Marsi Bionics

Marsi Bionics was created in 2013 as a spin-off of the Centro de Automática y Robótica (CAR), a joint centre between the Consejo Superior de Investigaciones Científicas (CSIC) and the Universidad Politécnica de Madrid (UPM), transferring more than 20 years of know-how in robot locomotion. **Exceptionally, the CSIC has been a shareholder of Marsi Bionics since 2019.**

Marsi Bionics' major milestone has been to develop the world's first children's exoskeleton. There is no similar technology that allows 360° movement for children who cannot walk or who have lost the ability to walk.

It is a 100% success story of knowledge transfer in Spain. It was born from public research (2009) with a very personal story: the parents of Daniela, a girl who became paraplegic after an accident, approached the CSIC to look for a project that could help her walk. That is where the 'first steps' of the exoskeleton began. Once the project was completed, with a first prototype, Elena García Armada decided to create Marsi Bionics (2013) to transfer the results of the research to society.

From 2013 to 2021, Marsi Bionics finances, develops, industrialises, performs clinical research and certifies the device, which received the CE marking from the Spanish Agency for Medicines and Medical Devices in May 2021.

There is now distribution both in Spain and internationally. This process is the culmination of 8 years of knowledge transfer: from public research to hospitals and rehabilitation centres around the world.

Elena García Armada

Founder, promoter and director of the project, Elena García is considered one of the 10 most renowned scientists at the CSIC and one of the 30 most influential women in the world in the field of robotics.

He has more than 50 awards to his name. Among the most outstanding are the Queen Letizia National Disability Award from the Royal Board on Disability, the European Inventor of the Year Award from the European Patent Office, an international recognition that only two other Spaniards hold: Margarita Salas and José Luis Gómez (Talgo), the Gold Medal from the Red Cross and the Discapnet Award from the ONCE Foundation.

She is currently a member of the jury of the Princess of Asturias Award for Technical and Scientific Research and in 2022 she became the fifth woman to become an Academician of the Royal Academy of Engineering.

Paediatric exoskeleton

17 million children in the world are unable to walk due to neurological disorders of all kinds. And this lack of movement, beyond the difficulty in carrying out any activity, generates, above all, complications that affect the patient's quality of life and life expectancy. In order to provide a solution, Elena García Armada and her team have combined health with robotic technology and artificial intelligence to develop the world's first paediatric exoskeleton.

The exoskeleton is a device that adapts to the child's body to enable the child to stand and walk. It has 8 joints, with internationally patented technology, which imitate the functioning of natural muscle. This is achieved thanks to the concept of biomimicry.

The joint technology is elastic, which allows us to adapt to the child's muscular condition.

It has two modes of operation. The passive mode where the legs move automatically according to a configuration tailored to the child. And the movement intention mode that requires the child to exert a certain force - selected by the therapist - in order for the exoskeleton to move forward.

The exoskeleton is able to adapt its stiffness intelligently to different pathologies: from spinal muscular atrophy (SMA), a rare disease characterised by muscle weakness, to more spastic and dystonic conditions such as infantile cerebral palsy, which is the leading cause of motor disability in children.

What does the use of the exoskeleton entail?

The advance of this technology means changing the paradigm of rehabilitation of neuromuscular pathologies in childhood. Thanks to robotics, children who have never walked can stand up, and this is a fundamental change. Giving children the opportunity to move around in space means changing the concept of rehabilitation. It is no longer a machine or a person who forces you to make certain movements, but it is the child, in his or her eagerness to move, explore and play, who is working. And this produces effects that go beyond the muscular: we are talking about changing their visual field and the way they move, we are talking about self-confidence, security, voice projection. Getting a child who has never walked before to walk in an effective and real way is an opportunity for physical improvement, but also for personal growth.

Explanatory video for use by children, families and doctors at the Hospital Universitario La Paz: https://youtu.be/qwLZKlM95X4

Benefits

The human body is made for standing. That is why it is vital for children who have been in a wheelchair all their lives to be able to stand upright. Cardiorespiratory, muscular, gastrointestinal...

There are, of course, important clinical benefits. We are talking about respiratory improvement, strengthening of the thoracic and cephalic musculature, which leads to a delay in the musculoskeletal complications of their pathologies. But the change that occurs on a psychological and personal development level is vital: improved attention at school, improved sociability, motivation, self-perception and even autonomy to carry out daily activities such as eating on their own. And these changes are as or more important than the physical ones because we are talking about children in the midst of a process of personal growth.

These are some of the testimonies of patients and relatives: https://www.marsibionics.com/atlas-pediatric-exo/#expertos