RESPIROCYTES - IMPROVING UPON NATURE'S DESIGN:

BREATHE EASY WITH RESPIROCYTES

A respirocyte is a theoretical engineering design for an artificial red blood cell about a micron in diameter - a machine that cannot be constructed with current technology. Respirocytes are micron-scale spherical robotic red blood cells comprised of nanometer-scale components, containing an internal pressure of 1000 atmospheres of compressed oxygen and carbon dioxide.

The intense pressure would be safely contained in two separate high pressure vessels likely made of pure diamond. At this intense pressure, a respirocyte could hold 236 times more oxygen and carbon dioxide than our natural red blood cells. Respirocytes are an elegantly simplistic design, powered by glucose in the blood and able to manage carbonic acidity via an onboard internal nanocomputer and a multitude of chemical/pressure sensors. 3D nanoscale fabrication will allow respirocytes to be manufactured in practically unlimited supply very inexpensively, directly from a computer design.

An injection of such nanotechnological devices would enable a person to run at top speed for 15 minutes or remain underwater for four hours on a single breath. Because of their smaller form factor, 1µm diameter, compared with the 8µm diameter of a red blood cell, respirocytes would have potential unique medical applications including the prevention and treatment of ischemia (inadequate oxygen delivery to tissues.) Being smaller in diameter, respirocytes could squeeze into much thinner blood vessels, delivering vital oxygen to cells.

A respirocyte consists of three major design components: rotors to take in oxygen from the lungs and release it in the bloodstream; rotors to gather carbon dioxide from the bloodstream and release it in the lungs; and rotors to take in glucose from the bloodstream for generating energy in a process similar to cellular respiration. Preliminary studies have found that extremely smooth diamondoid surfaces would be practically invisible to white blood cells, making the devices biocompatible.

Respirocytes were designed and analyzed in detail by Robert Freitas, a nanotechnology researcher at the Institute for Molecular Manufacturing. The paper describing the concept is titled, "A Mechanical Artificial Red Cell:"
Exploratory Design in Medical Nanotechnology.* Nanomedical applications such as those envisioned by Freitas could become commonplace in the mid-to-long term futures of many of those alive today.

Respirocytes would have interesting applications for **diving**. A diver with respirocytes in his/her bloodstream would be able to dive for hours on a single breath while avoiding both the bends and narcosis, since these afflictions are caused by breathing compressed air underwater (under pressure) which allows more nitrogen to dissolve into the bloodstream than at one atmosphere of pressure. Returning to the surface after prolonged submersion can cause the nitrogen dissolved in the blood to return to a gas (bubbles) more quickly than it can it can be removed.

The dramatic enhancement of human performance made possible by respirocytes could cause the body to overheat. It is also possible that such enhancement to one part of the body will have unforeseen consequences to other bodily systems. Only with actual testing of nanotechnological respirocytes in a living body will determine for certain exactly how these devices will behave in the real world.

Eventually, as we continue to enhance and replace the biological body one part at a time, artificial white blood cells will likely be developed to augment and ultimately replace the human immune system. Even sub-cellular systems such as the organelles, and even the entire nucleus within each of our cells are not beyond technological replacement - at least in theory.