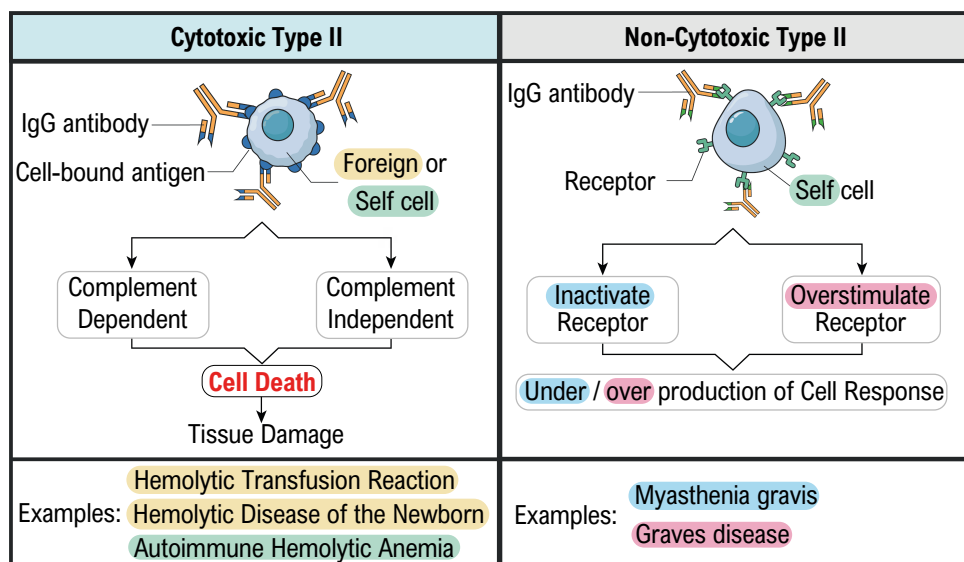


TOPIC: TYPE II HYPERSENSITIVITIES

Type II Hypersensitivity

- ◆ **Type II (Cytotoxic) Hypersensitivity:** Ig___/Ig___ antibodies target antigens on _____-surfaces or in their *matrix*.
 - Most are **cytotoxic**, targeting *foreign* or *self* cells: triggers cytolysis (cell bursting), ADCC, &/or inflammation.
 - But can be _____-cytotoxic, always targeting *self-cells*: inactivate/overstimulate receptors.
 - Either way, they lead to unwanted effects: direct tissue damage or under/over production of cell responses.



PRACTICE

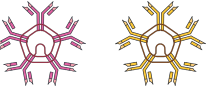
Which of the following is not a way that type II hypersensitivity can cause tissue damage?

- Cell lysis.
- Phagocytosis.
- Degranulation of basophils & release of proinflammatory mediators.
- Overstimulation of receptors.

TOPIC: TYPE II HYPERSENSITIVITIES

Understanding the ABO Blood System

- ◆ There are _____ main blood types, each defined by specific carbohydrate antigens present/absent on RBCs.
 - The immune system naturally makes antibodies (*isoheamagglutinins*) against any ABO antigens it _____.
 - Therefore, giving *incompatible* blood can cause RBC clumping & destruction, leading to *life-threatening* effects.

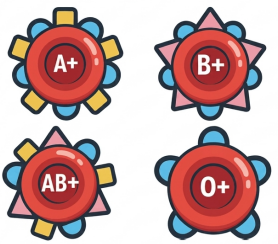
Blood Type	Antigens on RBCs	Antibodies in Plasma
A	A 	Anti-B 
B	B 	Anti-A 
AB	A & B 	Neither Anti-A nor Anti-B
O	Neither A nor B 	BOTH Anti-A & Anti-B 

NOTE: Whole blood is _____ typically used in transfusions (cells & plasma are separated).

Understanding the Rh Blood System

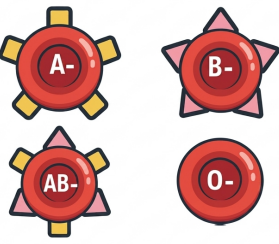
- ◆ A set of protein antigens found on red blood cells (**Rh Factors**) is also commonly used to ID blood types.
 - _____ people have the Rh factor (~85% of population); _____ people *lack* the Rh factor.
- ◆ Anti-Rh antibodies are _____ normally made in Rh— people, but exposure *sensitizes* immune system to make them.
 - Once anti-Rh antibodies are made, those Rh— people can have a hemolytic transfusion reaction to Rh+ blood.

_____ Rh Factor 



Rh⁺ people can receive Rh⁺ or Rh[−] blood

_____ Rh Factor 



Rh[−] people should **ONLY** receive Rh[−] blood

TOPIC: TYPE II HYPERSENSITIVITIES

EXAMPLE

Humans have four major blood types in the ABO system: A, B, AB, and O. Which of the following statements about the ABO blood types is true?

- a) A person with type AB blood has anti-O antibodies in their plasma.
- b) A person with type O blood has both anti-A and anti-B antibodies in their plasma.
- c) A person with type O blood has both A and B antigens on their RBCs.
- d) A person with type B blood naturally produces antibodies specific to type B antigens on RBCs.

PRACTICE

Which of the following statements about Rh factors is true?

- a) Rh factor and AB antigens cannot be found on the same red blood cell.
- b) An individual with Rh+ blood will make anti-Rh antibodies after exposure to Rh antigens.
- c) Rh factors are antigens found on the surface of red blood cells in individuals with a + blood type.
- d) Rh factors are lipid antigens found on the surface of red blood cells in individuals with a – blood type.

PRACTICE

A patient's blood type is AB⁻, therefore _____.

- a) Their RBCs have no A or B antigens.
- b) Their RBCs have A antigens and the Rh factor.
- c) Their RBCs have A and B antigens and the Rh factor.
- d) Their RBCs have A & B antigens but not the Rh factor.

TOPIC: TYPE II HYPERSENSITIVITIES

Proper Blood Transfusions Based on Blood Types

- ◆ Now that we've gone over ABO & Rh antigens, we can review the variety of blood types & proper transfusions.
- ◆ Donate Rule: you can only *donate* to recipients whose RBCs have *at* _____ your RBC antigens (or more).
- ◆ Receive Rule: you can only *receive* from donors whose RBCs have *at* _____ your RBC antigens (or fewer).

Blood Type	Can <u>Donate</u> To:	Can <u>Receive</u> From:
A+	A+ & AB+	A+, A-, O+, & O-
B+	B+ & AB+	B+, B-, O+, & O-
AB+ (Universal _____)	AB+ only	ALL types
O+	O+, A+, B+, & AB+	O+ & O-
A-	A+, A-, AB+ , & AB-	A- & O-
B-	B+, B-, AB+ , & AB-	B- & O-
AB-	AB+ & AB-	AB-, A-, B-, & O-
O- (Universal _____)	ALL types	O- only

AB+ = **positive** for **All** **B**lood antigens (A, B, & Rh)

O- = has n**O**ne of these blood antigens.

EXAMPLE

Mark the following situations with a tick (✓) if they would be a safe blood transfusion, or a cross (X) if they would be unsafe:

A patient with type O— blood receives type A+ blood	_____
Type O— blood is given to a patient with type AB— blood	_____
Type AB— blood is given to a patient with type O+ blood	_____
Heart failure due to decreased blood pressure	_____
A patient with type B+ blood receives type B— blood	_____

TOPIC: TYPE II HYPERSENSITIVITIES

PRACTICE

A patient with type A+ blood is in the emergency room & requires a blood transfusion. Which of the following types of blood could they receive?

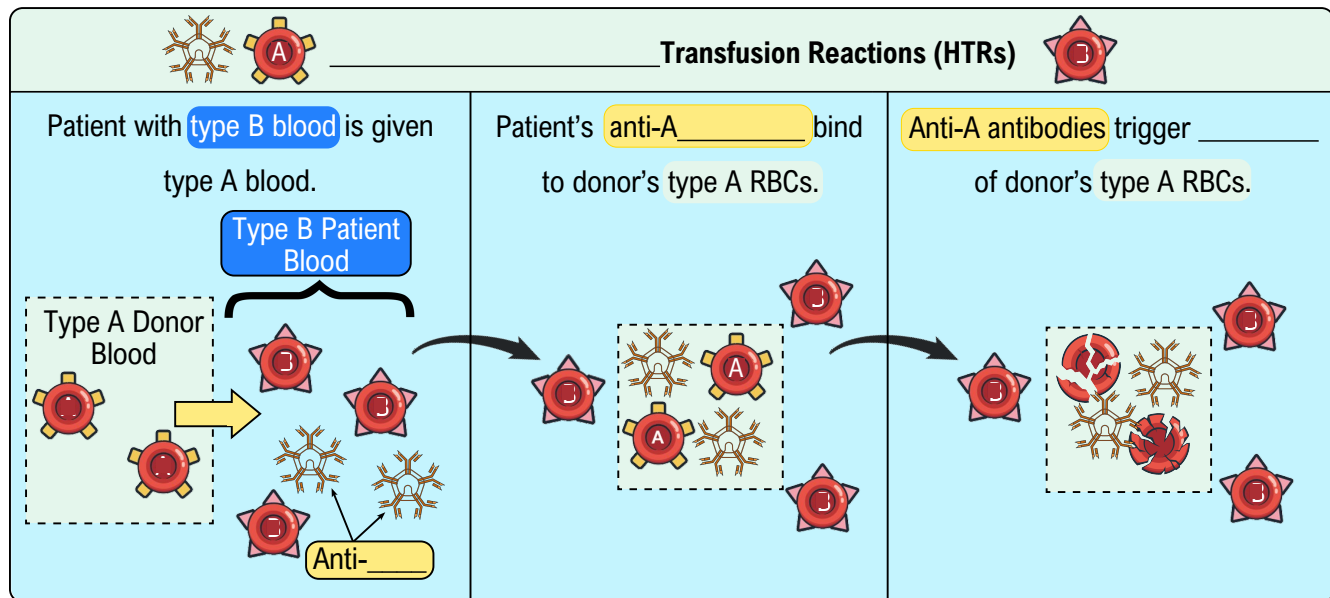
I) Type O+ II) Type A— III) Type B+ IV) Type AB—

- a) I or II only.
- b) I or III only.
- c) II or IV only.
- d) I, II, or III.
- e) II, III or IV.
- f) I, II or IV.

TOPIC: TYPE II HYPERSENSITIVITIES

Improper Blood Transfusion Reactions

- ◆ **Hemolytic Transfusion Reaction (HTR):** incompatible donor RBCs are _____ by recipient's immune system.
 - Recipient's antibodies bind antigens on donated RBCs & tag them for destruction.



- ◆ HTRs can cause severe blood clotting, kidney damage, shock, & failure of vital organs.

PRACTICE

Why would someone with type O— blood be considered a “universal donor”?

- Type O— RBCs do not have A or B antigens & therefore would not cause a transfusion reaction when donated.
- Type O— blood does not contain any antibodies that bind to antigens on red blood cells.
- Type O— RBCs have antibodies that bind to both A & B antigens, so it integrates well with other blood types.
- Type O— blood only has O antigens, which are not recognized as foreign by any human antibodies.

TOPIC: TYPE II HYPERSENSITIVITIES

PRACTICE

All the following statements about hemolytic transfusion reactions are true except:

- a) The patient's IgM antibodies will recognize foreign red blood cells and tag those cells for destruction.
- b) The patient's antigens recognize antigens on donated RBCs, triggering a type II hypersensitivity reaction.
- c) To avoid these reactions, patients are given blood that is either the same type as their own or type O— blood.
- d) If a patient who has type B blood is given donated type A blood, an HTR will occur in the patient.

PRACTICE

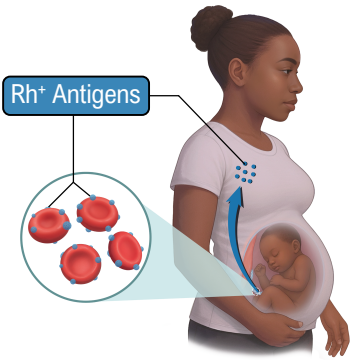
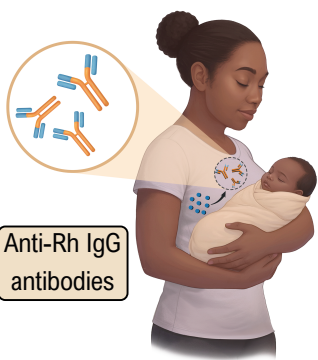
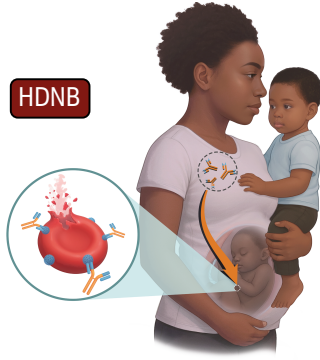
What will happen if a patient is accidentally given blood that does not match their own AB or Rh antigens?

- a) Isohemagglutinins bind to the foreign red blood cells triggering the destruction of mast cells and basophils.
- b) The immune system will attack all foreign and “self” red blood cells, resulting in blood clots.
- c) Complement system proteins attack & destroy foreign red blood; cell membranes can cause blood clots & the released hemoglobin in the bloodstream can cause kidney damage.
- d) All of the above.

TOPIC: TYPE II HYPERSENSITIVITIES

Hemolytic Disease of the Newborn (HDNB)

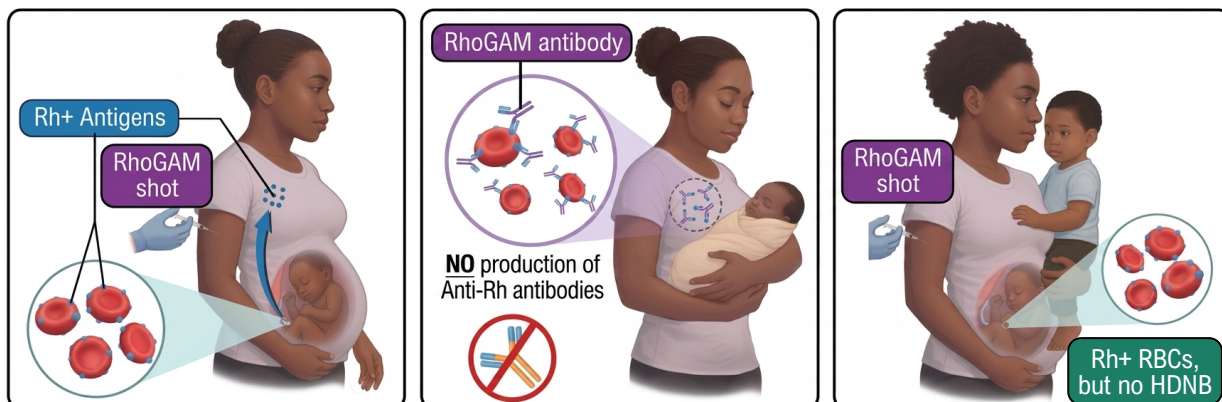
- ◆ When an Rh⁻ mother is pregnant with an Rh⁺ baby, it can *sensitize* the mother's immune system & lead to *HDNB*.
 - **Hemolytic Disease of Newborn:** a pregnant mother's anti-Rh antibodies enter her next Rh⁺ fetus & kill its

Exposure to Rh Antigens	Sensitization of Mother's Immunity	HDNB: Subsequent pregnancy w/ Rh ⁺ fetus
A pregnant ____ mother is exposed to Rh antigens (often from 1st Rh⁺ fetus). 	Exposure causes mother to produce <i>anti-Rh IgG antibodies</i>. 	Mother's anti-Rh IgG antibodies cross the placenta & _____ fetal Rh⁺ RBCs. 

- ◆ HDNB only harms ____ fetuses/newborns after the mother's sensitization (does not harm mother).

Treating HDNB

- ◆ HDNB can be prevented with strategic dosage of a *medication* containing *anti-Rh* _____ (e.g. RhoGAM®).
 - These antibodies _____ Rh factors on the first Rh⁺ fetus' RBCs as they enter the mother's circulation.
 - _____ mother's immune system from producing her own anti-Rh IgG antibodies.



TOPIC: TYPE II HYPERSENSITIVITIES

EXAMPLE

Which of the following terms is mismatched with its description?

- a) A Rh⁻ mother's firstborn who has Rh⁺ blood.
- b) A Rh⁺ mother's firstborn who has Rh⁻ blood.
- c) An Rh⁻ mother's second baby who has Rh⁺ blood, & her first baby also had Rh⁺ blood.
- d) An Rh⁻ mother's second baby who has Rh⁺ blood, & her first baby had Rh⁻ blood.

PRACTICE

A mother is pregnant with her first child. The mother has Rh⁻ blood and the infant has Rh⁺ blood. What is likely to occur during pregnancy/birth?

- a) The mother is "sensitized" to the Rh antigen and eventually begins to create anti-Rh antibodies.
- b) The infant's immune system immediately attacks the mother's blood, resulting in a severe cytotoxic reaction.
- c) The infant's Rh antigens will break down so that the infant's blood type matches the mother's blood type.
- d) If the mother is not given RhoGAM, her immune system will attack the infant's RBCs, causing major damage.