УДК 617.3
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BIONICS AS THE PROSPECT FOR PEOPLE WITH LIMITED ABILITIES

Bionics, science of constructing artificial systems that have some of the characteristics of living systems. Bionics is not a specialized science but an interscience discipline, it may be compared with cybernetics. Bionics and cybernetics have been called the two sides of the same coin. Both use models of living systems, bionics in order to find new ideas for useful artificial machines and systems, cybernetics to seek the explanation of living beings' behaviour.

Advances in bionics have already had a huge impact on patients' lives. Bionic implants refer to electronic or mechatronic parts that augment or restore physical functionality to a differently-abled person. The bionics industry has grown along four major application areas: vision, hearing, orthopedics and a small, motley group of implants that augment cardiac and neurological functions are the current landscape, with extreme potential to grow.

According to the World Health Organization, more than 1 billion people (approximately 15% of the world's population), are living with some form of physical disability, and about 190 million adults have a major functional difficulty. Orthopedic bionics are designed to restore motor functionality (not necessarily sensory functionality) to the physically challenged. Bionic limbs are replacing prosthetic limbs, which were standard fare for more than 100 years. Despite notable innovations that resulted in lighter devices and better designs, prosthetic limbs did not provide the necessary functional restoration that bionic devices now do.

A bionic limb is interfaced with a patient's neuromuscular system for limb control – flexing, bending and grasping – using the brain. A similar functional pathway exists here: The damaged peripheral nerves are bypassed and a new electronic pathway connects the mechatronic limb with the brain.

In the current situation, orthopedic bionics is very relevant for Ukraine, where many people who have suffered as a result of hostilities require medical assistance in this area.

Limb amputation requires a lifetime of care. For each amputation, the cost of prosthetic care has been estimated to range between $1.4 and $2.8 million over a lifetime. Prosthetic fittings that allow sustained high-levels of daily activities are difficult to achieve. Indeed, skin, nerves, muscles and bones of the residuum (also called the stump) may be compromised by acute and chronic skin issues, oedema, neuroma, muscle contractures, or fractures. This makes daily prosthetic loading difficult to withstand. Challenges with prosthetic fittings lead to frequent and, too often, permanent prosthesis abandonment in 25–57% of cases.

Alternatively, individuals experiencing overwhelming socket issues can be fitted with bionic limbs. A bionic solution is a technological platform relying on three interconnected pillars: the engine, the chassis, and the power-assisted steering wheel. Bionic limbs have physical connections with all sorts of body parts like the brain, nerves, muscles, skin and bone.

A relative new space in the bionics industry is robotic exoskeletons. As the name indicates, these are electromechanical structures that patients wear to benefit from "motorized muscles". These powered suits help patients who have limited or no muscle control walk, lift and generally be mobile. Exoskeletons are promising innovations that are expected to make a huge impact in the rehabilitation of patients who have suffered strokes or spinal injuries, and those who suffer from degenerative neuromuscular diseases such as amyotrophic lateral sclerosis.

Bionics offers a suitable framework for the specific and efficient transfer of knowledge from pure research right up to technical implementation. This transfer of knowledge is indispensable, in order to keep a long term technological edge. From the way that things stand at the moment bionics represents a technology option with immense potential.