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ELE 282
Respirocytes

According to the World Health Organization the today's world is suffering an extreme shortage of donor blood, even with Red Cross receiving 36,000 units a day this doesn't satisfy the 80,000 that are needed. People that have anemia also run into a blood problem when they're hemoglobin concentration in the red blood cells fall below normal, which can case severe tissue damage. The root of the problem lies in hemoglobin because it delivers oxygen from the lungs to the body tissue. A possible future solution to this problem has been purposed by Scientists at the Institute for Molecular Manufacturing with their mechanical artificial red cell called a "Respirocyte". The respirocyte is a nanomedical spherical device made up of a flawless diamond or sapphire shell. This sphere is 100 nanometers in diameter, and due to its size is constructed atom by atom. The sphere will be contained with a high pressure level of oxygen, as well as a mechanical engine, sorting rotors, and other sub-systems. The respirocyte carries gas molecules out of pressurized micro-vessels, to do this micro-rotors are exposed to the interior (the chambers) and exterior (blood plasma) areas of the respirocyte, and through molecular binding the gas is brought into the chamber. The gas is released from the tanks by forcible ejecting the gas by rods. By driving the rotor a particular speed the rotor could release the oxygen at the desired rate. This rotor is powered by combining glucose with oxygen to generate the amount of mechanical energy needed. Perhaps one of the most important factors with the respirocyte is the amount of compressed oxygen it can hold, as well as how long it will last. A liter of blood normally contains around .2 liters of oxygen, the respirocyte contains 530 liters. Using Van de Walls equation it has been calculated, that a mol of oxygen at 1000 atmospheres, occupies .048 liters, and at 1 atmosphere occupies around 25.4 liters. The ration is around 530:1, by further calculations oxygen at 1000 atmospheres could approximately last 36 hours.

Perhaps an even more advanced respirocyte could detect when the oxygen levels reached too low, and only then would it released oxygen as a means of reserve for emergency situations. Theoretically if the resiprocyte could also simultaneously absorb carbon dioxide when it was present in high concentrations in the tissue, and release at low levels it could remove a major product of metabolic activity, and there wouldn't even be a need for red blood cells in the body. This type of respirocyte would also be around 1000 times more efficient then normal red blood cells. The issue of problems that could occur with a respirocyte has been brought up, however in most situations since the respirocyte is a nanometers in size it would produce an oxygen bubble nanometers in size, therefore if a complication did occur the result wouldn't be so sever. Another problem discussed is placing the respirocytes in the body and how they will be accepted. The surface could have a variety of "camouflage" molecules covalently bound to its surface therefore interacting more friendly with the body.