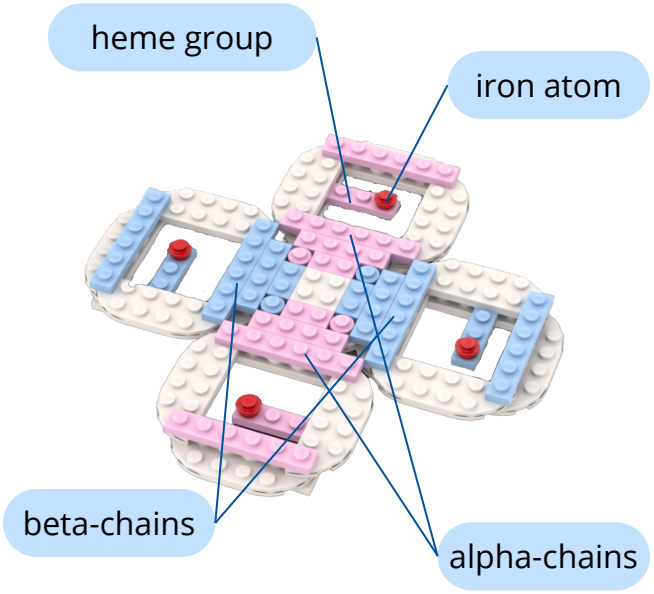
HEMOGLOBIN

Hemoglobin is a protein in your red blood cells. It transports oxygen around to different tissues in your body. This oxygen powers your cells and gives you energy. It is hemoglobin that makes your blood red.

When you breathe, oxygen passes from your lungs into your blood vessels and into the red blood cells, where it binds to hemoglobin. The bound oxygen is then transported around your body to where it is needed, where it is replaced with carbon dioxide. Your body's cells are rich in carbon dioxide, which is a waste product of cellular processes that is removed by hemoglobin.

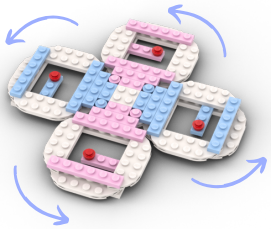
Hemoglobin is composed of four protein chains: two alpha chains (pink) and two beta chains (blue). Each chain contains a heme group and an iron atom (red). An oxygen molecule binds to the iron atom and is transported through the blood in your body.



Like LEGO bricks, biological molecules can be assembled into a large number of complex protein structures. Unlike LEGO, the molecular building blocks of life are flexible, soft, plastic and dynamic.

Hemoglobin is an amazingly dynamic molecule that uses small structural changes to help it transport oxygen. Once an oxygen molecule has bound one of the four protein chains, it will change the structure of the remaining protein chains, thereby facilitating the binding of oxygen molecules to the remaining three protein chains. It is thus difficult to bind the first oxygen molecule, but it gradually becomes easier and easier to bind the second, third and fourth oxygen molecule.

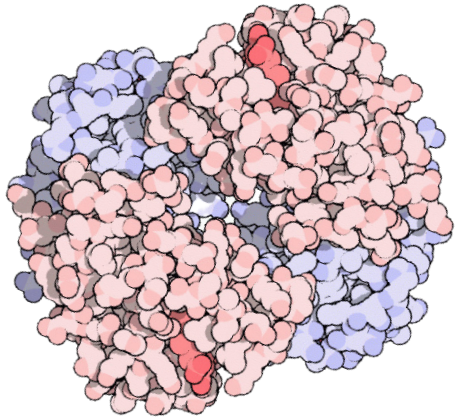
Your LEGO hemoglobin is also dynamic. If you push all the protein chains you can find out what hemoglobin looks like when it is activated.



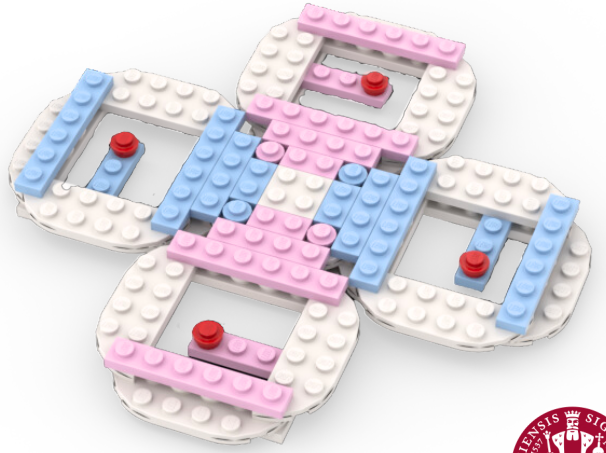
TO SEE MOLECULES

Molecules are quite small. In the tiny dot in the line above, there are over a hundred million molecules. They are so small that you can't even see them with a microscope. To find out what molecules look like, researchers use different techniques. The main ones are X-ray crystallography, cryo-electron microscopy and NMR spectroscopy.

In cryo-electron microscopy, researchers shoot an electron beam at frozen molecules. When the beam hits them, the molecules cast a shadow. The researchers use these shadow images to find out what the molecules look like.



BUILD A MOLECULE HEMOGLOBIN



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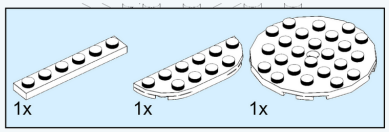

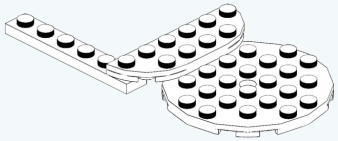

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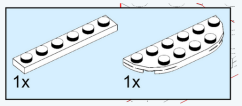

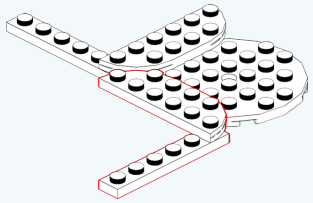

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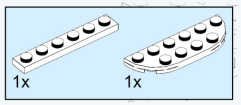

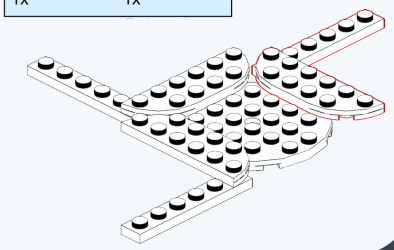

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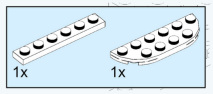

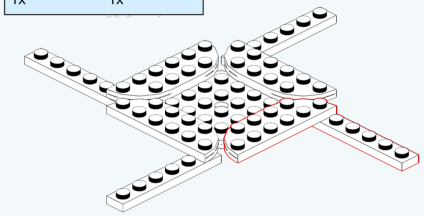

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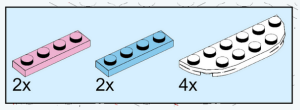

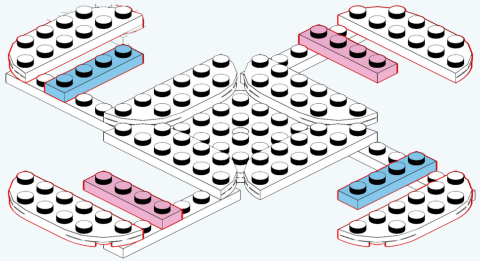

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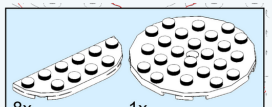

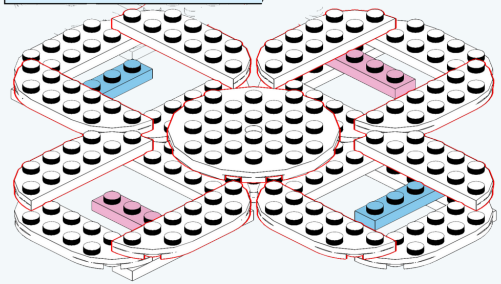

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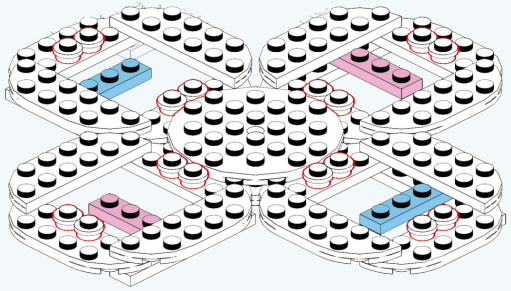

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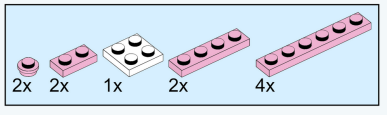

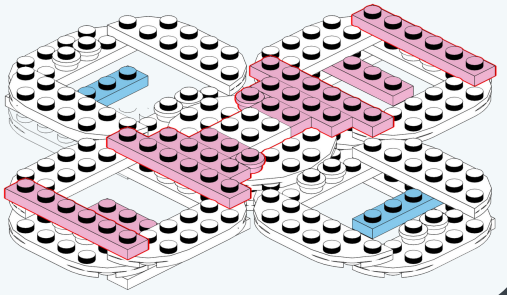

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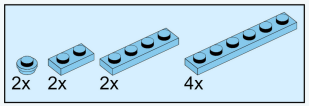

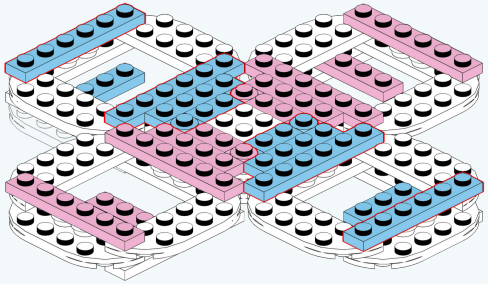

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