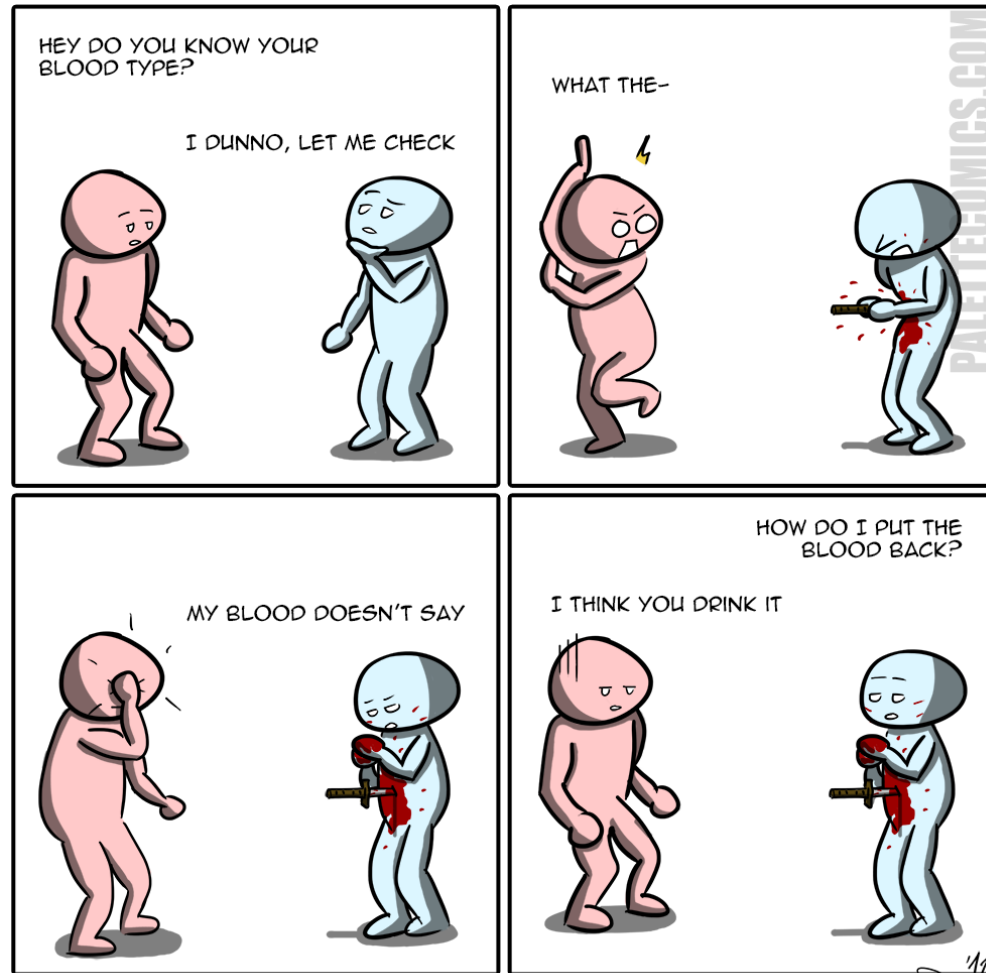


Beyond Mendel: Inheritance by Multiple Alleles

The Inheritance of ABO Blood Type



A Quick Review

- Some traits show complete dominance
 - controlled by one gene with 2 alleles
 - one allele is dominant to the other and is always expressed if it is present

TT & Tt both = tall tt only = short

- traits which demonstrate complete dominance have 3 possible genotypes and 2 possible phenotypes

More Review

- Some traits demonstrate codominance or incomplete dominance.
 - these are similar in that they are controlled by one gene with 2 alleles, but since neither allele is dominant, there are three possible phenotypes
 - RR = red RW = pink WW = white
 - 3 possible genotypes & 3 possible phenotypes

There are 4 Human Blood Types

- A, B, AB & O = 4 phenotypes
- Blood type is controlled by one gene, with 3 different alleles – A, B and O
- The 3 alleles can be combined to produce 6 different genotypes

AA

BB

AO

BO

AB

OO

Inheritance of Blood Type

- Is a mix of complete dominance and codominance
 - AA & AO produce type A blood
 - BB & BO produce type B blood
 - AB produces type AB blood
 - OO produces type O blood

From this we can infer that both A & B alleles are dominant to the O allele

The A allele is codominant with the B allele

Determining Possible Outcomes

- Notating Blood Type

I^A = A allele

I^B = B allele

i = O allele

Example a person who heterozygous for A blood is notated $I^A i$

And a person with O blood = $i i$

- How would a person who is homozygous for B blood be notated?

- - $I^B I^B$

- How would a person who is heterozygous for B blood be notated?

- - $I^B i$

- How would a person with AB blood be notated?

- $I^A I^B$

Practice

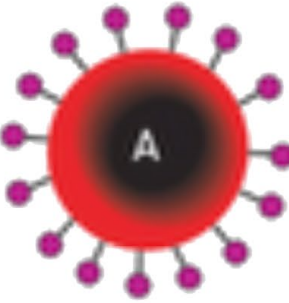
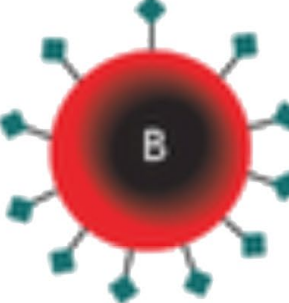
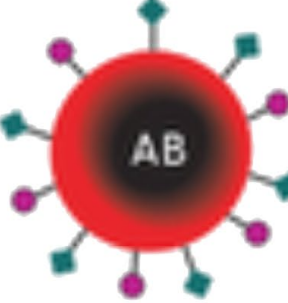
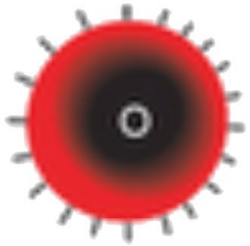
Conduct a cross between an individual with AB blood and one who is heterozygous for B blood

	I^A	I^B
I^B	I^A I^B	I^B I^B
i	I^A i	I^B i

What exactly is blood type?

- Each blood type is the result of a specific combination of proteins found on the blood cells called **antigens** and proteins found in the blood plasma called **antibodies**
 - type A blood = A **antigens** & B **antibodies**
 - type B blood = B **antigens** & A **antibodies**
 - type AB blood = both A & B **antigens** & no **antibodies**
 - type O blood = no **antigens** & both A & B **antibodies**

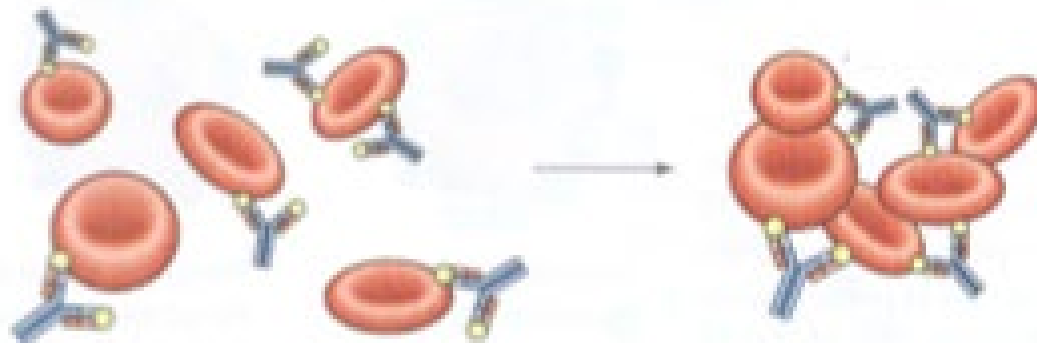
A Graphic Look at Blood Type

	Group A	Group B	Group AB	Group O
Blood Type				
Antigens Present	A antigen	B antigen	A and B antigens	None
Antibodies Present	Anti-B	Anti-A	None	Anti-A and Anti-B

Why is Blood Typing Important?

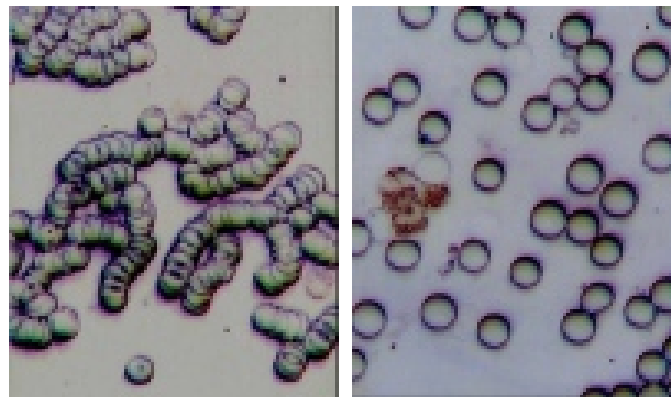
- If a person is given blood with antigens that their blood plasma contains antibodies for, the antibodies will attach to the blood causing it to clump and split
 - this clumping is called **agglutination**
 - When blood agglutinates, it splits releasing its contents causing toxic and potentially fatal consequences

Figure 8-9. An antibody reaction to surface proteins on red blood cells causes agglutination, or clumping, of the cells.



Importance of Blood Type

- A blood has **B antibodies** so if someone with A blood received blood with B antigens, agglutination would occur with potentially fatal results
- A blood can't receive B or AB blood



Typical
Agglutination No
Agglutination

Importance of Blood Type

- B blood has A antibodies, so persons with B blood can't receive blood with A antigens
 - B can't receive A or AB
- AB blood has no antibodies, so they can receive all blood types
 - this makes AB the universal recipient
- O blood has both antibodies, so they can only receive O blood.
 - since O has no antigens on the red blood cells.
O blood can be given to all other blood types
 - O is the universal donor

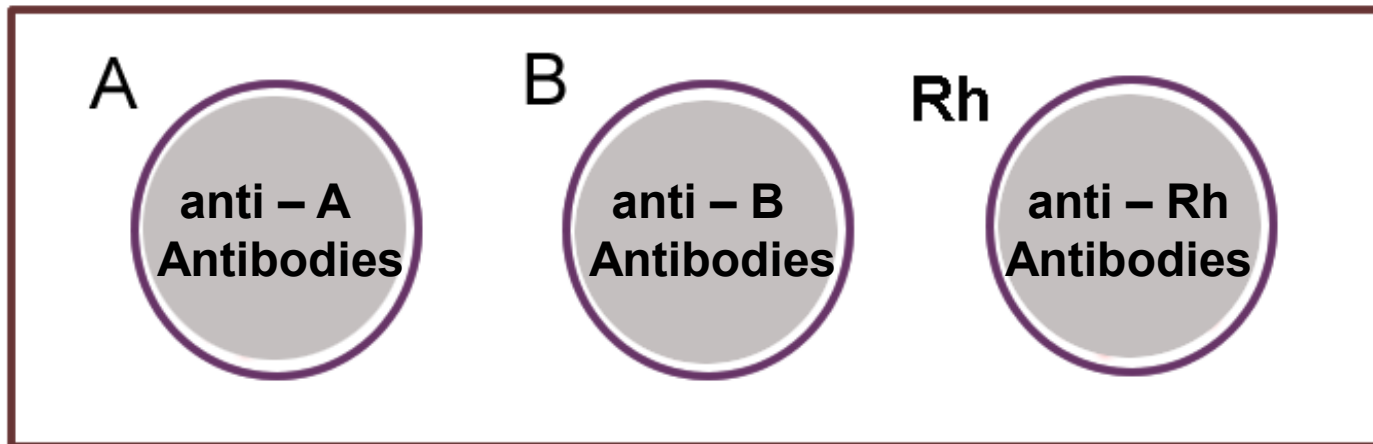
Positive or Negative?

Rh factor

- A & B are just two of numerous blood antigens found on human blood
 - Rh represents another antigen that can be found on blood.
 - if it is present on the blood, you are Rh +, and if it isn't you are Rh –
 - if your blood is Rh + it will have no antibodies for Rh
 - if your blood is Rh negative, it will have no Rh antigen but can develop Rh antibodies if exposed to the Rh antigen
- So a person with type A+ blood has both A and rh antigens but only B antibodies
- A person with A- blood has only A antigens and B antibodies but can develop Rh antibodies

Typing Blood

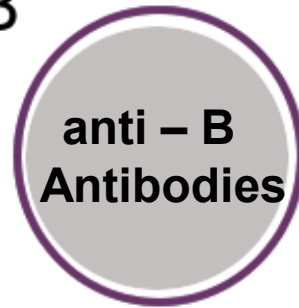
- Blood is typed by testing it for agglutination
 - the blood to be typed is mixed with anti A antibodies from type B blood and with anti B antibodies found in type A blood.
 - it is also mixed with anti-Rh antibodies found in Rh⁻ blood.



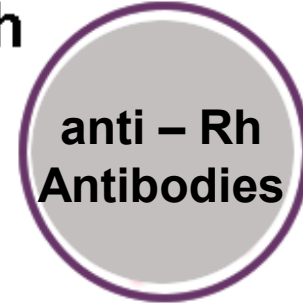
A



B



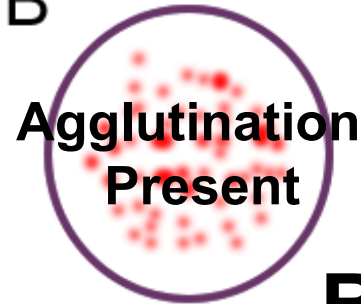
Rh



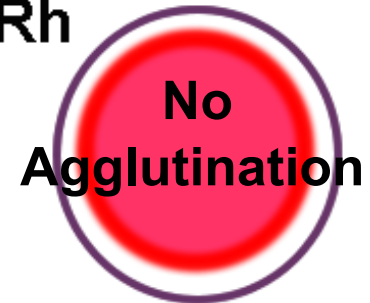
A



B



Rh

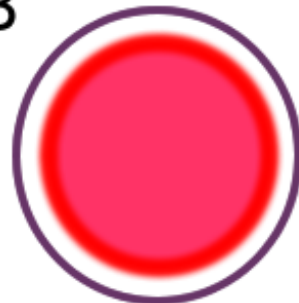


B -

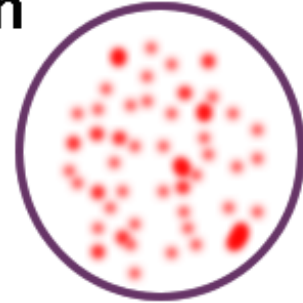
A



B



Rh



A +

