

*This newsletter is the second in a series intended to highlight innovative technology relevant to the Courage Centre.*

Robotics are used in rehabilitation to:

- deliver therapy,
- assist with functional activities,
- act as cognitive helpers and
- enable independent play and exploration by persons with disabilities.

This issue focuses on commercially available robots used to deliver therapy.

**Why use a robot to deliver therapy?** A key factor in promoting recovery from many neurological disorders is intensive, repetitive, goal-oriented practice. A robot can deliver a duration of repetitive therapy that is not practical by manual means. Sensors on the robot continuously measure motions and forces, allowing the robot to assist as necessary and provide new ways of evaluating progress. Motivation and engagement are also key elements in therapy and patients are helped to persist by incorporating goal-oriented games and virtual reality scenes into the therapy.

### **Lower Extremity**

The Lokomat ([www.hocoma.com](http://www.hocoma.com)) locomotion system consists of a treadmill, a body weight-support system, and two robotic arms that attach to the thighs and shanks with padded straps. The subject's legs are moved through a gait-like pattern while the Lokomat controls knee and hip motion, the amount of gait assistance provided (0 to 100%), gait speed, and the amount of body weight support. Force sensors measure the amount of resistance/assistance generated by the subject and this can be used as biofeedback for motivational purposes as well as a progress indicator.



### **Upper Extremity**

InMotion robotic systems ([interactive-motion.com](http://interactive-motion.com)) for upper extremity therapy include shoulder-elbow, wrist, and hand modules. The robot moves or guides the affected upper extremity through appropriate therapeutic motions while analyzing position, velocity, and forces applied. As the patient gains movement control, the robot provides less assistance and continually challenges the patient. The patient is encouraged to achieve specific motion targets through a series of game-like applications. Active hand grasp and pinch and release capabilities are available in the hand module.



### **Balance and Coordination**

The CAREN system (Computer Assisted Rehabilitation Environment [www.motekmedical.com](http://www.motekmedical.com)) is a robotic base combined with ground force sensors, motion analysis, and a virtual reality environment. It allows clinicians to analyze balance, locomotion and coordination in interactive controlled environments. For example, motion of the robotic platform can simulate a slip-like condition during balance assessment and training. It differs from the previous two devices in its versatility; being used to analyse a wide variety of impairments as well as deliver therapy.



Barriers to implementing robotic technology include acceptance by staff and the high initial cost versus the available evidence.

Robotic therapy is always considered to be an additional tool available to the therapist and is only one feature of a planned therapy regime. Different stages of the rehabilitation timeline require different strategies and emerging research is finding the optimal use for robotic therapy. New robot designs (particularly for upper extremity) and "smarter" adaptive software are being tested and hold the promise of exciting advances in therapeutic robotics.

### **Comments by the Editorial Advisor:**

**Gary McPherson C.M., A.O.E., LLD**

Special Advisor to Glenrose Rehabilitation Hospital

In the last 10 to 15 years, technology has significantly changed the way I conduct my life; and generally speaking, it has increasingly improved the lives of individuals with a disability. Robotic technology in terms of its rehabilitative applications can still be considered to be in its infancy. When it comes to extending rehabilitation into the home and into the community, I believe that we are just seeing the proverbial "tip of the iceberg". I expect that someday robotic technology will become almost as commonplace in our homes as voice technology, and in ways that were not envisioned only a few short years ago. Robotic technology has the promise to increase independence, while possibly decreasing the dependence on others, whether it be in the kitchen, the bathroom, or God forbid -- the bedroom!