| ISBT 001 | ABO |
| ISBT 002 | MNS |
| ISBT 003 | P |
| ISBT 004 | Rh |
| ISBT 005 | Lutheran |
| ISBT 006 | Kell |
| ISBT 007 | Lewis |
| ISBT 008 | Duffy |
| ISBT 009 | Kidd |
| ISBT 010 | Diego |
| ISBT 011 | Cartwright |
| ISBT 012 | Xg |
| ISBT 013 | Scianna |
| ISBT 014 | Dombrock |
| ISBT 015 | Colton |
| ISBT 016 | Landsteiner-Weiner |
| ISBT 017 | Chido/Rodgers |
| ISBT 018 | H |
| ISBT 019 | Kx |
| ISBT 020 | Gerbich |
| ISBT 021 | Cromer |
| ISBT 022 | Knops |
| ISBT 023 | Indian |

**Chromosome 1**
- Rh
- Duffy
- Scianna
- Cromer
- Knops

**Chromosome 2**
- Rh
- Duffy
- Scianna
- Cromer
- Knops

**Chromosome 3**
- H
- Lewis
- Landsteiner-Weiner
- Lutheran

**Chromosome 4**
- MNS

**Chromosome 5**
- Cianna

**Chromosome 6**
- Chido/Rodgers

**Chromosome 7**
- Cartwright
- Colton
- Kell

**Chromosome 8**
- ABO

**Chromosome 9**
- Indian

**Chromosome 10**
- Diego

**Chromosome 11**
- Kidd

**Chromosome 12**
- H
- Lewis
- Landsteiner-Weiner
- Lutheran

**Chromosome 13**
- P

**Chromosome X**
- Xg
- Kx

**Chromosome: Not known**
- Dombrock

**Von Descatello (Decastello)**
- AB

**Sturle (Sturli)**

**Blood groups**
(Most common) O > A > B > AB (Least common)
<table>
<thead>
<tr>
<th>Rh HDN</th>
<th>(-) C’ binding = extravascular hemolysis (delayed HTR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother: Rh (-)</td>
<td></td>
</tr>
<tr>
<td>Child: Rh (+), 2\textsuperscript{nd} pregnancy</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RhoGam or RhIg</th>
<th>Purified anti-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administer w/in 72 hrs after 1\textsuperscript{st} delivery</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full dose RhoGam (≥12 weeks gestation)</th>
<th>300 μg anti-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect up to 30mL D+ WB or 15mL D+ RBCs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minidose/Microdose RhoGam (&lt;12 weeks gestation)</th>
<th>50 μg anti-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect up to 5mL of D+ WB or 2.5mL D+ RBCs</td>
<td></td>
</tr>
<tr>
<td>Ex. Abortion</td>
<td></td>
</tr>
</tbody>
</table>

# RhIg vials

\[
\text{Volume of FMH (mL)} \div 30 \\
\text{Vol. FMH = % fetal cells \times 50} \\
\text{---------------------------------------------} \\
x = \left(\frac{\% \text{ Fetal cells} \times 50}{30}\right) \\
x \approx _{-} + 1 = \# \text{ RhIg vials} \\
\]

As little as 1mL Rh(+) RBC Produces anti-D

Rh+ RBCs + anti-D = (+) agglutination

Perform test for D\textsuperscript{u} (IAT)

If RBCs + anti-D = (-) agglutination = IAT is (+) agglutination = +D\textsuperscript{u} (weak D)

Rh- RBCs + anti-D + AHG reagent = (-) agglutination

2 conditions wherein an Rh- pt. can be transfused w/ Rh+ blood

1. No prior exposure to D Ag (males) or past childbearing age (females)
2. Administer RhoGam

Anti-LW (Landsteiner-Weiner) Originally identified as anti-Rh in early experiments involving rabbits immunized w/ Rhesus monkey blood

Anti-LW agglutinates Rh- and Rh+ cells except Rh\textsubscript{null} cells

Rh\textsubscript{null} No Rh Ag

Designated as ---/---

Stomatocytes

Rh\textsubscript{deleted} No C/c and E/e Ag

Designated as D--/D--

Lewis system Le gene codes for the production of fucosyltransferase enzyme that catalyzes addition of fucose to the 4\textsuperscript{th} C of N-acetylgalactosamine of type 1 precursor

Lewis Ag’s Le\textsuperscript{a} ---(Se)--- > Le\textsuperscript{b}

Produced by tissue cells

Not well developed at birth = NB/cord cells = Le(a-b-)

Decreased expression during pregnancy

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Substances (Secretion)</th>
<th>Phenotype</th>
<th>Le Ab’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABH, lele, sese</td>
<td>None</td>
<td>ABH, Le(a-b-)</td>
<td>Anti-Le\textsuperscript{a} &amp; Anti-Le\textsuperscript{b}</td>
</tr>
<tr>
<td>ABH, lele, SeSe/Sese</td>
<td>ABH</td>
<td>ABH, Le(a-b-)</td>
<td>Anti-Le\textsuperscript{a} &amp; Anti-Le\textsuperscript{b}</td>
</tr>
<tr>
<td>ABH, LeLe/Lele, sese</td>
<td>Le\textsuperscript{a}</td>
<td>ABH, Le(a+b-)</td>
<td>Anti-Le\textsuperscript{b}</td>
</tr>
<tr>
<td>ABH, LeLe/Lele, SeSe/Sese</td>
<td>ABH, Le\textsuperscript{a}, Le\textsuperscript{b}</td>
<td>ABH, Le(a-b+)</td>
<td>none</td>
</tr>
</tbody>
</table>

Lewis Ab’s Anti-Le\textsuperscript{a} & Anti-Le\textsuperscript{b}

Naturally occurring IgM Activates the C’

MN Ag’s Glycophorin A (MN-SGP)

M = Ser-Ser-Threo-Threo-Gly
N = Leu-Ser-Threo-Threo-Glu

Well developed at birth Important in paternity testing

Anti-M IgM, pH-dependent (6.5), glucose-dependent
<table>
<thead>
<tr>
<th>Patients with cardiac disease</th>
<th>Prevention: Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Therapeutic phlebotomy</td>
<td></td>
</tr>
<tr>
<td>b. IV diuretics</td>
<td></td>
</tr>
<tr>
<td>c. O₂ therapy</td>
<td></td>
</tr>
</tbody>
</table>

**Bacterial contamination**

- Cause: Endotoxin production by psychrophilic/cryophilic bacteria
  - *Y. enterocolitica* (most common)
  - *E. coli*
  - *P. aeruginosa*

  **Factors:**
  - During phlebotomy
  - During preparation/processing
  - During thawing

  **Prevention:**
  - Sterile technique
  - Visual inspection of unit

  → Blood unit = Brown, purple, hemolysis, clot
  → Plasma = Murky (dark brown) purple, red

**PCITR**

- Causes:
  - Small bore needle
  - Warming blood above 50°C
  - Freezing blood w/o cryoprotective agent
  - Citrate toxicity

**Delayed Nonimmune Transfusion Reactions**

- **Iron Overload (Hemosiderosis)**
  - Patients w/ normovolemic anemia
  - Transfusion-dependent patients:
    - Aplastic anemia
    - Congenital hemolytic anemia
  - Prevention:
    - Iron chelating agent = Deferoxamine
    - Neocytes = young RBCs, has longer lifespan

**Disease transmission**


**Hemolytic Disease of the Newborn**

- **In utero**
  - Anemia (↑ immature RBCs, enlarged spleen & liver = extramedullary hematopoiesis)
  - Hydrops fetalis = cardiac insufficiency, edema

- **Neonatal period**
  - ↑ Unconjugated bilirubin → Brain → Kernicterus

**Treatment**

1. Intrauterine transfusion
   - In utero
   - Corrects anemia
   - X-match: Mother’s serum
2. Exchange transfusion
   - Neonatal period
   - Removes bilirubin & Ab-coated RBCs
   - X-match: Mother’s serum (preferred) or infant’s serum

**Cross-Matching**

- **Full X-match**
  - 2 hours
  - Can be shortened to 30 mins

- **Abbreviated X-match**
  - Type/screen + immediate spin
  - DC/PS = no agglutination/hemolysis

- **Electronic X-match**
  - Patient blood type is determined on 2 occasions