



Victor Chang
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SCHOOL PROJECT MATERIAL

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THE HEART

The heart is a vital organ. It is a muscle that pumps blood to all parts of your body and provides your body with oxygen and nourishment to keep you alive and healthy. It is the first organ in a newly developed baby to start functioning and it has to function very efficiently if the baby is to grow and survive.

Your body has a network of blood vessels called arteries and veins which carry the blood pumped by your heart. Together the heart and the blood vessels make up the circulatory system.

The heart has a right and left side separated by a wall. Each side has a small collecting chamber called an atrium leading into a large pumping chamber called a ventricle. There are four chambers: the left atrium and ventricle, and the right atrium and ventricle.

The right side of the heart collects blood on its return from the rest of the body. The blood entering the right side of the heart is low in oxygen because oxygen is removed from the blood as it travels through the body's organs and tissues. The heart then pumps the blood onwards to the lungs to receive more oxygen after which it returns directly to the left side of the heart which then pumps it to all parts of the body.

The left ventricle is larger and thicker than the right ventricle due to the need for it to generate the high pressures required for blood to be pumped further around the body.

Valves guard the entrance and exit of the heart's chambers to ensure the blood flows in the right direction.

Your circulatory system is made up of your heart together with a network of blood vessels called arteries and veins which carry the pumped blood to your heart.

The largest artery in your body is the aorta which has branches that carry blood to your heart, brain, arm and legs and organs inside the chest and abdomen. Arteries carry blood away from the heart, whereas veins bring blood back to the heart.

The heart muscle has its own blood supply fed by branches of the aorta known as coronary arteries. Capillaries, which are smaller blood vessels, carry oxygen and nutrients into body tissues and cannot be seen by the naked eye.

The heart is fatigue resistant. It contracts relentlessly approximately 70 times a minute, 100,000 times a day, two and a half billion times a lifetime.

The heart pumps between 70 ml and 100 ml of blood each beat. The heart pumps blood to the lungs, back to the heart, out to the body and back to the heart again in about 23 seconds.



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ARTIFICIAL HEARTS

An artificial heart is a man-made pumping chamber capable of pumping blood around the body of a person whose own heart is failing. It is made of a combination of metal and plastic and consists of a small pumping chamber that is lined with a special material to prevent blood clots. It may be implanted within the body or may lie outside the body depending on the type used.

Blood enters the artificial heart from the left or right atrium and is then pumped into the aorta or pulmonary artery, depending on which side of the heart is being supported.

The device is powered by either compressed air or electricity. A thin cable connects the pumping chamber to a control console from which the pump function is regulated. The control console may be a large box on wheels that moves with the person or a much smaller controller with attachable batteries that can be worn on a belt or vest.

The artificial heart normally remains in place until the person receives a donor heart. The person receives a transplant when his or her medical condition has improved enough to make it safe to perform the transplant and a suitable donor has been found. During the transplant operation, the artificial heart is removed.

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HEART TRANSPLANTS

People whose hearts are severely damaged may develop a condition known as heart failure where the heart is unable to pump properly. It is usually caused by coronary heart disease or by cardiomyopathy, a condition that weakens the heart muscle. Only a small percentage of the people who have heart failure need a heart transplant.

Untreated heart failure can lead to breathlessness, tiredness, swelling of the legs and abdomen, electrical disturbances of the heart and an inability to exercise. In more advanced cases, patients become breathless after very little activity.

Once it has been determined that a patient is in need of a heart transplant, the following must be taken into consideration before the patient is put on the waiting list. Other organs such as kidneys and liver must be functioning normally, the patient must not smoke or drink alcohol, and be willing to take care of their new organ.

If a patient fits the above criteria, they carry a pager so they can be contacted at very short notice and can get to hospital immediately a suitable donor heart becomes available.

Surgery normally takes from three to six hours. The old heart, in most cases, is removed through an incision in the chest and the diseased heart replaced with the donor heart, commonly known as an 'orthotopic' heart transplant. Sometimes the donor heart can be attached to the old heart acting as an assist pump for the old heart. This is known as a 'heterotopic' heart transplant. A patient normally stays in hospital 8 – 10 days after a transplant. Medical supervision, which is frequent at first, is then given on an outpatient basis. Eventually patients need only to be seen for an annually for a check-up.

Most patients suffer some form of organ rejection, particularly in the first six months after the transplant because the body recognises the transplanted heart as 'foreign' and therefore the patient's immune system attempts to 'reject' the transplanted organ. To control this, drugs must be taken by the recipient over their lifetime to slow down the rejection process.

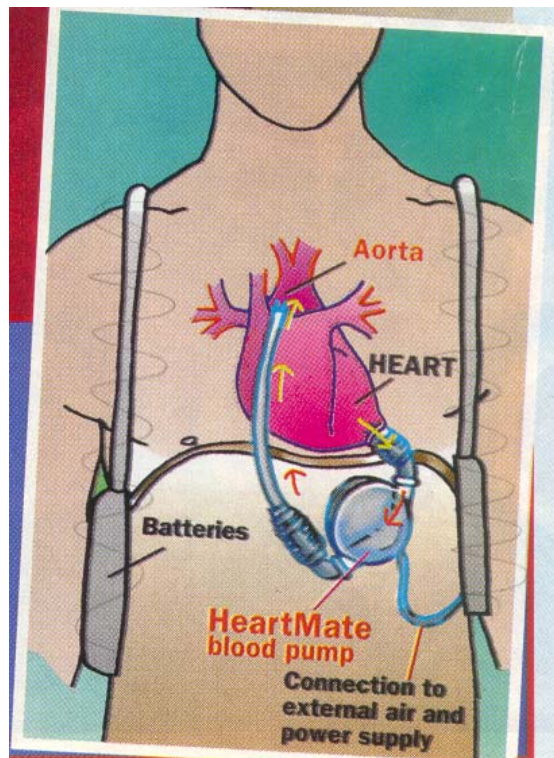
The average heart transplant can be expected to last between 10 and 20 years and can be performed from infancy to 65 years of age (results are not quite as good in patients over 60).

Heart transplant recipients go back to work and can lead a normal life. There is generally no need for lighter work; manual labour and other 'physical' occupations are often still possible.



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The HeartMate Blood Pump



The Heart Mate Blood Pump is a ventricular-assist device which acts like a fifth heart chamber and helps push oxygenated blood out through the arteries. The HeartMate has two chambers: an upper one to collect and expel blood and a lower one that houses the electric motor. Each time the motor rotates, the piston moves upward, pushing the diaphragm into the blood chamber and forcing blood out of the pump. The HeartMate is secured to the abdomen just below the diaphragm and powered, in this model, by an air pump. The device is made of titanium microspheres to give it a rough surface to prevent blood from clotting.

Dr Victor Chang pioneered the heart pump until his death in 1991.

Reference

The New Weekly – April 1994, 10 year anniversary of the first heart transplant



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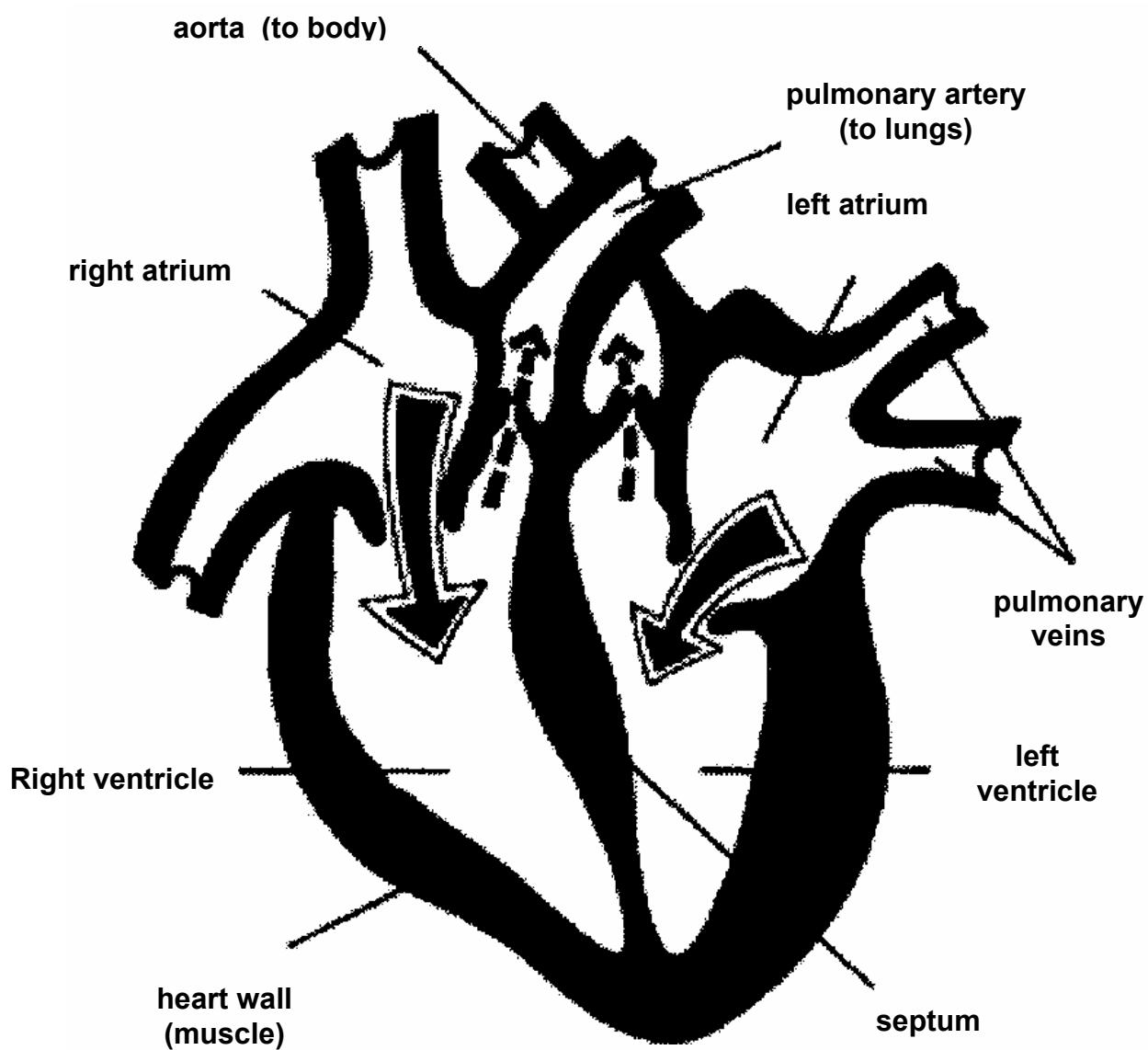
Victor Chang's Artificial Heart

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The Heart





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HEART FACTS

- The word cardiovascular comes from a Greek word cardiac meaning heart, and latin word vasculum meaning vessel. The cardiovascular system comprises the heart and blood vessels, arteries, veins and capillaries.
- 280,000 Australians of all age groups suffer from heart disease
- Heart disease does not discriminate – it strikes young and old
- The heart is fatigue resistant
- The heart contracts unrelentlessly approximately 70 times a minute, 100,000 times a day, two and a half billion times a lifetime
- The heart pumps between 70 ml and 100 ml of blood each beat
- The heart pumps blood to the lungs, back to the heart, out to the body and back to the heart again in about 23 seconds.
- The heart is the first organ to begin functioning during embryonic life
- Despite recent progress, heart disease claims the life of one Australian every 10 minutes (1)
- In 2000, 12,469 Australian women died from coronary heart disease. That is 5 times as many deaths from breast cancer. (1)
- In Australia, the number of heart failure deaths is 1.7 times higher in woman than in men. (1)
- Women have an average of ten to fifteen years free of coronary heart disease when compared with men and as a consequence are much older than their male counterparts when symptoms develop. (1)
- In Australia the life expectancy of women is 82.0 years compared with 76.6 years for men. (1)
- For a 40 year old, the risk of having coronary heart disease at some time in their future is one in two for men and one in three for women. (1)
- The health and economic burden of cardiovascular disease (CVD) exceeds that of any other disease. (1)

- Cardiovascular disease was the leading cause of death in Australia in 2000, ahead of all cancers and other groups of causes of death, accounting for 49,741 deaths or 39% of all deaths. (1)
- During 1990-2000 , death rates from Cardiovascular Disease fell by 4.2% per year for males and 4.0% per year for females. (1)
- People with a history of CHD account for 5% of the population but 31% of coronary events. (2)
- Each year, around 40,000 Australians have a stroke, with 70% of these being first-ever strokes. (1)
- Over 90% of heart attack victims survive especially if treated at a world class medical facility such as St Vincent's Hospital
- Despite this, 50% of those survivors go on to develop heart failure because of the critical loss of heart muscle.
- There are over 3000 children, teenagers and adults who are waiting desperately for heart, kidney or lung transplants
- The first heart transplant in Australia was performed at ST Vincent's hospital in 1968
- The first heart lung transplant was performed at St Vincent's Hospital in 1986
- The First single lung transplant was performed in Australia in 1990 and the first bilateral lung transplant in 1992.

References:

- (1) Australian Institute of Health and Welfare 2001. Australia's Health 2002 Canberra: AIHW
- (2) Australian Institute of Health and Welfare 2001. Heart,stroke and vascular diseases: Australian Facts 2001. AIHW Cat No. CVD 13. Canberra: AIHW, National Heart Foundation of Australia, National Stroke Foundation of Australia (Cardiovascular Disease Series No. 14)