



FES Rowing: Development Project in Chile, South America

June 2012

What is FES Rowing?



- **Functional Electrical Stimulation (FES)** is the artificial activation of **targeted paralyzed muscle**. In FES Rowing, electrodes placed on the skin, and controlled by the user, mean that the rower's legs can be moved to produce a normal rowing action.
- Following their injury, most people with spinal cord injuries **cannot voluntarily exercise enough muscle mass** to gain the benefits of a full body workout. The muscle mass in the upper body is small compared to the rest of the body and this has implications for the maximum intensity that can be reached. **FES Rowing is the only cardiovascular exercise** available to a person with a spinal cord injury **where their whole body is actively involved** in the exercise and the potential health benefits are enormous.

Health issues in SCI (Spinal Cord Injuries) population :



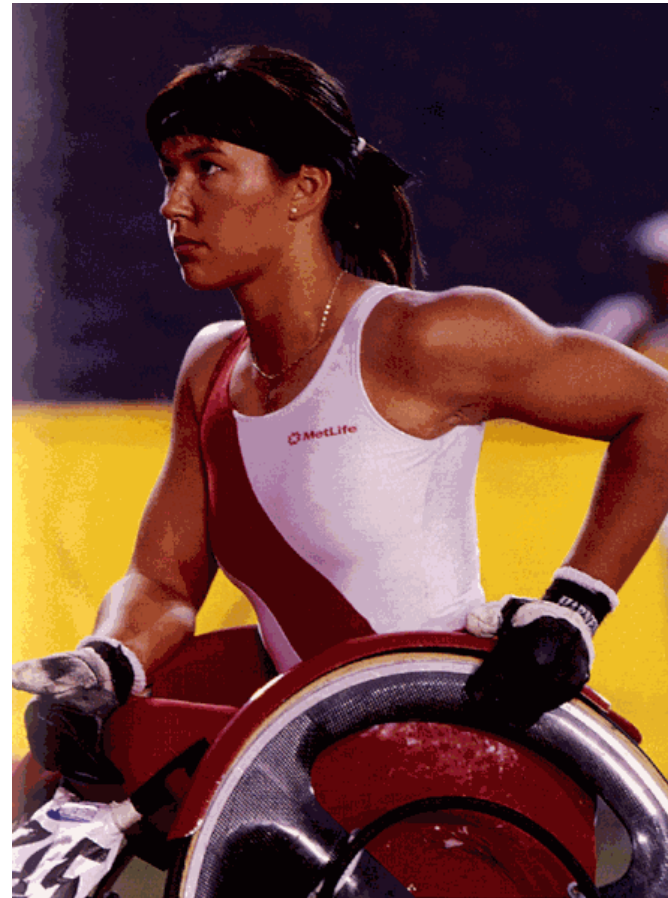
- People with SCI have reduced levels of activity resulting in serious secondary conditions including: Cardiovascular Disease (CVD), Diabetes 2 and Osteoporosis. CVD is now a leading cause of death in this population. Osteoporosis can lead to low-impact fractures. These conditions are essentially irreversible and may limit the effectiveness of future treatments such as stem cell therapy.

- Also
 - There is a high incidence of depression and stress.
 - There is a high incidence of painful overuse syndrome in the shoulder due to wheelchair propulsion and weight transfer. The pulling action of rowing may be therapeutic for this condition.

Chronic overuse conditions of the shoulder are a problem for approx 50% of those who use wheelchairs

Wheelchair propulsion and weight shifts involve repetitive high-force pressing actions that stress the anterior deltoid, triceps and pectoral muscles.

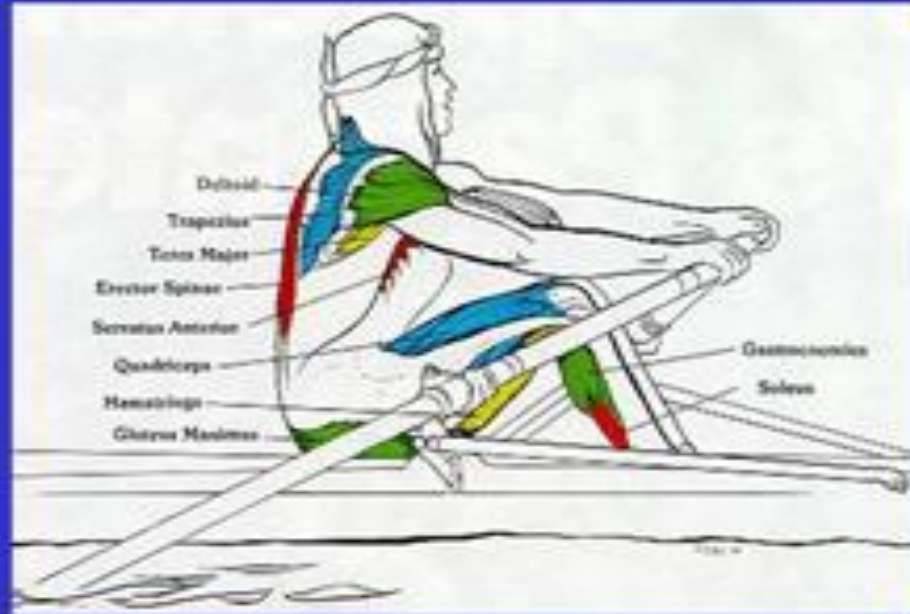
Upper limb exercise based on pulling actions may be therapeutic.



Why Rowing?



Why Rowing?



Rowing involves opposite muscles to wheeling. This can balance the shoulder musculature and prevent injury.

What are the objectives of the project?



1. Develop a low cost rowing ergometer, in order to secure access to everyone who wants to start rowing.
2. Develop a low cost FES system attached to the low cost rowing ergometer, to ensure full access to every Rehabilitation patient
3. Develop a low cost monitor system to allow internet tele-health. This will facilitate medical follow up and research to document the health benefits of the project.

**→ ROWING IS FOR EVERYONE,
EVEN DISABLED PEOPLE**

How is the project going to be developed?



- The project has **three clear defined phases**:
 - Development of Rowing Ergometer (cheaper than the existing Ergos, like Concept 2 or RowPerfect)
 - Development of FES System integrated to Rowing Ergometer
 - Medical Research and Follow up
- The first two phases are critical for the medical research, and we will try to fund them through a CORFO project (Chilean state agency for Innovation and Technology transfer)

Example of a FES Rowing Machine



Who will be supporting the project?



- **Prof. Brian Andrews (UK):** Is a presently with the Nuffield Department of Surgical Sciences at Oxford University. He was trained in Cybernetics, Mathematics, Control Systems and Bioengineering and has held academic/clinical positions in the UK, USA. He was awarded "Heritage Scientist" by the Alberta Heritage Foundation for Medical Research. He has a long standing interest in human movement, beginning with his PhD at Strathclyde that led to the Vicon motion analysis system.
- **Jim Flood MSc.(UK):** Rowing coach, consultant and freelance writer on rowing and online learning

Who are the team members in Chile?



- Pablo Aqueveque (Ph.D) → FES Subject Matter Expert, and team from Universidad de Concepción (www.udec.cl)



- Other:
- Juan Pablo Berlinger → Project Coordinator
- Manuel Reyes → Engineering

Experience in the UK



Experience in the UK Olympic Champion: Tom Aggar



Beijing 2008 AM1x Gold





FES Rowing is possible on an indoor ergometer or on-water.
Example:
Olympic Champion 2008
AM1x: Tom Aggar



Key SCI Statistics



SCI (Spinal Cord Injuries) Population:

- **More than 230,000 cases in USA**
- **11,000 new cases every year in USA**
- **82% male**
- **55% aged 16-35yrs old**
- **39% RTA, 25% violence, 22% falls, 7% sports**
- **48% paraplegic complete, incomplete: paraplegia (21%)**
- **Approx \$1M lifetime care cost for a 25 yr old paraplegic**