

## The discovery of blood groups



Blood transfusions<sup>1</sup> become necessary when due to extreme blood loss a patient does not have enough red blood cells to provide his tissue's mitochondria with oxygen.

Experiments with blood transfusions were carried out hundreds of years ago. Many patients died and it was not until 1901, when the Austrian Karl Landsteiner discovered human blood groups, that blood transfusions became safer.

Mixing blood from two individuals can lead to *blood clumping* or *agglutination*<sup>2</sup>. This can have *fatal*<sup>3</sup> consequences.

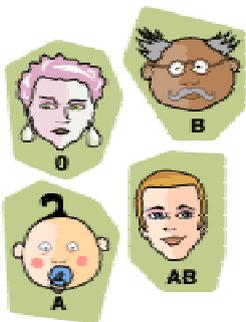
Karl Landsteiner discovered that blood clumping was a reaction which occurs when the *receiver* of a blood transfusion has *antibodies* against the *donor* blood cells.

Karl Landsteiner discovered the most important blood groups and a way to determine blood types. Thus he paved the way for blood transfusions to be carried out safely. For his discovery he was awarded the Nobel Prize in Physiology or Medicine in 1930.

(Images Source: <http://nobelprize.org/medicine/educational/landsteiner/readmore.html>)

### Tasks:

1. Why did many people die in former times after blood transfusions?
2. What do you call the following in English?
  - Blutspender -
  - Empfänger der Blutspende –
3. What did Karl Landsteiner get the Nobel Prize of Medicine for?



The differences in human blood are due to the presence or absence of certain protein molecules called *antigens* and *antibodies*. The antigens are located on the surface of the red blood cells and the antibodies are in the blood plasma. Individuals have different types and combinations of these molecules. The blood group you belong to depends on what you have inherited<sup>4</sup> from your parents.

The ABO characteristics are the most important ones. Not all

<sup>1</sup> Transfusion

<sup>2</sup> Verklumpung, Zusammenballung, Agglutination

<sup>3</sup> tödlich

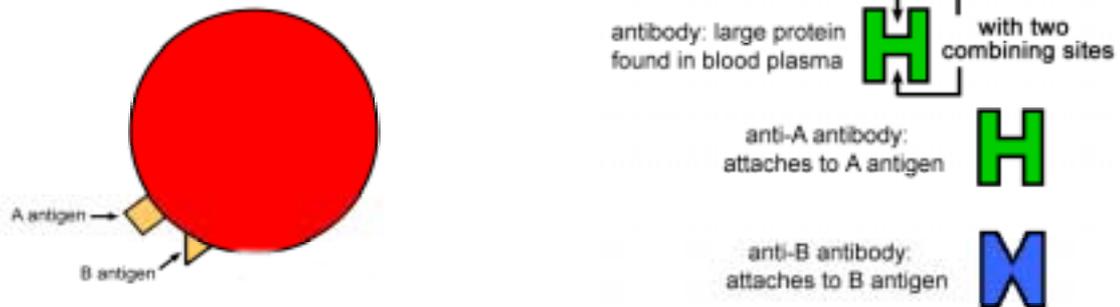
<sup>4</sup> to inherit =erben

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blood groups are *compatible*<sup>5</sup> with each other. Mixing incompatible blood groups leads to blood clumping or agglutination, which is dangerous for individuals.

(Image Source: <http://nobelprize.org/medicine/educational/landsteiner/readmore.html>)

According to the ABO blood typing system there are four different kinds of blood types: A, B, AB or O (null).



### Task:

Complete the left column of the table with the corresponding symbols.

	<p><b>Blood group A</b></p> <p>If you belong to the blood group A, you have A antigens on the surface of your red blood cells and B antibodies in your blood plasma.</p>
	<p><b>Blood group B</b></p> <p>If you belong to the blood group B, you have B antigens on the surface of your red blood cells and A antibodies in your blood plasma.</p>
	<p><b>Blood group AB</b></p> <p>If you belong to the blood group AB, you have both A and B antigens on the surface of your red blood cells and no A or B antibodies at all in your blood plasma.</p>
	<p><b>Blood group O</b></p> <p>If you belong to the blood group O (null), you have neither A or B antigens on the surface of your red blood cells but you have both A and B antibodies in your blood plasma.</p>

For a blood transfusion to be successful, ABO blood groups must be compatible between the donor blood and the patient blood. If they are not, the red blood cells from the donated blood will clump or agglutinate. The agglutinated red cells can clog<sup>6</sup> blood vessels and stop the circulation of the blood to various parts of the body. The agglutinated red blood cells

<sup>5</sup> verträglich, kompatibel

<sup>6</sup> verstopfen, blockieren

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also crack<sup>7</sup> and its contents leaks out<sup>8</sup> in the body. The red blood cells contain hemoglobin which becomes toxic when outside the cell. This can have fatal consequences for the patient.

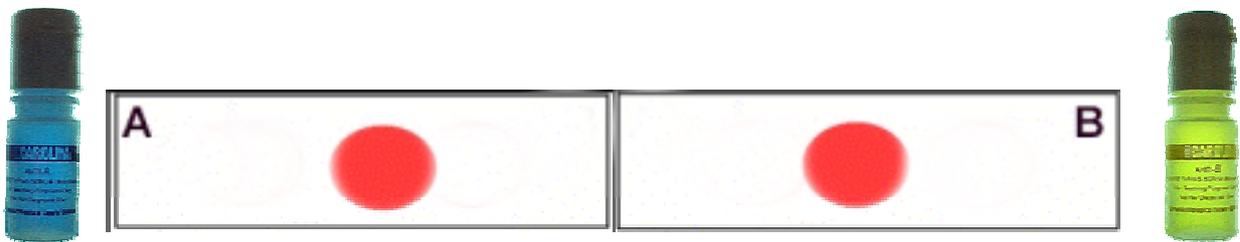
Make a sketch of what will happen if you give a patient of the blood group A blood of a donor with blood group B.

## Blood typing<sup>9</sup> – how do you find out to which blood group someone belongs?

Your task is to determine the blood group of four patients.

Proceed as follows:

1. For each new patient prepare two clean (!!!) slides. Place them on white paper.  
Label them with A and B.
2. Add a drop of blood of the patient on each slide.
3. Add a drop of the test substance containing antibodies A on the slide labelled A and a drop of the test substance containing antibodies B on the slide labelled B. **Let the drop of test substance fall freely onto the drop of blood. Avoid any contact between the test substance bottle and the blood.**



4. To mix the blood and the test substance carefully joggle<sup>10</sup> the slides.
5. Let the slides stand for 3 – 6 minutes, joggle them again.
6. Analyse the blood samples. Has agglutination taken place or not?
7. Enter the result in the table and determine the blood group of the patient.
8. Carefully rinse the slide before you start the next test.

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<sup>7</sup> bersten, aufbrechen

<sup>8</sup> auslaufen

<sup>9</sup> Blutgruppenbestimmung

<sup>10</sup> rütteln

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Patient	Anti -A	Anti-B	Blood Group
Mr Smith			
Mrs Miller			
Mr White			
Mrs Braun			

### Blood transfusions – who can receive blood from whom?

Blood Group	Can give blood to	Can receive blood from	Explanation
AB			
A			
B			
O			