Human Blood Agglutinogens and Blood Typing

• RBC membranes bear different many **antigens**
  • Antigen =
    • anything perceived as foreign that can generate an immune response
    • Typically glycoproteins or glycolipids of the glycocalyx
• RBC antigens are referred to as **agglutinogens** because they promote agglutination
• Mismatched transfused blood is perceived as foreign
  • Host antibodies (agglutinins) stick to foreign antigens (agglutinogens) resulting in agglutinated and destroyed RBCs

Human Blood Groups

• Humans have at least 30 naturally occurring RBC antigens
• Presence or absence of each antigen is used to classify blood cells (and whole blood) into different groups
  • **ABO blood groups**
    - Based on presence or absence of two agglutinogens (A and B) on surface of RBCs
      • Type A has only A agglutinogen
      • Type B has only B agglutinogen
      • Type AB has both A and B agglutinogens
      • Type O has neither A nor B agglutinogens
    - Blood may contain preformed anti-A or anti-B antibodies (**agglutinins**)
      • Act against transfused RBCs with ABO antigens not present on recipient’s RBCs
      • Pre-teens and older
Table 17.4 ABO Blood Groups

<table>
<thead>
<tr>
<th>Blood Group</th>
<th>RBC Antigens (Agglutinogens)</th>
<th>Plasma Antibodies (Agglutinins)</th>
<th>Blood That Can Be Received</th>
<th>Frequency (% of U.S. Population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>A</td>
<td>None</td>
<td>A, B, AB, O</td>
<td>4 4 7 2 &lt;1</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>Anti-A (a)</td>
<td>B, O</td>
<td>11 19 25 10 4</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>Anti-B (b)</td>
<td>A, O</td>
<td>40 26 28 31 16</td>
</tr>
<tr>
<td>O</td>
<td>None</td>
<td>Anti-A (a) Anti-B (b)</td>
<td>O</td>
<td>45 51 40 57 79</td>
</tr>
</tbody>
</table>

Rh Blood Groups

- 52 named Rh agglutinogens (Rh factors)
  - C, D, and E are most common
  - Rh⁺ indicates presence of D antigen
    - 85% Americans are Rh⁺
  - Anti-Rh antibodies are not spontaneously formed in Rh⁻ individuals
    - Anti-Rh antibodies form if Rh⁻ individual receives Rh⁺ blood
  - Second exposure to Rh⁺ blood will result in typical transfusion reaction.
Figure 17.16 Blood Typing of ABO Blood Types

**Blood typing**

- Donor blood is mixed with antibodies against common agglutinogens
  - If agglutinogen is present, clumping of RBCs will occur
- Blood is typed for ABO and for Rh factor in same manner