The Road to Recovery

April Frawley Birdwell
Andrea Behrman’s goal is to change the face of neurological physical therapy.

There was no way to know if it was going to work. The boy was only 4, and he couldn’t move. Not an inch.

Kyle Bartolini hadn’t been able to wiggle his toes or move his legs since the accident in 2003, when he’d found an unlocked gun at a Labor Day party and accidentally shot himself in the chest. Forget walking — Kyle’s spinal cord was so damaged he almost didn’t live.

In the 10 years Andrea Behrman had been researching locomotor training at the University of Florida, she and her...
staff had never treated a patient so young, so severely injured. The therapy, which relies on an instinct in the spinal cord to learn patterns and, over time, to help people with spinal cord injuries relearn how to walk, requires hours of walking on a treadmill and over ground. A 4-year-old might not be able to handle it.

But the risk was worth it. Now 6, Kyle can walk with the aid of a walker, a vast improvement for a boy who was never supposed to walk again.

“There was not a good reason not to attempt this with this child,” recalls Behrman, sitting in her office, where pictures of Kyle and other patients are tacked to the cabinets above her desk. “It’s not 100 percent recovery, but it changes the trajectory of his life.”

Behrman has never been the type to shy away from challenges or avoid trying something new, though. Ten years ago, after reading studies detailing the gains researchers were making using locomotor therapy on animals, Behrman tried the new treatment on a patient with a mild spinal cord injury. Twenty sessions later, the man’s walking speed had doubled.

Since becoming a physical therapist in 1980, Behrman has made the transition from diehard clinician to teacher and now, finally, to researcher, something she scoffed at when she started her physical therapy training. But the same goal has driven her throughout her career: improving the practice of physical therapy.

In 1980, she sought to learn new ways to help her own patients. Now she spends her days working to help all patients with spinal cord or other neurological injuries recover the ability to walk.

“My goal is to change the face of rehab,” she says. “We’ve been stagnant. I don’t want to go back to the clinic and see what I’ve been seeing for years. We have new evidence upon which to change how we practice. It should start to look like something different, not what we were doing 20 years ago.”

visited the Great Smoky Mountains National Park as part of an independent study course during her senior year, she realized wildlife biology wasn’t for her, either. She didn’t want to spend most of her time collecting data in the field, in isolation. Behrman wanted to work with people.

She had already developed a taste for helping people through the Collegiate Educational Service Corps (now the Heller Service Corps), Furman’s student service organization. While volunteering at a center for children with developmental disorders, she learned about different disabilities and toyed with the idea of going into adaptive special education.

But when she graduated in 1976, Behrman felt lost.

“[Research] is not where I intended to go. The clinic still drives everything I do or ask. I try to take what we have and drive it back into clinical practice.”

She no longer has her own practice, as her patients are technically research subjects. But many of those “subjects” say Behrman has changed their lives.

“I can’t even tell you how much she has given my son,” says Jamie Bartolini, Kyle’s mother. “She’s much more to us than a therapist. She’s really a friend.”
Early in his training, Kyle Bartolini works to regain locomotor function. A harness system supports his body weight, and trainers assist with leg movements, posture, pelvic movements and weight transfer. A year later, Kyle shows how well he uses a rolling walker. Sensors and other devices record his muscle activity and limb motions.

in for weeks. Her leg suddenly didn’t work as it normally did. She had to go to physical therapy.

“I found the whole process interesting and found this therapist interesting, how he managed the whole thing,” she says. “I said, ‘How do I become one of you?’”

After a series of odd jobs — she was a counselor for first offenders, a preschool teacher at a developmental center and an after-school program director at a community center — she entered Duke University to pursue a master’s degree in physical therapy.

A new class of patients
Behrman graduated from Duke in 1980, just in time for what she refers to as “the golden age of physical therapy.” Until the ’80s, most patients with spinal cord injuries had what were known as complete injuries, meaning they had no feeling or motor function below the point of injury, Behrman says. Therapy meant learning how to use a wheelchair or other adaptive device.

As knowledge improved about neurological injuries, first responders began stabilizing their patients’ heads and necks before moving them. This one action can keep a bad spinal cord injury from becoming a devastating one. Retaining any motor or sensory function below the point of injury, whether it’s wiggling toes or moving a leg, means the patient will have a chance to learn to walk again.

But at the time, therapists weren’t quite sure how to help these patients, who had what are called “incomplete” injuries. Behrman kept mental diaries of her patients, trying to figure out how to help this new class of patients who seemed to have more potential.

“I remember my first two patients with incomplete spinal cord injuries,” Behrman says. “They drive me today. They’re in my head.”

One of them was a 14-year-old boy, on the verge of independence, who was struggling to relearn how to walk after an injury. She had to push him — he was a teen-ager, after all — but the reward came as he regained movement. He returned a couple of years later to speak to a class Behrman was teaching. Listening to him, she couldn’t help but feel like a proud mother.

“I think the thing for us is we’re part of someone’s life, injected into it because of an event,” she says. “Then we step out and watch that person carry on and move forward.”
“No one in the physical therapy department had tried to work with neuroscience. I was the first to knock on their door and say hi. They, at the same time, were starting to have an interest in [translating their research to] humans.”

The teacher
By 1987, after seven years of practice, Behrman was ready for a new challenge. She’d always envisioned herself as a teacher, and indeed, teachers and physical therapists have the same basic goal: help students, then watch them move on and grow. So when Beaver College (now Arcadia University) in suburban Philadelphia offered her a spot on the faculty, Behrman accepted.

“We were looking for a strong clinical person,” remembers Rebecca Craik, chair of Arcadia’s physical therapy department. “Andrea’s reputation as an outstanding clinician was well known before we got her.”

Behrman taught the neurology portion of the physical therapy curriculum. She had never really taught before — just a few continuing education courses while working at the Woodrow Wilson Rehabilitation Center in Virginia — but according to Craik, she was a natural in the classroom. She taught students how to clog when she wanted to show them how to learn. The students loved her, Craik says.

Behrman was popular outside class, too, once convincing a coterie of faculty to perform as the California Raisins at a party, singing “I Heard It Through the Grapevine” while wearing brown trash bag costumes.

She loved Beaver College, but to move forward in academia, Behrman had to go back to school to earn her doctorate.

Behrman had never planned on pursuing research. She chafed at the idea when she was at Duke, telling a research-oriented classmate, “Not me, I’m a clinician.” But with Craik’s encouragement, she decided to seek answers to those questions she still had in the back of her mind about patients with incomplete spinal cord injuries.

“I think my role in her life was to get her to put her clinical subjectivity aside and look at the problem objectively,” Craik says.

Behrman went to the University of Florida, where she could merge the two principles she wanted to study: how people learn motor skills and control their movements, and how that knowledge can be used to help injured patients.

It was a new concept, but two Florida researchers in different departments supported the idea and agreed to mentor her.

“She has so much enthusiasm and so much passion for the field, it spills over wherever she goes,” Craik says.

The scientist
While a doctoral student, Behrman found time to teach, serving as an instructor for the spinal cord unit in the physical therapy department of the University of Florida College of Public Health and Health Professions. After earning her doctorate in 1995, she joined the department’s faculty full time and quickly began collaborating with neuroscientists in the College of Medicine who were trying to understand the role of the spinal cord in walking.

“No one in the physical therapy department had ever crossed the street and tried to work with neuroscience,” she says. “I was the first to knock on their door and say hi. They, at the same time, were starting to have an interest in [translating their research to] humans.”

She collaborated with researchers in the Evelyn F. and William L. McKnight Brain Institute, working on one of the first neurological projects that translated animal research into human subjects. But it would be her work with a patient that would push Behrman to study the therapy that would help people like Kyle Bartolini.

She’d read the research on locomotor training in animals. Scientists had discovered that the hind limbs of cats with complete spinal cord injuries — injuries that completely separate the brain from the signal-carrying spinal cord — could be retrained to walk again. The discovery amazed Behrman, whose mind raced, thinking of how she could use the information to help patients, particularly those with less severe, incomplete spinal cord injuries.

“It turns out there’s a network in the spinal cord that’s really smart,” Behrman explains. “We’re taking advantage of what’s called a central pattern generator.”

Behrman asked a patient if he’d mind trying the new form of therapy. The patient, who had a mild spinal cord injury, agreed.
Patients are connected to an overhead body support system. With the help of this system and the assistance of two trainers, they walk on a treadmill for hours at a time. The body support allows the patient to walk like a healthy person, retraining the spinal cord to repeat the motion.

Typical physical therapy for movement struggles involves walking over ground with the help of therapists, or learning to use walkers or crutches. Locomotor therapy is a bit more intense.

Patients are connected to an overhead body support system. With the help of this system and the assistance of two trainers, they walk on a treadmill for hours at a time. The body support allows the patient to walk like a healthy person, retraining the spinal cord to repeat the motion. Patients in Behrman’s studies also spend part of their day walking over ground in addition to the treadmill, she says.

Twenty sessions after she and that first patient began the training, he had doubled his walking speed. Instead of walking at the pace of an elderly person, he was close to walking at average speed.

“We learn throughout life, but people always thought the brain is where all the learning happens,” she says. “Well, there can be retraining at the spinal level. But it takes intense repetition and practice.”

**Seeing patients as people**

It was 10:30 a.m. on March 6, 2001, when Paul Schauble flew over the handlebars of his bicycle. But who’s counting, the University of Florida psychology professor says of the injury that left him paralyzed, a quadriplegic.

From about the middle of his body down, movement was not automatic. He could shuffle, using a walker, but he wasn’t really walking. That slowly began to change seven months after his injury, when he enrolled in Andrea Behrman’s locomotor research study.

It took months to get where he is today, but now Schauble can walk unassisted for short distances. He owes his success to Behrman and her team, he says.

“She looks at us as people first, then patients, and then subjects,” Schauble says. “That’s a refreshing perspective.”

Jamie Bartolini agrees, saying that it wasn’t just the locomotor training that helped her son, also a quadriplegic. It was everything else Behrman did, too.

For starters, Behrman was the only one who agreed to help Kyle. Other institutions Jamie called had turned her away because her son was so young and his injuries were so severe.

“He couldn’t move at all,” Bartolini remembers. “He was like a noodle.”

Behrman gathered a special team of respiratory therapists and pediatric physical therapists to work with Kyle, and she devised creative ways to make his therapy fun.

“She took a chance on Kyle because of his age, and she gave him the chance of a lifetime,” says Bartolini. “She just opened up her heart to him. It was so much more than just therapy. We feel so unbelievably fortunate.
“We hope soon that locomotor training will just be a part of rehab.”

Behrman does, too. Other institutions are using similar body-weight support systems for locomotor training, but the practice is not widespread.

Behrman’s overall mission is to change the way physical therapists practice, and to make her field better and more current using the latest scientific principles. The technology will change through the years, but it’s those key scientific principles, like understanding how the spinal cord learns patterns, that will help the most people, she says.

Currently Behrman is working on two clinical trials. One, funded by the National Institutes of Health, measures the difference between a locomotor training program and an at-home exercise program to help stroke survivors regain the ability to walk.

She is also leading a Veterans Administration Rehabilitation and Research Development-funded trial comparing the effect of locomotor training provided manually by therapists to training provided by a robotic device for people with incomplete spinal cord injuries. Both trials have the capacity to change the practice of physical therapy, she says.

Behrman’s success doesn’t surprise Craik, one of the mentors Behrman says altered the course of her life.

“I’ve watched her career skyrocket,” Craik says. “I wish I could clone her. We need more of her in this field.”

Andrea Behrman is a scientist. A teacher. A clinician.

But the best moments of her career have been with the patients she has helped. The Paul Schaubles. The 14-year-old kids. And especially, the Kyle Bartolinis.

“That’s probably going to carry me to my death,” she says with a smile. “The thing I like about rehab is it’s the total person. It’s affected their entire life. It’s happened, and we go forward.”

Opposite: After enrolling in Andrea Behrman’s locomotor research study, Paul Schauble can now walk unassisted for short distances. Above: Behrman and her team at the University of Florida review data on a patient (seated at right), looking for progress across training sessions. The information tells them about the positions of his limbs in space and the ground reaction forces beneath each limb as he walks.

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