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INTRODUCTION

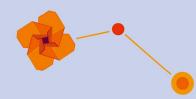
Imagine a world where all around us are people with bionic limbs, machine-assisted hearts and cameras for eyes. This same world has cyborgs who can hear colours and communicate via their teeth, and even people who use robotic skeletons to walk marathons. In this world, children learn to hear with external ears, and people born without legs can walk using ones made of metal and carbon fibre. Some people use chips inside their bodies to get into their offices, or to pay for their coffees on their way into work. This world is full of incredible people who are using technology to do amazing things... but the most astounding part of it all is that this world is the one we already live in.

Technology has changed all of our lives, and not just with the smartphones or tablets that we use. For some people, particularly those with disabilities, recent technological advances have crossed the realms of the purely imaginable, and reached a place of possibility. We don't notice it all the time, but bionic technology exists and is right in front of our noses. Far from a scene from a science-fiction film, the future is in fact already here.

This book explores the most recent devices that mimic biology, from intricate bionic hands (see pages 32–33) to neural implants (pages 40–41), and includes some of the major milestones that got us here. We will also look forwards at the exciting inventions that lie around the corner, as well as what they mean for us as a species. Our journey to the future has already begun, and it is time to get to know Human 2.0.

THE FIRST PROSTHESES

For as long as humans have been around, we have been losing limbs, or are born without them. Whether due to an injury or congenital impairment (a condition that is present from birth), people have been trying to replace missing arms, legs, fingers and toes for thousands of years. Early prostheses were revolutionary for their time, yet their inventors did not have the technology needed to provide better functionality and comfort. Even so, some of these early prostheses closely resemble those that exist today.



The earliest-known example of a prosthesis (an artificial body part) belonged to an Egyptian noblewoman over 2,600 years ago. This wooden prosthesis replaced the big toe on her right foot, and even had a ridge in the shape of a nail carved into it to make it appear more realistic. It would have been strapped onto her foot with string, and scientists believe that it would have greatly aided her balance.

The earliest-written mention of a prosthesis dates to around 77 cc, and describes the iron hand belonging to the Roman general Marcus Sergius. Sergius was said to be one of the finest generals of his time, especially because of his bravery in battle. Across two campaigns he was wounded 23 times, resulting in the loss of his right hand. Sergius's replacement hand was strapped to his arm, perhaps allowing him to hold a shield for future battles.







WHAT IS BIONIC?

Bionic refers to the transfer of technology between artificial objects and living organisms. The word itself comes from a combination of the Greek word for 'life', bios, and the word 'electronics'. It was coined by American doctor and ex-US Air Force colonel Jack E. Steele in the 1950s.

Prior to Steele, the American biophysicist Otto Schmitt developed the concept of 'biomimetics' – the transfer of ideas from biology to technology. In 1960, Steele presented an ambitious lecture and organised a gathering of experts on the topic of how new technologies could be discovered by looking at examples in nature. This field of research is known as biomimicry. A few of the best inventions to come from this field include streamlined swimsuits inspired by the structure of shark's skin, Velcro® fasteners modelled on how burrs (plant seeds) latch onto animal fur, and the shape of aeroplanes, which were designed by looking at how birds soar through the air.

Steele's lecture was titled How Do We Get There?, and the term 'bionic' was later picked up by the writer Martin Caidin in his 1972 novel, Cyborg. From this point onwards, the word 'bionic' became part of today's culture and has been used to describe a whole range of prosthetic devices ever since.

BIONIC LIMBS AND IMPLANTABLE DEVICES

'Implantable devices' is a broad term describing anything that is surgically implanted inside the body. Because surgery is required to gain access, these devices cannot easily be removed, and are typically designed to stay inside the body forever. Examples of these include pacemakers and cochlear implants.

A prosthesis can be internal or external to the body. The ways in which people can replace parts of their body can largely be broken down into two groups: bionic limbs and implantable devices.

Bionic limbs are artificial body parts, which are intended to replace the function of a human body part, such as an arm or a leg. These are attached to the body, usually via a belt, strap or socket, and can be easily taken on and off by their wearer.

If either a bionic limb or an implant has batteries that need to be charged, they are called 'active'. Those that do not are called 'passive'. Some implants, such as cochlear implants, need batteries. These sit outside the body and attach to the implant via a wire, so the user does not need surgery every time the battery runs out (see pages 28–29).

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