

# HUMAN CYBORGS vs. BIONIC HUMANS

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(1) Before we can discuss human cyborgs and bionic humans, we have to understand the difference between robots, androids, human cyborgs and bionic humans. These terms can often be confused for one another, so let's make things clear before we begin. A robot is a machine used to perform a task. An android is a robot that is designed to look and behave like a human. A cyborg is a human whose brain is connected to a robotic device attached to their body. They can control this device with their mind. A bionic person is someone who has robotic hardware attached to them, but it is not connected to their brain. This hardware is meant to replace or enhance body parts but it cannot be controlled by their mind. Bionic people have been around for longer than human cyborgs. The technology to develop bionic implants (implants are devices attached to the body) was developed earlier than cybernetic implants because bionics does not involve the complex task of connecting hardware to the brain.

(2) Most bionic people became bionic because they were either born without a limb or had a limb removed due to an accident or disease. These people are called amputees after the word amputate, meaning to cut off a body part. Many war veterans and car crash victims become amputees.

(3) A bionic leg implant reproduces many of the functions of a lower limb. A bionic leg has parts that mimic the muscles and tendons of a real leg to generate the forces and motions needed to restore a natural walking motion, speed and gait. A typical prosthetic arm has very little hand function, but a bionic arm has a hand which has movable fingers and thumb that can grip as well as a mobile wrist. Not surprisingly, the word bionic means "life-like". Bionic implants are more complex devices than "fake" arm and leg prosthetics which are not able to replicate many functions of a limb.

(4) The mechanics in a bionic arm or leg can be controlled by the user when sensors on the bionic implants are connected to the muscles located on the stump (end part) of the amputated limb. When these muscles contract, signals are sent through the sensors to the bionic device to control its movement.



(5) Many types of artificial hearts have also been developed over the last few decades. They can be used for different reasons. Some are developed to be used temporarily for patients who are on heart transplant waiting lists. A bionic heart can be used as a "bridge" to extend the life of the patient until a proper organ donor can be found. Some artificial hearts are used to give a damaged heart time to rest and heal when it doesn't have to do the work of pumping. When the heart heals, the bionic heart can be removed and the healed heart can resume its role of pumping blood. This technique has been used most successfully in young children. Some artificial hearts are being developed as permanent replacements. This is the most difficult type of heart to successfully make because it not only has to function properly, but it also has to last for many years if not many decades.

(6) If a bionic leg or arm were connected to the user's brain, instead of onto the muscles of a stump, it would no longer be called a bionic implant; it would be called a cybernetic implant. Instead of a bionic human, the user would become a human cyborg. The advantage of connecting to the brain is that it gives the user more control of the implant. It may even allow the user to receive and detect sensory information from the implant like stimulus from pressure, temperature or light, if the implant is equipped with certain sensors.

(7) What allows a cybernetic limb to work is that a person still has the ability to control a limb even when the limb has been removed. An area of the brain, called the motor cortex, is responsible for controlling the movement of all

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the voluntary skeletal muscles that move the limbs. The motor cortex is connected to the muscles in the limbs through long nerve tracts that run from the brain, through the spinal cord, and then towards the limb. If an amputation is performed but the nerve tracts remain undamaged, except for the cut ends of the nerves, then the nerves in the stump are still functional and capable of sending and receiving signals to and from the brain. A cybernetic implant has wires that attach to the end of the nerves and this allows the motor cortex to communicate with the cybernetic implant and control it.

(8) There are two types of cybernetic technologies. One type tries to restore normal function for people who have lost it and another, more controversial type, tries to enhance human abilities so that they become superhuman. Imagine removing a healthy eye in order to replace it with a cybernetic eye that could see in the dark or detect thermal radiation. What about replacing your leg muscles with electronic muscles that give you the ability to run faster and longer, and jump higher? The cybernetic enhancement of body parts is of great interest to military agencies around the world and it brings up the question of ethics surrounding this type of technology.

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## Article Questions

- 1) What is the main difference between a bionic human and a human cyborg?
- 2) What does amputation mean?
- 3) What does the word bionic mean?
- 4) When an artificial heart is used as a "bridge", what does that mean?
- 5) What challenge is involved in making a permanent bionic heart?
- 6) Describe how a person with a bionic arm implant versus one with a cybernetic arm implant would control the implant differently? Be specific.
- 7) Describe the difference between restorative cybernetics and enhanced cybernetics. What is your opinion on enhanced cybernetics?