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Bionics potential largely untapped in India

27 April 2017 | Features

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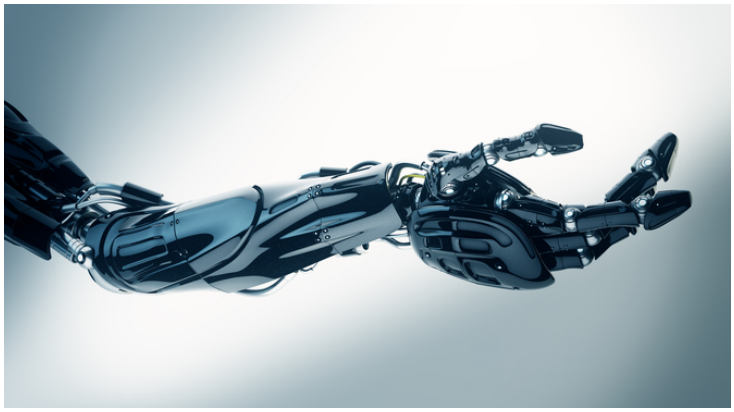

Artificial limbs that can help people walk, artificial eyes that help blind people see! Who knew that original body parts can be replaced by artificial ones. Welcome to the new world of bionics. Traditional applications of bionics in healthcare, including artificial organs replacing, mimicking and even enhancing biological function when compared to native organic equivalents, is quite old. Recently there has been a new wave of bio-inspired treatments that act through the reorganisation of the existing biological organs in an individual to enhance physiology.

According to Suresh Ramu, CEO Cytecare Hospital, “Bionics, which is a combination of biology and electronic equipment, is gaining a rising demand in India, even though the technology is currently in its developing stages. Presently, many medical institutions prefer bionics over organ transplants or usage of traditional methods such as a wooden leg or a marble or glass eye. However, bionics still has a long way to go as it requires a more growth inductive environment for further development.”

Bionics Market

“Bionics, when extended to the field of medicine, seeks to replace or enhance organs or parts of the human body using artificial prosthesis. The market is expected to grow at a CAGR of 7.1 per cent from 2012 to 2017 to reach $17.82 billion by 2017,” according to report by MarketsandMarkets.

In another report by Mordor Intelligence, “The Indian artificial organs and bionics market is expected to reach USD 2.15 billion by the end of 2019. The CAGR during this period of estimation is expected to be 11.65 per cent.”

Currently, the global market is dominated by North America, primarily due to higher per capita income and increased awareness among the population. Following North America are Europe and Asia-Pacific. The Asia-Pacific market is filled with potential and is penetrated only to a certain extent. There is great scope for new entrants in the emerging markets of Asia and Latin America.

Dr Deepak Joshi, Assistant Professor, Centre for Biomedical Engineering, IIT Delhi said, “Unfortunately, the awareness about bionics in India is still below expectations. The main reason is the research and development in bionics at infancy stage. The awareness about artificial organs has to be done intensely to get full benefit of this technology. Further, start-

ups in this emerging area of technology will strengthen the healthcare sector. Also, there is an urgent need of clinicians and engineers working together to make strong impact of this technology in India. The courses like biomedical engineering with a focus on bionics will help students to get ready for future in bionic research and artificial organs."

Dr Narayan Pendse, Associate Vice President, Medical Strategy & Operations, Fortis Healthcare underlines the importance of high-end care institutions. "Most of the publications too are only in scientific research journals and practically no information is available in the public domain. Many doctors feel that this is an evolving area of science and medicine and is still futuristic for a healthcare system like ours; it will take years for the technology to be more user friendly and affordable – hence interest levels are low. Ironically, a population like ours will need bionics the most - aging population, high incidence of road traffic accidents, and high incidence of diabetes related morbidity like amputations and loss of vision. Hence, strong messaging on the importance of developing bionics is needed supplemented by detailed cost-benefit analysis."

Market drivers

Bionics market in India is hugely driven by some of the positive and negative factors that are playing a crucial role in its growth with one or more hindrances. India's rapidly aging population, increased number of people suffering from organ failures, rising incidents of motors accidents and injuries leading to amputations, rapid technological advancements in the bionics sector and huge scarcity of donor organs for organ transplantations are directly or indirectly responsible for the growth of the bionics market. There are some factors limiting the growth of the market — stringent regulatory framework for use of artificial organs and bionics and sometimes fear of malfunction or failure of device.

Milestones

Bionic Eye

Bionic Eye help a blind person to see even the basics of light, movement and shape. Argus II is the first ever bionic eye which uses electrodes implanted in the eye, which could help people who've lost some of their retinal function.

"The recent development in the field have been bionic eye, which allows blind or heavily sight-impaired individuals to make out objects, see edges and detect light. This is a huge improvement for anyone in need of the technology," said Ramu

Bionic ear

It is a neural prosthesis designed to produce hearing sensations by electrically stimulating nerves inside the inner ear of deaf patients. It is surgically placed under the patient's skin behind the ear and consist of stimulator. Here in India, Defence Research & Development Organisation (DRDO) has developed an cochlear implant that will boost the hearing capacity of the hearing impaired. This implant can create and convey sound to people severely hard of hearing due to loss of sensory hair cells in the cochlea. Unlike hearing aids that make sounds louder, cochlear implants bypass the damaged hair cells of the inner ear (cochlea) to provide sound signals to the brain.

Prosthetic Limb

A hand amputee can expect a replacement hand that replicates a whole host of normal hand functions and looks remarkably lifelike. Similarly, in case of amputated legs or other locomotors, amputee can now get a replacement that replicates a whole host of normal organ.

Bionic Heart

World's first bionic heart was developed by Australian researchers. It pumps blood without a pulse.

India in Bionics: Status & Challenges

In India, cochlear implants have been developed by a unit of DRDO. The imported cochlear implant generally costs about Rs 7 to Rs 10 lakhs. The indigenous bionic ear will be available for Rs 1 lakh. Scientists from institutes like Advanced Numerical Research and Analysis Group (Hyderabad), Andhra University, Visakhapatnam and Naval Science and Technological Laboratory (NSTL), Visakhapatnam, are working with DRDO on this project. This bionic ear is under clinical trials now. Also, Bionic eye or retinal implant has been co-invented by an Indian origin Scientist, Dr Rajat N Agrawal, an ophthalmologist and retina specialist/surgeon, University of Southern California, US. The device will enable to restore the sight of people who go blind due to conditions such as retinitis pigmentosa and age-related macular degeneration. He is presently working in collaboration with All India Institute of Medical Sciences and several IITs to indigenously develop a

cheaper variant of the eye implant so that people in India can afford it. The indigenously developed implant is expected to bring down the cost to Rs 5 lakh from its present cost of Rs 45 lakh.

Indian bionics market is still lagging behind as compared to markets of other countries.

Dr Neeta Raj Sharma, Associate Dean, LPU School of Biotechnology & Biosciences said, “Beyond biology, engineering, and clinical challenges, bionics have to face the regulatory and policy considerations. Since clinical trials and regulatory strategies are well established for traditional drugs, the bionics and implanted biosensors need new paradigms to test its efficacy and safety to replace the existing technologies.”

Future of Bionics

Bionics can be the next big thing in healthcare sector. With all the technological advancements that it has to offer, it can actually make a big difference in the way surgeries are performed but researchers and doctors in India are still not completely sure about this.

“While major challenges (overcoming host immune response, contact blood clotting, high costs, device failures and defects) are being overcome as newer versions are developed and the learning curve matures, it is still a distant dream for bionics to replace the traditional way of treating disease or surgery. The surgical profession by learning and training is wired to deal with ‘natural’ tissues and adapting to artificial ones will not come easy. However, as software and hardware evolves further to venture into the biomechanical domain it is bound to profoundly impact the very concept of natural versus artificial and may completely alter the traditional approach towards disease and surgeries,” said Dr Pendse

“There are certain limitations of the current technologies in bionics research in establishing the absolute integration between mind, body and machine. In most of the cases, bionics products do not replicate the complex fluid movements and also not capable to communicate directly with brain. At Lovely Professional University (LPU), we are trying to mix the knowledge of various domains together to overcome the possible hurdles in the desired research work. In my opinion, LPU bio-sciences and bio-technology schools are perfectly flourishing on these lines and multi-disciplinary researches one after the other,” said Dr Sharma

The next decade can be exciting for the field of Bionics. Just as biologists are discovering the structural and physiological mechanisms that underlie the functional properties of plants and animals, engineers are beginning to develop a fabrication tool kit that is sophisticated enough to capture their salient features. As the performance gap between biological structures and our mechanical analogs shortens, engineers may feel increasingly encouraged to seek and adopt design concepts from nature. Although the devices they construct may at first appear alien, their origins in the organic world can serve as an odd familiarity.