Artificial Blood

Micky Tamayo – Biomedical Engineering – University of Rhode Island

Artificial Blood is essentially just a liquid to fill volume and the oxygen the body needs for a short time. However, artificial blood is much better called blood substitutes since it does not execute many of the functions that blood does. The two main blood substitutes are volume expanders and oxygen therapeutics. Volume expanders are simply there to fill in for the shortage of blood, whereas oxygen therapeutics imitates the blood's oxygen carrying ability.

When you lose a lot of blood the most important thing to do is to stop the blood flow and replace the volume. Volume expanders are often made up of Ringer's Lactate, normal saline, Haemaccel and Gelofusin. What remains of the red blood cells in the body will still transport oxygen, not to mention that the average human has an excess of oxygen in their blood which is only used in immense physical exertion. Once the volume expanders take the place of the lost blood, the heart will quickly pump more blood resulting in more oxygen flow. The person's blood will then be diluted, but provides them with enough oxygen and volume to be okay.

Oxygen transporting blood is not nearly as easy to reproduce. There are two ways to obtain the oxygen carrying trait of blood, through usage of perfluorocarbons and hemoglobin from another person or animal. Perfluorocarbons will not mix with blood, and therefore is diluted with water. It is then mixed with a large number of vitamins and salts so that it won't be denied by the body's immune system. These PFC particles are about 40 times smaller than the diameter of an average red blood cell, and it therefore takes a lot of PFCs to make to cover any oxygen loss.

Although 33% of red blood cells are made up of hemoglobin, it is very difficult to use to cover an oxygen loss. The reason for this is because pure hemoglobin without a red blood cell can be toxic to the kidney. The only way to get hemoglobin into the blood stream safely is through use of cross-linking, polymerization, or encapsulation.

Blood substitution is very important because while donations increase 2-3% annually, demand increases 6-8%. While blood transfusion is very safe in the US, 40% of Southern African countries have AIDS/HIV and testing for this isn't financially possible.

References:

http://en.wikipedia.org/wiki/Artificial_blood
http://www.dcmsonline.org/jax-medicine/1998journals/december98/artificialblood.htm
http://www.howstuffworks.com/artificial-blood.htm
http://www.medicine.mcgill.ca/artcell/