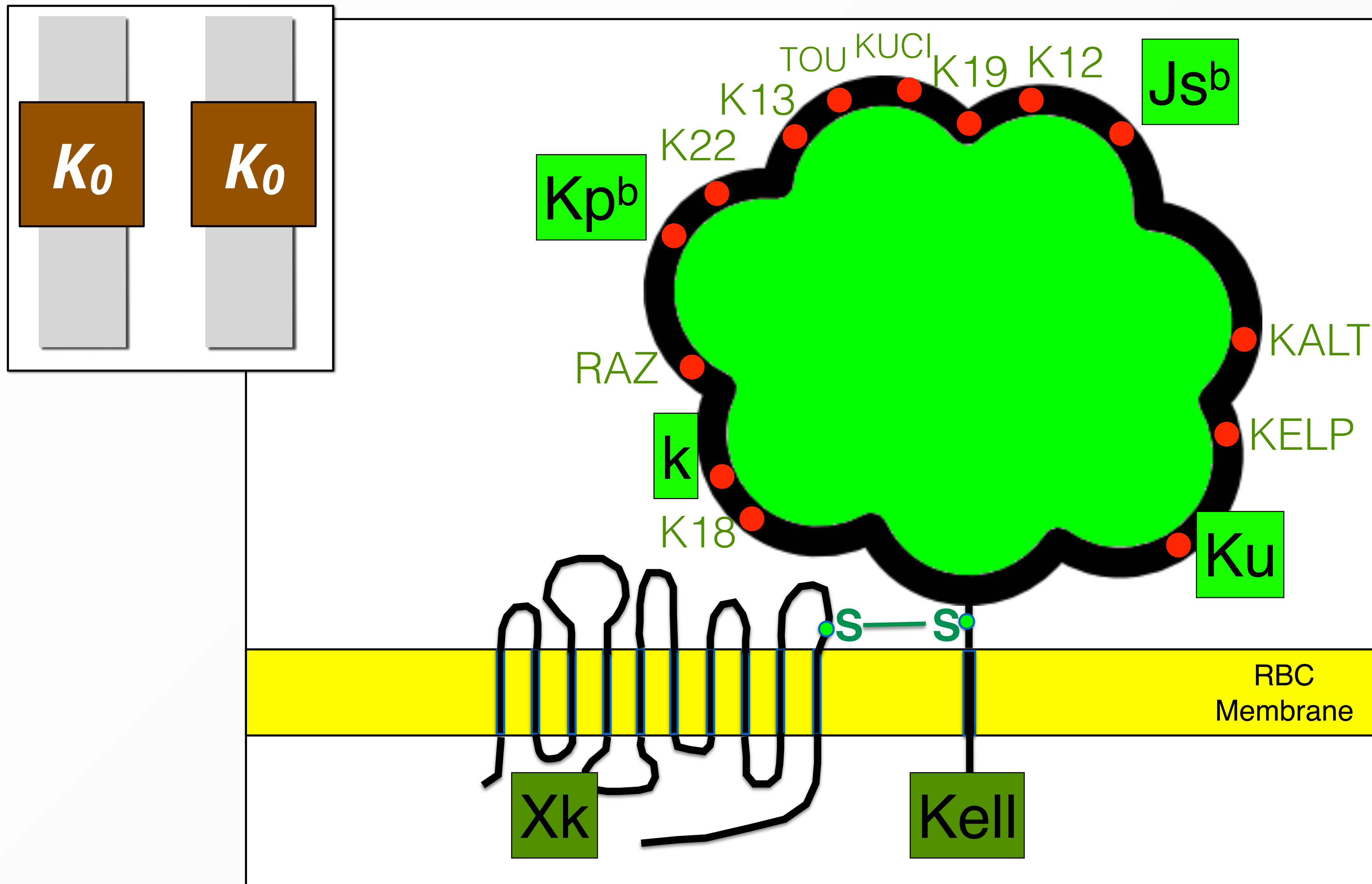
Anti-K “HDFN”

- Suppression 
- Reticulocytopenia
- ANEMIA
- Titers hardly matter

vs.

RhD HDFN

- Hemolysis 
- Reticulocytosis
- Hyperbilirubinemia
- Anemia



“Kell Null”

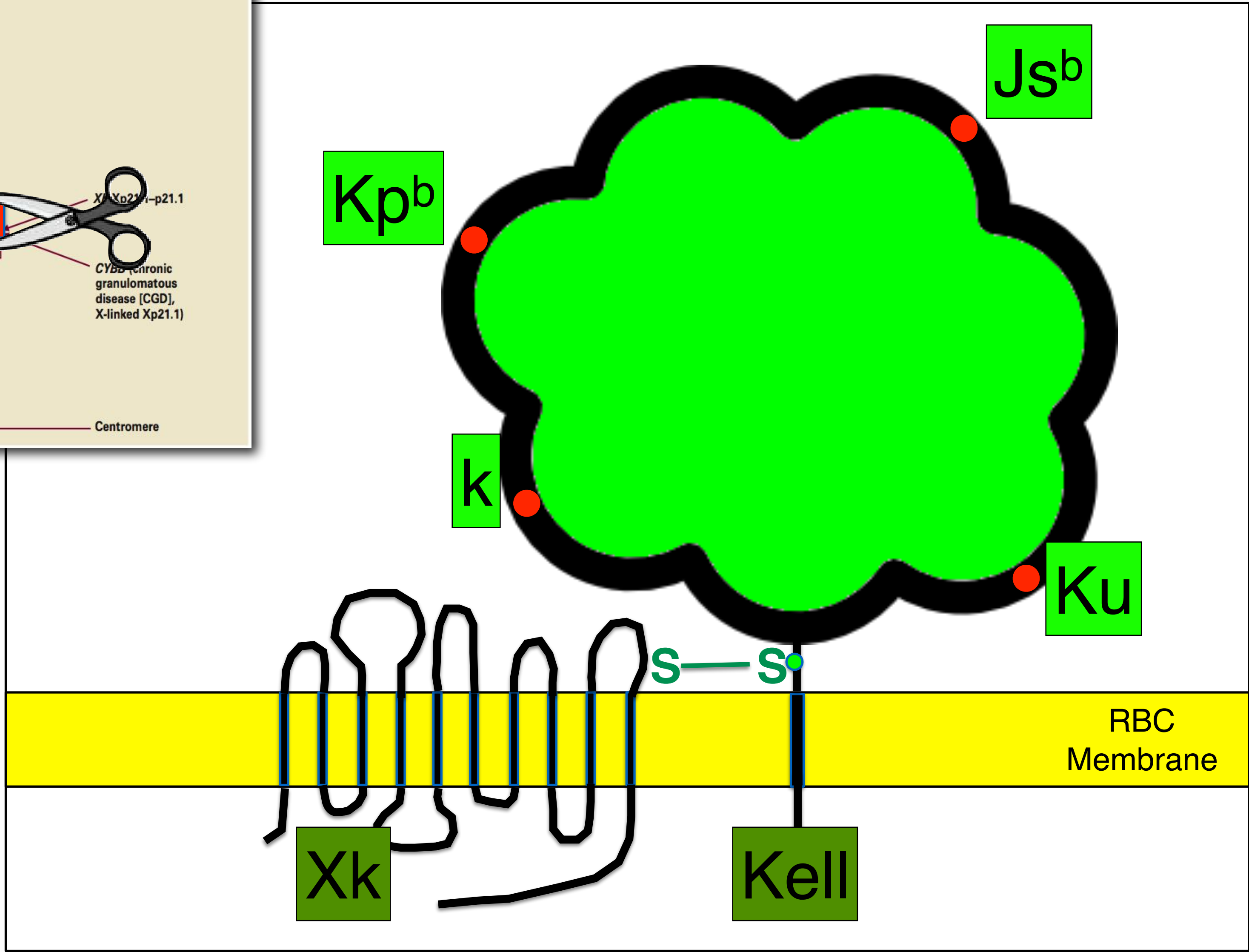
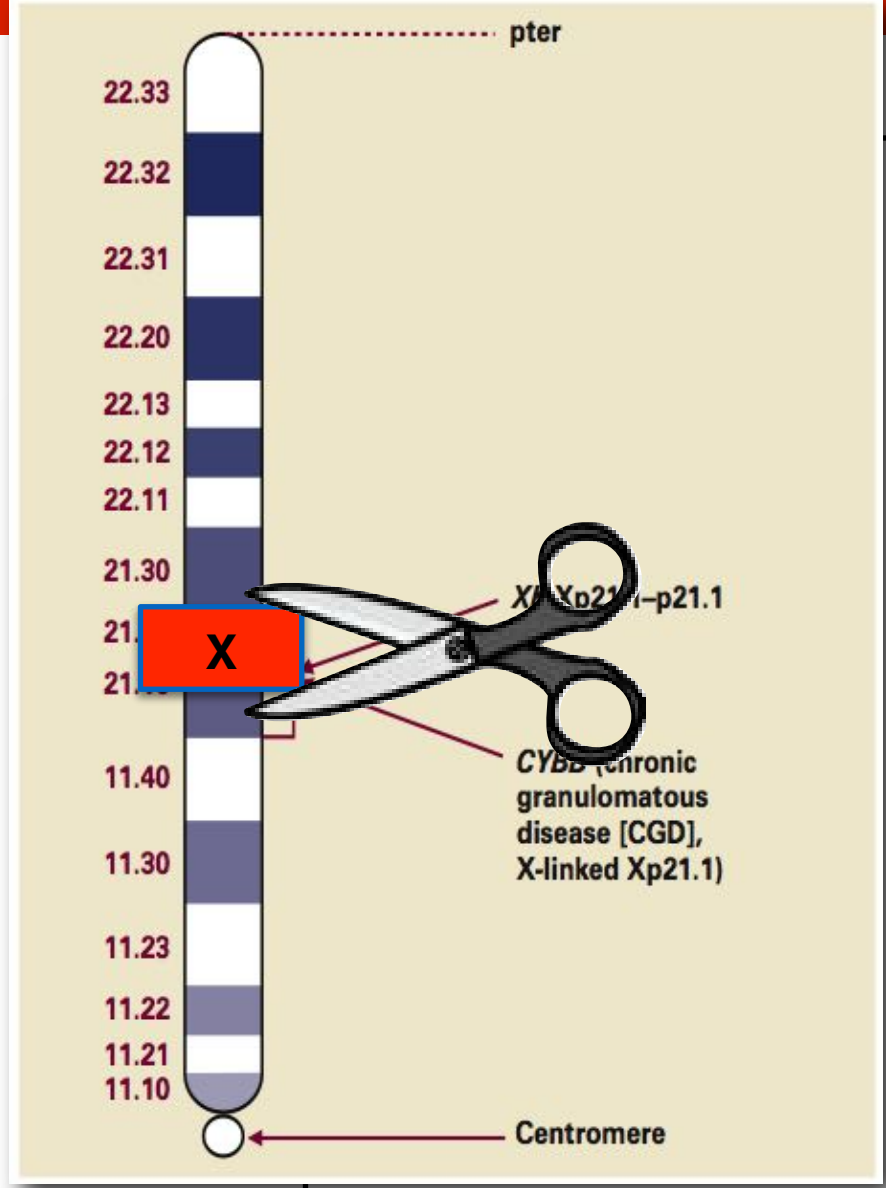
K_0

Anti-Ku

Severe HTRs
Severe HDFN

Ku = Kell “universal”

“McLeod”



McLeod Neuroacanthosis

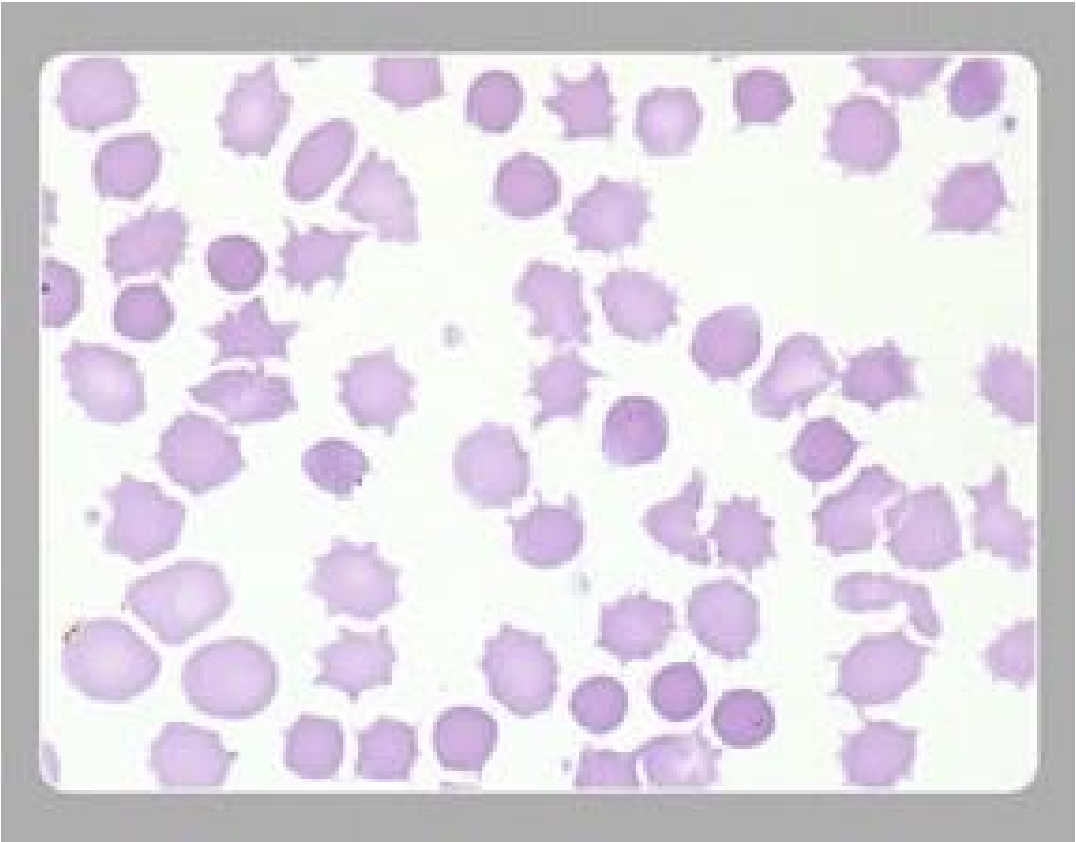
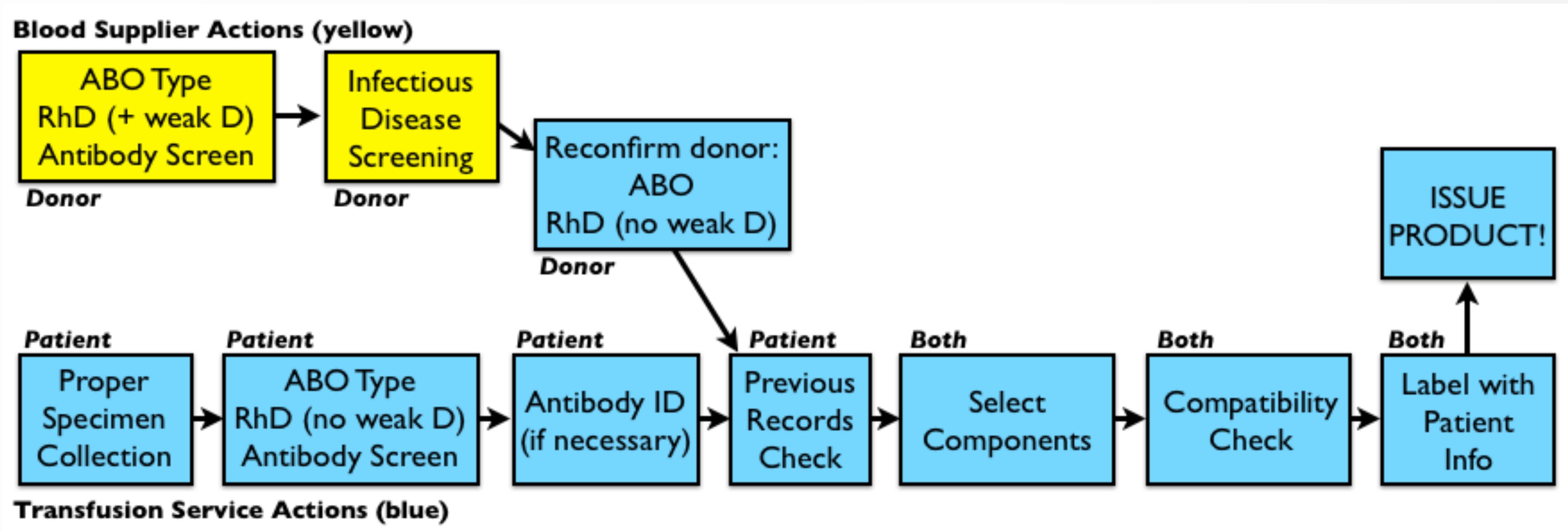
McLeod <u>Phenotype</u>	McLeod <u>Syndrome</u>
RBCs lack Kx RBCs have decreased Kell Ags	RBCs lack Kx RBCs have decreased Kell Ags
	<u>Acanthocytic</u> hemolytic anemia X-linked CGD (minority) Chorea, seizures Psychiatric disorders Muscle wasting Cardiac arrhythmia

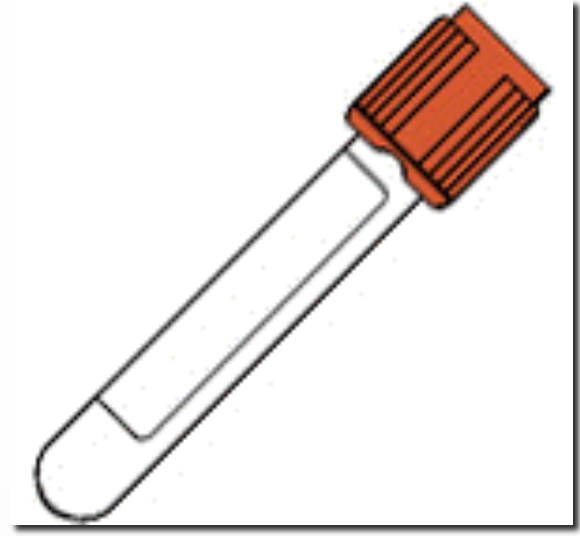
Image: Blood 108:5;1433 (Maslak P)

Pretransfusion Testing

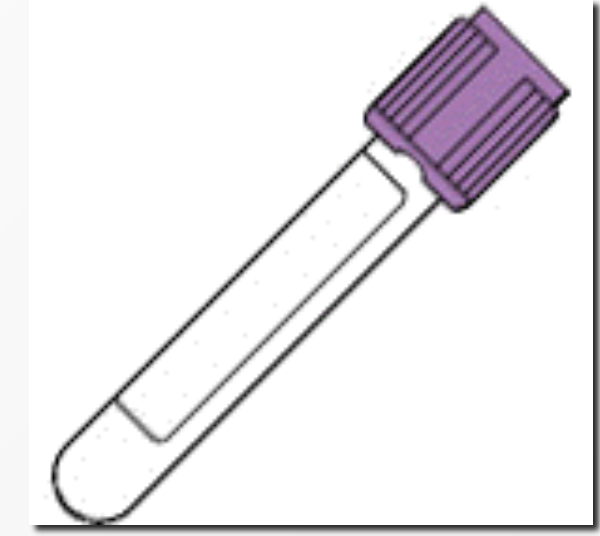


Recipient Testing

- Request forms
 - Proper ID critical!
 - No ID labeling errors should be corrected
 - ✓ 1997 study: samples 40X more likely to have issues if mislabeled
 - What's needed and when needed
 - Provider
 - Modifications



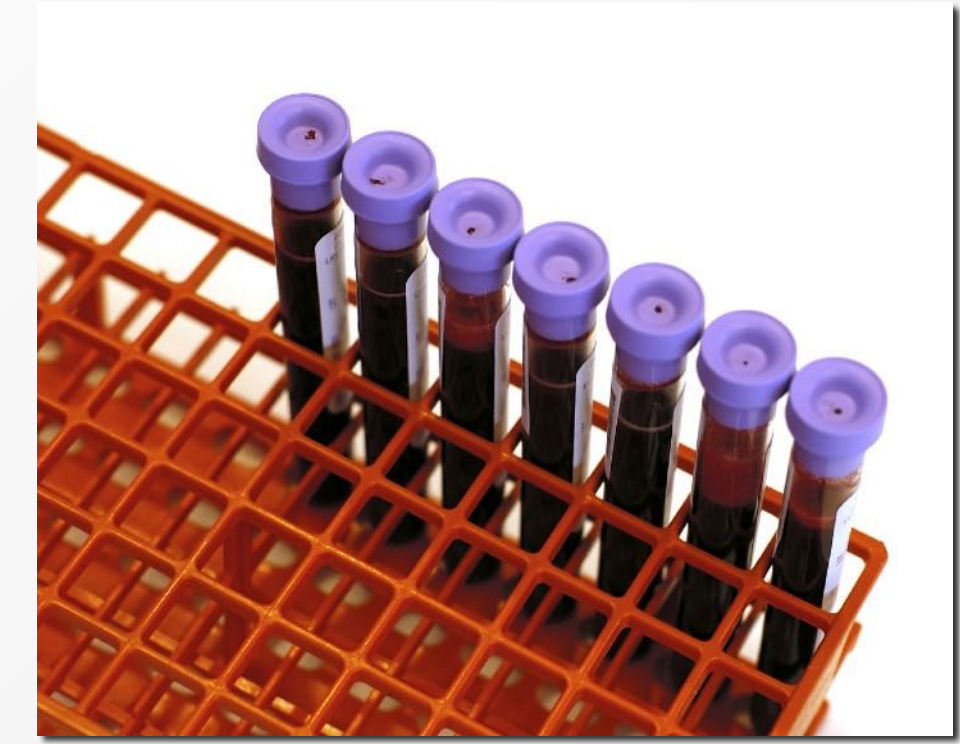
Specimen



- Labeled at bedside
- Red top (serum) or lavender top (plasma) OK
 - Current technologies: Plasma
 - ✓ Serum: Debris interference
 - ✓ Plasma may inhibit C-dep. Abs
- Two separate samples required by AABB/CA if first time seeing patient in your facility

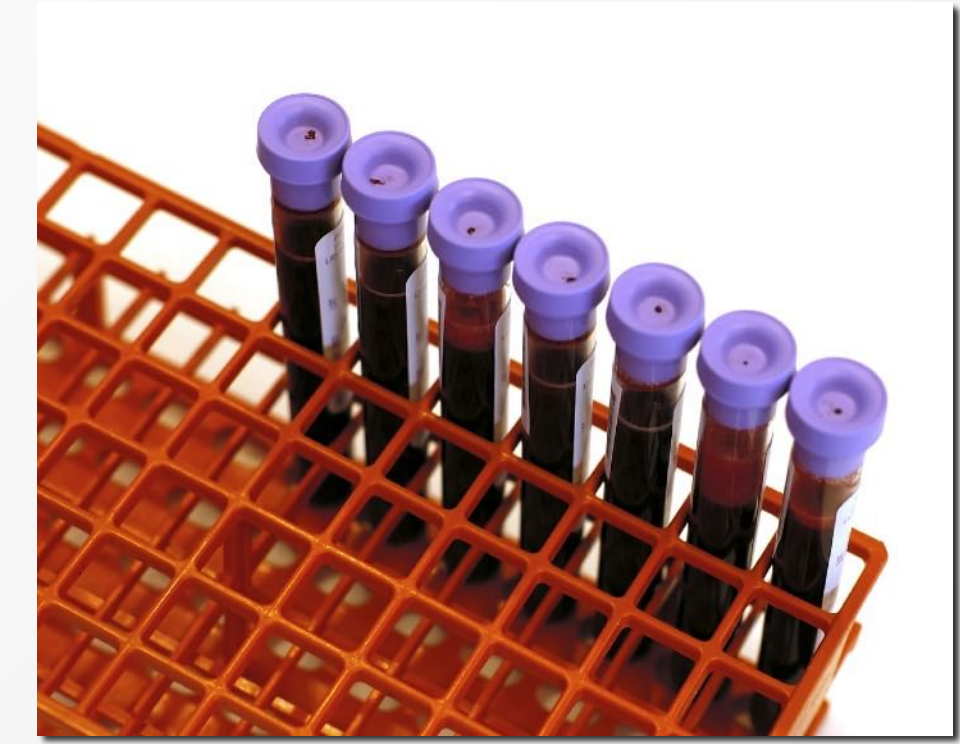
Type and Screen

- Test ordered when RBCs *might* be needed
- Records check for comparison only
- ABO testing
- Rh typing (no weak D)
- Antibody detection / “screen”

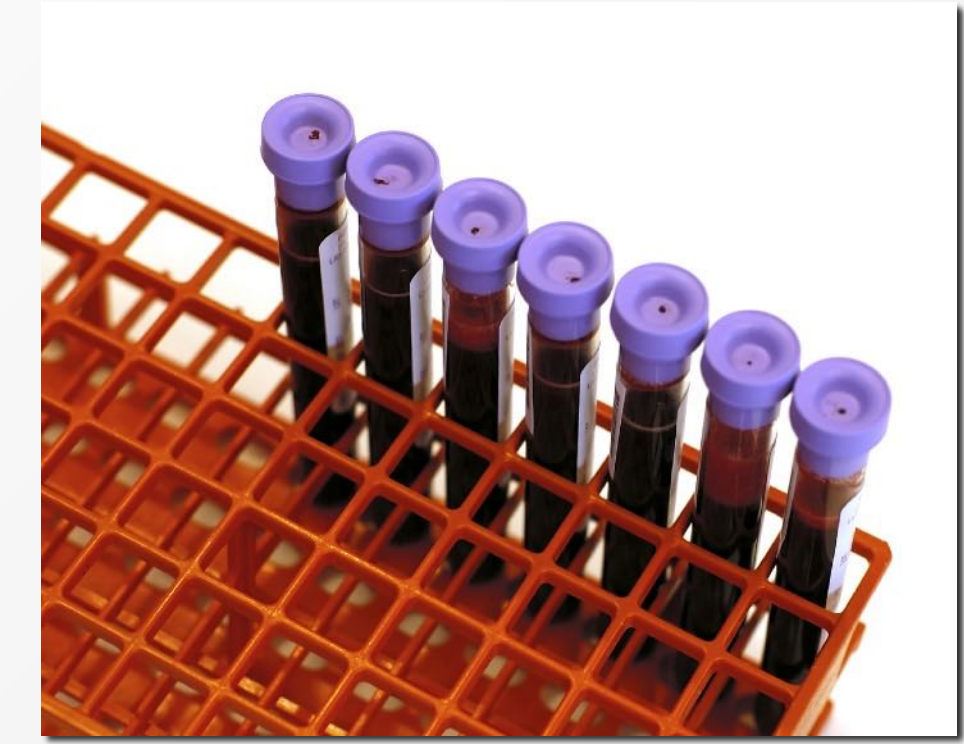


Antibody Screen

- Pt plasma/serum vs. 2/3/4 group O donors
- MUST read at AHG
- 18 antigens required by FDA
 - D, C, c, E, e, Jk^a, Jk^b, M, N, S, s, Fy^a, Fy^b, K, k
 - Le^a, Le^b, P1



Antibody Screen



Cell	Rh-hr	Rh							Kell					Kidd		Duffy		Lewis		MNS				P	Luth.		Results				
		D	C	E	c	e	f	C ^w	K	k	Kp ^a	Kp ^b	Js ^a	Js ^b	Jk ^a	Jk ^b	Fy ^a	Fy ^b	Le ^a	Le ^b	M	N	S	s	P1	Lu ^a	Lu ^b		Gel		
1	R1R1	+	+	0	0	+	0	0	+	+	0	+	0	+	0	+	0	0	+	+	+	0	+	+	0	+	0	+	1	2+	
2	R2R2	+	0	+	+	0	0	0	0	+	0	+	0	+	0	0	+	+	0	+	+	+	+	0	0	+	2	0			

Cell	Rh-hr	Rh							Kell					Kidd		Duffy		Lewis		MNS				P	Luth.		Results			
		D	C	E	c	e	f	C ^w	K	k	Kp ^a	Kp ^b	Js ^a	Js ^b	Jk ^a	Jk ^b	Fy ^a	Fy ^b	Le ^a	Le ^b	M	N	S	s	P1	Lu ^a	Lu ^b		IS	AHG
1	R1R1	+	+	0	0	+	0	0	+	+	0	+	0	+	0	+	0	+	0	+	0	+	0	+	+	0	+	1	0	0
2	R2R2	+	0	+	+	0	0	0	0	+	0	+	0	+	0	+	0	0	+	+	+	0	0	+	0	+	2	2+	0	
3	rr	0	0	0	+	+	+	0	0	+	0	+	0	+	0	+	0	+	0	+	+	0	+	0	+	3	3+	0		

Type and Crossmatch

- When RBCs are *most likely* or *definitely* needed
- Everything in T&S PLUS crossmatch
- Major crossmatch
 - Recipient serum vs. donor RBCs
 - ABO compatibility
 - Required if \geq **2 ml RBCs** in product
- ~~Minor crossmatch~~
 - ~~Donor serum vs. recipient RBCs~~

Crossmatch Types

- **Immediate Spin (IS)**
 - Rapid ABO check only
 - Only with no antibodies
- **Electronic (computer)**
 - Same as IS; no antibodies allowed
 - Validated system
- **AHG (“Full crossmatch”)**
 - Required with significant antibodies now or ever



“Convert” T&S to T&C

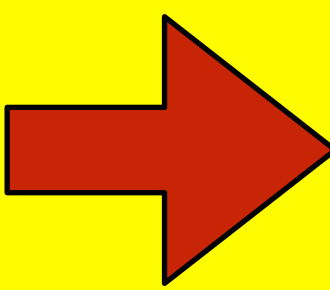
- If antibody screen negative:
 - ABO check only is needed
 - IS or computer crossmatch
 - Should be very quick!



The q 3 Day Rule

If transfused or pregnant in preceding 3 months:



Sun	Mon	Tues	Wed	Thurs
Draw Sample 2 pm				New Sample
Sample used for crossmatch for any transfusion thru Wednesday Midnight				
0	1	2	3	0

Variations for Neonates

- Babies < 4 months
 - Baby's antibodies = mom's antibodies
 - Check baby ABO/Rh, mom's plasma for Abs
 - No XM or serum grouping (if giving O RBCs)

