

# The Total Artificial Heart

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The number one leading cause of death in the entire world is heart failure. In the United States alone, more than 700,000 people each year die from heart failure. While nearly half can be saved by undergoing surgery, thousands die before they can ever reach an operating table- only about 2,000 individuals are lucky enough to get a heart transplant each year. Many people die because of the lack of availability or there are no matchable donor hearts. Due to the scarce availability of transplantable hearts, artificial hearts have made their way into many people chest.

An artificial heart is a machine or mechanical pump that is implanted or that can remain externally from a human body and replace once heart. Artificial hearts maintain blood circulation and oxygenation for various periods of time. Artificial hearts are often confused with Ventricular assist devices which, like the artificial heart is a mechanical pump that is used for temporary blood circulation support but unlike artificial hearts, they can't fully replace a once functional heart.

One type of artificial heart is the AbioCor artificial heart. This artificial heart unlike many other past artificial hearts, fully replaces an existing heart. Candidates for the AbioCor Heart are heart patients who suffer from congestive heart failure or coronary heart disease. The patients must have a life expectancy of less than 30 days and have no other viable treatment option.

The AbioCor is an artificial heart developed by the Massachusetts based company AbioMed and it is one of the only FDA approved hearts. The heart is designed to be fully mobile and allow bearers to still carry-out their regular day activities in moderation. Moving parts such as the valves and the hydraulic membranes are made from a material called Angioflex. Angioflex is a specially engineered plastic that helps prevent damage to blood cells and is made out of proprietary polyether-based polyurethane plastic.

The device has four implantable parts. The heart contains an internal motor that is able to pump blood to the lungs and the rest of the body almost mimicking a regular heartbeat with about 100,000 beats in a day. The heart also contains an artificial thoracic unit that weighs about two pounds and contains two artificial ventricles which are motor driven hydraulic pumping systems. The heart has electronic motoring devices that enables the

heart to pump faster based on physical needs. The heart also contains lithium batteries that are located internally and externally from the body. The internal battery can last for about 30 minutes while the external battery can hold a charge for up to 4 hours. The heart is powered from a TET (transcutaneous energy transmission) device which enables the heart to be powered from an external source without penetrating the skin with wires.



The AbioCor unit cost about \$70,000. The estimated cost for the artificial heart implantation is \$160,000. The surgery itself takes about 7 hours to complete and can only be done at any of the following four hospitals in the United States

1. St. Vincent Medical Center in Indianapolis, IN
2. Texas Heart Institute at St. Luke's Episcopal Hospital in Houston, TX
3. Robert Wood Johnson University Hospital in New Brunswick, NJ
4. Johns Hopkins Hospital In Baltimore, MD

Although a large number of artificial hearts are currently replacing damaged hearts they are still in their developmental stage. Scientist and engineers are still trying to invent a heart capable of replacing ones normal heart for extended periods of time without "damaging the fluid or the cellular elements of whole blood" and one that can fully take the place of a properly functioning heart.

Work Cited

<http://www.abiomed.com>

<http://health.howstuffworks.com/artificial-heart2.htm>

<http://www.texasheart.org/Research/Devices/abiocor.cfm>

<http://www.heartreplacement.com/centers.html>

The New Encyclopaedia Britannica, 2007 vol 1 . "Artificial hearts"