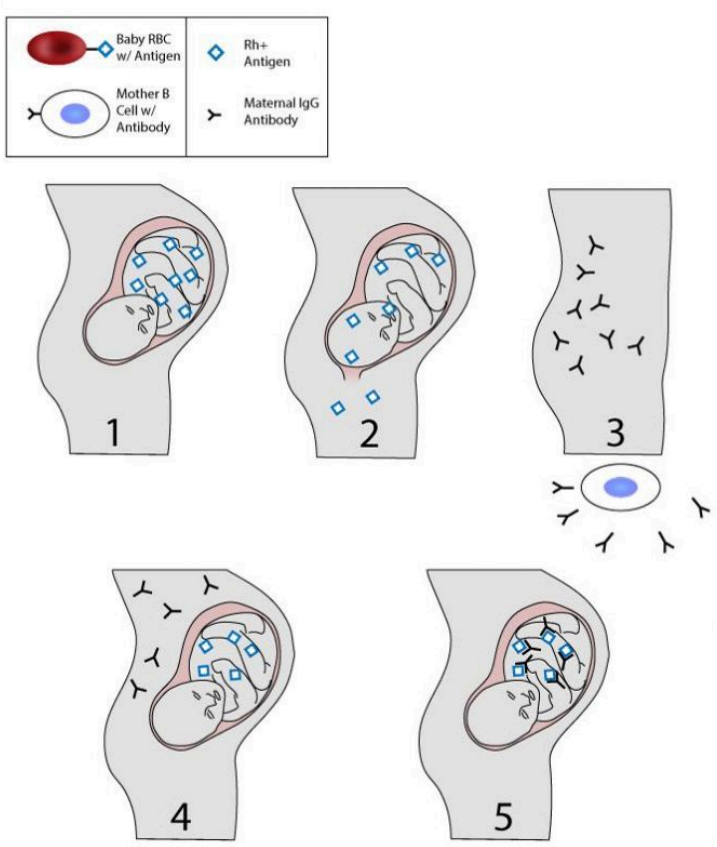
2.3.4

Hemolytic Disease of the Newborn

The scenario mentioned above is highly unlikely to occur, as modern technology generally prevents individuals from receiving incompatible blood transfusions. A more applicable example of the dangers associated with Rh factor incompatibility is a condition known as **hemolytic disease of the newborn (HDN).** During pregnancy and especially during delivery, fetal blood may unintentionally cross the placenta into the mother's bloodstream (normally the placenta prevents baby and mothers blood from mixing, but at birth it can sometimes tear, breaching the barrier). Should this unintentional transmission occur between a Rh-negative mother and a Rh-positive fetus, the maternal immune system will begin to produce anti-Rh antibodies capable of crossing the placenta and damaging the fetus.



Hemolytic Disease of the Newborn.
Image created by BYU-I student Austin Dean Fall 2016

1. An infant with Rh antigens is found in the womb of a mother who has no Rh antigens. Also, having never yet been exposed to Rh antigens, this mother has no Rh antibodies either. Therefore, the infant is not attacked by the mother's Rh antigens.

2. During birth, maternal and infant blood is mixed and the infants Rh antigens are exposed to the mother's immune system.

3. After delivering the baby, the mother continues to produce antibodies and immune memory B-cells against future exposure to Rh antigen.

4-5. If the mother who is Rh (-) gets pregnant again with a Rh (+) fetus, then the mothers new load of Rh antibodies can cross the placenta and attack the fetus's Rh (+) red blood cells.

The image above explains how there is not significant harm to the first Rh positive child. However, following initial exposure to the Rh factor, a sensitized mother will be capable of reacting quickly to the presence of Rh factor in a future pregnancy (she will have made lots of antibodies). If left untreated, HDN can cause agglutination, hemolysis accompanied by excessive bilirubin accumulation, jaundice, and fetal death.

Luckily, this condition can be prevented by the injection of a compound known as **Rho (D) Immune Globin (RhoGAM).** The RhoGAM injection contains donor anti-Rh antibodies that bind to any Rh positive fetal erythrocytes that cross into the mother's bloodstream, countering the stimulus for maternal sensitization. This will prevent the mother from forming immune memory cells and antibodies for the future. In a way, this injection "tricks" the mother's immune system into "believing" that Rh antigen has never been exposed to the mother and every pregnancy can be like the first one. In order to render the maternal production of antibodies unnecessary, this injection may be given multiple times during the later stages of pregnancy and even following delivery. Remember, HDN is a condition of Rh (-) mothers who give birth to Rh (+) children). This incompatibility is only possible if the mother has Rh (-) blood type and the father has Rh (+) blood type.

If the RhoGAM injection is not administered prior to maternal sensitization, then HDN cannot be prevented in the event of a subsequent incompatible pregnancy. Consequently, maternal levels of anti-Rh antibodies must be carefully measured should an additional incompatible pregnancy occur following sensitization. If critical levels are reached, the fetus is assessed in order to ascertain the extent of the damage caused by HDN. Possible treatments include in vivo transfusion, maternal plasma exchange, preterm labor induction, post-delivery transfusion, and phototherapy for jaundice.

HDN does not generally occur as a result of ABO blood type incompatibilities because anti-A and anti-B antibodies are too big to cross the placenta.