### 2014 Inpatient Admissions

**Number of Patients**

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquired Brain Injury</td>
<td>454</td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>434</td>
</tr>
<tr>
<td>Multiple Sclerosis and Other Neuromuscular Diseases</td>
<td>75</td>
</tr>
<tr>
<td>Dual Diagnosis (Brain and Spinal Cord Injury)</td>
<td>46</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,009</td>
</tr>
</tbody>
</table>

### 2014 Outpatient Visits

**Number of Patient Visits**

<table>
<thead>
<tr>
<th>Clinic</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Sclerosis Institute</td>
<td>11,789</td>
</tr>
<tr>
<td>Medical Specialty Clinics</td>
<td>8,475</td>
</tr>
<tr>
<td>Shepherd Pain Institute</td>
<td>7,879</td>
</tr>
<tr>
<td>Assistive Technology Center</td>
<td>3,059</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31,202</td>
</tr>
</tbody>
</table>
Dear Colleague,

I hope you enjoy the 2014 Annual Report of Shepherd Center’s Virginia C. Crawford Research Institute. This year, we celebrate 30 years of research at Shepherd Center and also welcome an exciting new era of spinal cord injury (SCI) research under the leadership of SCI research director Edelle Field-Fote, Ph.D., PT.

Lesley Hudson’s anniversary article reminds us of the humble beginnings of research at Shepherd Center and the success we have been able to build upon that foundation with a dedicated team of research directors. Dr. Field-Fote is the latest addition to this team. She has already made a tremendous impact in setting a clear direction for work in the Hulse Spinal Cord Injury Lab, and fostering collaborative relationships with colleagues at Emory University and Georgia Tech.

As part of her duties as SCI research director, Dr. Field-Fote will lead the newly created Emory-Georgia Tech DPT/Ph.D. program. Students who enroll in this program will get their doctorate in physical therapy from Emory School of Medicine and their doctorate in applied physiology from Georgia Tech’s College of Sciences. The goal of the program is to train the next generation of leaders in academic physical therapy and movement research. As this is Dr. Field-Fote’s primary area of interest, Shepherd Center and the Hulse Lab should figure prominently as an educational and research setting for students in the program.

This year’s report also features several ongoing research studies where technology plays a prominent role in innovative new treatments. As with most of everyday life, rehabilitation is being transformed by innovations...
in information and communication technology (ICT), including the ubiquitous cloud, millions of downloadable software applications for mobile phones (mobile apps) and growing interest in wearable technologies to interface with the wireless world. Shepherd Center researchers are taking advantage of these ICT advances to build apps that support individuals with cognitive impairments. One app will serve as an unobtrusive memory aid for use with Google Glass. A second app will help assess safety risk and provide support to reduce the risk of accidental injury or harm for patients with traumatic brain injuries when they return home.

Technology also figures prominently in two studies evaluating new interventions to improve the effectiveness and efficiency of walking rehabilitation in individuals with spinal cord injuries. The studies feature the Indego® robotic exoskeleton and use of a specialized vibrating platform to amplify the training effects of over-ground locomotor training. While these technologies have generated a lot of interest and enthusiasm among patients and clinicians, these studies are the first to empirically evaluate the benefits to be gained from them. We are excited to be at the forefront of research in this area.

I hope you enjoy this annual review of our accomplishments. Please feel free to share your thoughts and suggestions for the future with me via email at mike_jones@shepherd.org.

Kind regards,

Michael L. Jones, Ph.D.
Vice President of Research and Technology
The Crawford Research Institute continued or initiated 18 externally funded projects (current year funding noted) totaling approximately $4.1 million.

Georgia Regional Spinal Cord Injury Model System of Care, National Institute on Disability and Rehabilitation Research (NIDRR), $483,588.

Benefits Planning, Outreach and Assistance Program for SSDI Beneficiaries, Social Security Administration, $175,000.

Rehabilitation Engineering Research Center on Wireless Technologies, NIDRR, $488,859.

Evaluation of a NeuroRecovery Network (NRN) for Functional Improvements after SCI, Christopher and Dana Reeve Foundation, $30,000.


Research and Training Center on Secondary Conditions in SCI, NIDRR, Medical University of South Carolina, $26,884.

I-Step Long Leg Orthosis Validation Study, Vanderbilt University, NIH, $100,000.

Obesity/Overweight in Persons with Early and Chronic SCI: A Randomized, Multicenter, Controlled Lifestyle Intervention, Miami University, U.S. Department of Defense, $60,000.

Examination of Human Spinal Circuits, U.S. Department of Veterans Affairs, $233,600.

Mobile Phone Usability Studies, Samsung Corporation, $40,000.

Patient-Centered Approach to Community Transition after SCI, PCORI, $479,501.

Dose-Response Effects of Whole Body Vibration on Spasticity and Walking in SCI, NIH, $294,301.

Safe@Home: A Self-Management Program for Individuals with TBI and their Families, NIDRR, $200,000.

Impact of Massage Therapy on Fatigue, Pain and Spasticity in People with MS, Massage Therapy Foundation, $7,500.


Consumer Education in Use of Accessibility Features of Smart Phones, AT&T, $50,000.

Evaluating Fitness to Drive in Individuals with MS, National MS Society, $55,811.

Shepherd Center Transition Support Program, Robert W. Woodruff Foundation, $1,250,000.

27 clinical trials under way sponsored by pharmaceutical and biotechnology companies. More than 160 research participants enrolled and an estimated annual revenue of approximately $700,000.

Shepherd Center staff members made 77 presentations at professional meetings and conferences, and authored 29 articles in refereed journals during 2014. More than 30 clinical staff members participated in these research and knowledge translation efforts.
Edelle Field-Fote, Ph.D., PT, who became Shepherd Center’s director of spinal cord injury research in May 2014, knew at the tender age of 14 that she wanted to help people overcome the physical obstacles that confronted them. She was volunteering at a nursing home near her home in Auburn, Maine. During her shifts, she closely watched physical therapists working with patients. “They were really hands-on, and I saw the patients make progress,” she recalls. “I thought some patients would never be able to get out of bed, but with physical therapy they did! It was incredible to think of making such a difference in someone’s life – having that kind of impact seemed almost miraculous.”

So she set out to make her own difference. After earning a bachelor’s degree in physical therapy from the University of Miami, she worked as a physical therapist at a rehabilitation hospital in Fort Lauderdale, Fla. It was while working with people who had spinal cord injuries (SCI) that she decided she wanted to explore new ways to restore walking in people with such injuries. She later earned a master’s degree in environmental health and safety from the University of Miami and a doctorate in movement science from Washington University in St. Louis.

For the past 20 years, Dr. Field-Fote has been pursuing that very goal, serving as director of the Neuromotor Rehabilitation Research Laboratory at the Miami Project to Cure Paralysis. Now, she has brought her expertise to Shepherd Center. “Dr. Field-Fote is internationally renowned for her work in motor recovery after spinal cord injury,” says Mike Jones, Ph.D., vice president for research and technology at Shepherd. “Not only is she a leading neuroscientist in her own right, but she is also very highly regarded as a mentor to young research scientists, including many of the emerging leaders in the field. We are thrilled to have her join our staff, and we’re excited about the direction she will take our SCI research program.”

Dr. Field-Fote’s research has focused on restoring walking and hand function after SCI by making use of spinal pathways not damaged by injury. “The nervous system learns through experience,” she explains, “so we need to learn how to get the brain to better drive the information down to the remaining spinal pathways. We’re trying to build on what’s left. While the nervous system can’t make new motor neurons, it is possible to improve function by making new and stronger connections between the remaining neurons.”

Dr. Field-Fote is continuing this research at Shepherd, but on a larger scale. “Shepherd is a world-class rehabilitation center. People come from all over the globe to access the excellent rehabilitation services. Having more people available to participate as subjects in research will allow me to expand the number and types of studies that I do, and this will increase rate at which we develop interventions to restore walking function and hand function for people with SCI.”

The caliber of professionals and commitment to collaboration also drew her to Shepherd Center. “Altogether, enthusiast subjects, clinicians and researchers create an environment that makes Shepherd the perfect place for rehabilitation research,” she says. Dr. Field-Fote is inspired by seeing the results of her research make improvements in people’s lives. “Rehabilitation research is really exciting in that it impacts lives of people today,” she says. “But it also has the potential to affect the lives of others in the future. While rehabilitation research doesn’t typically get the big press that things like stem cell research do, those types of repair strategies will only be effective when combined with excellent rehabilitation strategies. So, identifying the optimal rehabilitation approaches is critical for the success of all types of spinal cord injury research.”
imply standing on a specialized vibrating platform could promote better mobility. Studies show whole-body vibration revs up the nervous system, priming the nerves and muscles for motion. For people with motor-incomplete spinal cord injury, that can mean improved walking speed and reduced muscle spasms, or spasticity.

But how long should you stand on a whole-body vibration device to get the best results? Typically, rehabilitation therapists vary the duration, hoping to find a level that leads to improvement while minimizing fatigue.

A new five-year study at Shepherd Center’s Hulse Spinal Cord Injury Lab aims to find a research-based answer to questions about the best use of the technique.

“We know that physical training is very effective, and in many cases more effective than any drug to improve walking ability,” says Edelle Field-Fote, PT, Ph.D., director of spinal cord injury research at Shepherd Center. “Whole-body vibration may enhance that training. But just as with drug studies, it is important to determine the proper dose. Too much or too little vibration could undermine the treatment.”

Whole-body vibration involves a device that looks like a cross between a large bathroom scale and an exercise machine. As the platform vibrates rapidly up and down, the motion activates reflexes that cause muscles to contract, much as they do during exercise.

CONTINUED ON NEXT PAGE
First developed in the space program, the devices have been used to boost athletic training. Studies show some benefits for cerebral palsy and stroke patients, as well as those with spinal cord injury.

The first phase of the five-year Shepherd study, funded by the National Institutes of Health, is testing the short-term effects of four different doses of whole-body vibration – high frequency or low frequency at different durations.

The 38 individuals who participate in Phase 1 also will receive electrical stimulation therapy as a comparison. Each episode will be followed by a walking evaluation and test of reflexes, which is an indication of spasticity.

“We feel there’s strong evidence that whole-body vibration can affect both reflex circuits that underlie spasticity and the central pattern-generating circuits that underlie walking.”

— Edelle Field-Fote, Ph.D., PT,
Director of Spinal Cord Injury Research

Phase 2 will look for long-term effects after 10 sessions of whole-body vibration once a day and twice a day, at the optimal frequency found in Phase 1. It will measure pain and leg strength, as well as walking speed and spasticity in 59 individuals with motor-incomplete spinal cord injury. A post-test two weeks after the vibration therapy will measure whether the benefits persist.

The study builds on prior research by Dr. Field-Fote that showed whole-body vibration decreased the level of spinal reflex activity (which is the basis for spasticity) even with just four rounds of 45 seconds, each followed by a one-minute rest.

“We feel there’s strong evidence that whole-body vibration can affect both reflex circuits that underlie spasticity and the central pattern-generating circuits that underlie walking,” she says. “So the purpose of this study is to identify the vibration parameters that have the largest effects, as well as the characteristics of subjects who do and do not respond.”

Therapists already use whole-body vibration in Shepherd Center’s Spinal Cord Injury Day Program and in the Beyond Therapy® program, the post-rehabilitation activity-based wellness program at Shepherd Center. The treatment makes a big difference for some clients but has little or no effect on others, says Nick Evans, lead exercise specialist in Beyond Therapy®.

“The work [Dr. Field-Fote] is doing is going to be extremely valuable for us because it’s been a matter of trial and error to this point,” Evans says.

To be eligible for this study, participants must be at least one year past their injury and be able to stand for at least a minute and take one step with one leg. To complete a research intake form to be considered for this study, visit shepherd.org/research/intake-form.
Lisa Dryden had leg weakness because of multiple sclerosis (MS) and no options for improving it. The available medications either didn’t work or had run their course. She had resolved to cope as best she could with the tightness and spasticity that made it difficult to walk and the extreme fatigue that overcame her. But at an MS support group meeting, she saw a pamphlet that gave her hope. Shepherd Center was recruiting patients for clinical trials.

“Research has given us the ability to change the course of a once-untreatable disease.”

— Ben Thrower, M.D., Medical Director of the Andrew C. Carlos Multiple Sclerosis Institute at Shepherd Center

Shepherd played a key role in advancing MS treatment. But most importantly, the MS research brought opportunity where there was none.

“Research has given us the ability to change the course of a once-untreatable disease,” says Ben Thrower, M.D., medical director of the Andrew C. Carlos Multiple Sclerosis Institute at Shepherd Center.

Issi Clesson, RN, MSCN, CCRP, director of clinical research, recalls when she began caring for MS patients as a nurse in 1990. “We literally had nothing to offer patients,” she says.

But soon, Shepherd Center was able to provide Copaxone (copolymer-1 or glatiramer acetate) through a clinical trial. The synthetic protein blocks T-cells that damage myelin, the coating of nerve fibers. For the first time, a drug was able to slow the progression of the disease and prevent relapses. Copaxone received approval from the FDA in 1996.

Beta interferon drugs were developed at about the same time. Shepherd Center was a clinical trial site for three such drugs: Avonex, Betaseron and Rebif.

Researchers continued to explore different approaches to stop the immune system from attacking myelin. Tysabri (natalizumab) is a monoclonal antibody that blocks immune cells from crossing the blood-brain barrier and entering the brain and spinal cord. Shepherd patients were among the first to receive Tysabri infusions as part of a post-approval clinical trial.

“It was effective in limiting the number of relapses, as well as preventing the development of new or enlarging lesions visible on the MRI,” Clesson says. While not a cure, it is a valuable tool to prevent disease progression.

CONTINUED ON NEXT PAGE
“MS is so individualized. What works for one person may not work for another. That’s why having plenty of options is so important.”

— Carlyn Kappy, RD, LD, CCRP, Research Quality Manager

More recent drugs, such as Gilenya (fingolimod) and Tecfidera (dimethyl fumarate), offer similar benefits but as oral drugs, rather than injections or infusions. Shepherd Center was part of clinical trials for both. In all clinical trials, Shepherd carefully screens patients and monitors participants for side effects.

“MS is so individualized. What works for one person may not work for another,” says Carlyn Kappy, RD, LD, CCRP, Shepherd Center research quality manager. “That’s why having plenty of options is so important.”

Lisa recently completed a trial with Tcelna, a biopharmaceutical made from T-cells in her own blood. The trial isn’t yet complete, but she is upbeat about the results. And she feels thankful for Shepherd Center’s contribution to the research.

“Hopefully, they’ll come up with something that will help regenerate the nerves,” she says. “I’m very positive about all the efforts they’re putting into trying to find a cure.”

<table>
<thead>
<tr>
<th></th>
<th>MS DRUGS THAT HAVE BEEN STUDIED AT SHEPHERD CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ampyra (dalfampridine) approved by the FDA in 2010</td>
</tr>
<tr>
<td>2</td>
<td>Avonex (interferon beta-1a) approved in 1996</td>
</tr>
<tr>
<td>3</td>
<td>Betaseron (interferon beta-1b) approved in 1993</td>
</tr>
<tr>
<td>4</td>
<td>Copaxone (copolymer-1 or glatiramer acetate) approved in 1996</td>
</tr>
<tr>
<td>5</td>
<td>Gilenya (fingolimod) approved in 2010</td>
</tr>
<tr>
<td>6</td>
<td>Lemtrada (alemtuzumab) approved in 2014</td>
</tr>
<tr>
<td>7</td>
<td>Rebif (interferon beta-1a) approved in 2002</td>
</tr>
<tr>
<td>8</td>
<td>Tecfidera (dimethyl fumarate) approved in 2013</td>
</tr>
<tr>
<td>9</td>
<td>Tysabri (natalizumab) approved in 2006 (reintroduced)</td>
</tr>
</tbody>
</table>
More than 100,000 steps have been taken to date across five clinical trial sites testing a robotic-assisted walking device named Indego®. The sites are Shepherd Center, Craig Hospital, Kessler Institute for Rehabilitation, Rehabilitation Institute of Chicago and Rusk Institute of Rehabilitation Medicine. Forty study participants are expected to complete the multi-site trial by June 2015. By then, the number of steps may double, or even triple.

Study participants report that using Indego has given them much more than just the opportunity to stand up and do some walking.

“Being in the Indego trials at Shepherd Center gave me confidence and encouragement. It’s not just about the walking,” says Casey Stroble, a wife and mother of two young children. She sustained a T-6 spinal cord injury in April 2012 in an automobile accident.

“For the first time in nearly three years, I had the confidence to go to the mall by myself,” Casey explains. “You cannot understand how great that made me feel. I did not have the confidence or belief in myself that I could do it before the Indego training.”

Casey broke into tears as she stood at the sink to wash dishes and wipe down the counter during one of her Indego trial sessions in an activities of daily living (ADL) suite at Shepherd Center. “It’s the little things that you forget until you are given the chance to do them again,” Casey says.

Her children were proud and happy to tell their friends that their mom could walk again. “Since I do not have an Indego at home, I can’t continue to walk with my children, but at least they have seen me and know that mommy can walk,” Casey adds. “I really hope the FDA approves this device. It will change people’s lives in many more ways than you would think.”

For more information about Indego®, visit Indego.com. To read more about Shepherd Center’s Indego research, visit http://bit.ly/1rY1etN.
Life with multiple sclerosis (MS) is often uncertain. As the body’s immune system begins to turn on itself, damaging the protective sheath (myelin) that covers the nerves, it’s difficult to know how this inflammatory, autoimmune disease will progress or affect a person.

Understandably, people living with MS often have their sights set on new and proven ways to feel better. Researchers at Shepherd Center are paving the way to find practical solutions and interventions to help – both in the clinic and through an increasingly robust research program.

“Although disease-modifying therapies help slow the progression of disability, they don’t treat the symptoms or address the remaining deficits due to MS,” says Deborah Backus, Ph.D., PT, director of MS research at the Eula C. and Andrew C. Carlos Multiple Sclerosis Rehabilitation and Wellness Program founded at Shepherd Center in 2012. “Our rehabilitation and wellness research is looking at ways to keep people as healthy and as functional as possible for as long as possible.”

In just a few short years, the program that was created with the expressed purpose of establishing and pushing forward therapies that help improve the quality of life for people with MS.

“We are building on the pilot studies initially funded by the Carlos family, and the results are leading to more funding and international recognition.”

— Deborah Backus, Ph.D., PT, Director of Multiple Sclerosis Research
forward MS wellness research has already made a name for itself. Dr. Backus and her team have initiated several research studies being conducted at Shepherd Center and with collaborators around the world.

“We are building on the pilot studies initially funded by the Carlos family, and the results are leading to more funding and international recognition,” says Dr. Backus, adding the National Multiple Sclerosis Society is among the new funders. “We are also beginning to publish and disseminate our research so we can start impacting clinical care.”

Some recent research highlights include studies to assess the potential benefits of functional electrical stimulation (FES) bike training, therapeutic massage and assessments for driving safety (see news.shepherd.org).

Functional Electrical Stimulation (FES) Cycling

Dr. Backus and her team conducted a four-week trial in collaboration with the University of Georgia that showed FES bike training three times a week appears to be safe for people with more progressive forms of MS. They are analyzing outcomes, but the initial data suggests that stimulating the legs to move in a rhythmical way may benefit these patients.

“We saw changes in their muscles, and it also significantly reduced pain and fatigue,” Dr. Backus says. “For people using a wheelchair, they improved in their cycling in a short period of time, suggesting they have the capacity to improve.”

More research is needed to see how this might relate to function. So far, 15 people have completed this study, and up to 20 more will be enrolled in 2015.

Massage and MS

Human touch can have a powerful effect on health, and research has found it may even promote healing. Therapeutic massage is known to help relax muscles, enhance range of motion, improve blood flow and reduce stress. Although as many as one-third of individuals with MS reportedly use massage as an adjunct to their medical treatment, there has been very little research on this approach.

Now, thanks to funding from the Massage Therapy Foundation, the research team at Shepherd Center is investigating whether and how routine massage can help improve pain, spasticity and overall quality of life among people with MS. Twenty-five participants are receiving standardized massages – for the same amount of time, number of strokes, parts of the body worked on – for one hour a week for six weeks.

Driving Safety

Being able to drive gives people a sense of independence, but there are often factors that can limit someone’s ability to drive safely. Shepherd Center researchers are conducting a study, called “Fitness to Drive,” in partnership with Georgia Regents University. This program is ongoing and has collected data for nearly 100 people with MS to date. The ultimate goal is to identify ways to rehabilitate driving to allow people with MS to retain the ability to drive safely.

For information about these and other studies, visit shepherd.org/research/multiple-sclerosis/current.
The human brain is an incredible machine. It helps orchestrate our every move, thought and emotion—often seamlessly. But in people recovering from traumatic brain injury (TBI), there may be lapses in this complex coordination that make potentially harmful situations and poor decisions more likely. In fact, unintentional injuries are the leading cause of death following TBI once a patient has discharged from the hospital.

“Most of these events are preventable, so we need to be able to anticipate and plan for potential risks after patients leave the rehabilitation setting,” says Ron Seel, Ph.D., the O. Wayne Rollins Director of Acquired Brain Injury Research at Shepherd Center.

Under Dr. Seel’s leadership, Shepherd Center has developed a dynamic assessment tool to gauge and predict the risk of someone having unsafe events after returning home. The Safety Assessment Measure (SAM) has been developed with input from caregivers and patients for more than a year, and researchers have studied its use with 155 patients with TBI.

SAM asks caregivers 99-items about how well the person with TBI performs everyday activities to predict the overall risk of unsafe events especially related to: 1) carrying out activities; 2) walking mobility; 3) wheelchair mobility; 4) judgment; 5) health decision-making; and 6) self-control. The research team is still testing scales that assess safe operation of a motor vehicle and taking care of children.

Keeping People with Traumatic Brain Injury Safe At Home

Shepherd Center develops new patient-centered tool to assess risk and inform changes.

BY AMANDA CROWE, MA, MPH
How the Safety Assessment Measure Works

Someone with a moderate level of risk has a 30 percent chance of an unsafe event, such as a fall. If that person is sleeping well, the risk of falling goes down, but if they consume any alcohol, the risk goes up. At this level of risk, it might be reasonably safe for the person to walk on even surfaces, but he or she might need to take extra care walking up and down stairs – making sure to hold the railing or having someone walk behind them – and avoid carrying things while walking. In this case, the individual might benefit from balance and endurance training, Dr. Seel notes.

Higher scores on SAM scales indicate a greater likelihood of an unsafe event; lower scores are associated with lower risk. But this assessment goes beyond simply assigning a score or likelihood of something happening. The SAM scales and items flag areas of concern to guide decisions about additional rehabilitation, logical next steps as goals, if home or behavioral modifications are needed, how much supervision is needed, and what activities are deemed safe.

While other scales are available, Dr. Seel says they don’t provide as complete a picture of someone’s risk for harm after TBI.

“It’s important because this tool not only tells us the likelihood that something unsafe could happen, but based on a person’s severity of risk, it also gives very specific information for what activities should be the focus of therapy and what activities might be beyond their reach currently,” Dr. Seel explains. “It’s a great example of personalized medicine, and it’s grounded in patients’ and families’ real-world experiences.”

Improvements have been made to make the report more user-friendly – in part, to help save time and maximize any therapy patients might receive after discharge.

“It means therapists and coaches have much more information at their disposal from the beginning,” Dr. Seel says. “Instead of spending lots of time on assessments, they can walk in with a feel for what the person can do, their challenges, what kind of assistive devices they use and the like.”

Other institutions are taking note. In 2014, Shepherd Center was awarded a grant from the Emory Center for Injury Control to translate the paper-and-pen research version of SAM into a Web-based program that can be completed online. The new electronic version will reduce the number of items respondents need to answer for each safety scale. It will also be center stage in an upcoming randomized controlled clinical trial called Safe@Home – made possible by a $600,000 grant from the National Institute on Disability and Rehabilitation Research.

This study will enroll up to 130 dyads of patients and family members to evaluate whether using the SAM – coupled with 10 in-home visits for prevention education and skills training – compared to usual care can improve a person’s independence in activities, while also reducing the number of unsafe events.

“Families want their loved one to be safer, and patients want to do more activities,” Dr. Seel says. “It’s their mindset, so we’ve included two outcomes. If effective, we will consider whether this type of program can eventually be delivered remotely and to individuals living alone.”

The goal is to expand SAM to help predict risk for injury in people with spinal cord injury, stroke and neurologic diseases, Dr. Seel notes.

Common Unsafe Events

Some of the more common unsafe events experienced by people recovering from TBI include:

- Falls while walking or doing a wheelchair transfer
- Inappropriate behavior or judgment in social situations
- Incidents using motorized equipment
- Property loss due to mismanaging money or other valuables

It’s important because this tool not only tells us the likelihood that something unsafe could happen, but based on a person’s severity of risk, it also gives very specific information for what activities should be the focus of therapy and what activities might be beyond their reach currently.”

— Ron Seel, Ph.D., The O. Wayne Rollins Director of Acquired Brain Injury Research

shepherd.org/research
Julius Caesar once said, “Experience is the teacher of all things.” This old adage holds true when it comes to adjusting to and learning how to live with a spinal cord injury (SCI). And it seems learning from and being coached by a peer – someone who has experience managing many of the complications that can arise from an SCI – may be a very effective way to prepare patients to return home.

Leveraging and engaging peer mentors throughout the rehabilitation process is at the heart of a three-year project headed by Shepherd Center’s Julie Gassaway, MS, RN, and funded by the Patient-Centered Outcomes Research Institute (PCORI) and the Robert W. Woodruff Foundation.

Now in its second year, the PCORI/Woodruff-funded project has already allowed Gassaway and her team to revamp the way patients are educated about their injury and how to successfully manage issues such as bowel, bladder and skin health after leaving the rehabilitation setting.

Beginning in January 2015, all patients will attend an education week, which includes one-hour classes for four consecutive days covering different topics. Classes are facilitated by nurse educators, but led by peer mentors who have been living with their injury for three to 20 years. These sessions are designed to stimulate discussion about personal care topics and provide a forum for sharing practical tips and concerns.
“The peer-led classes are more engaging and infused with a bit of humor; patients participate frequently in the open discussions and ask questions that are of concern to them.”

— Julie Gassaway, MS, RN, director of health and wellness research and PCORI grant co-investigator

“It’s been a huge shift from traditional ways of educating our patients,” says Gassaway, director of health and wellness research and PCORI grant co-investigator. Because these new educational modules are being rolled out in stages, it has given the research team an opportunity to record the sessions on video and count points of positive and negative engagement. Positive engagement involves how often patients participate in conversation, ask questions or nod/gesture/raise their hand; whereas instances of using a cell phone or falling asleep are interpreted as negative engagement. After the last class, each participant is interviewed and asked:

1. Which classes were most informative and engaging;
2. Why and what style of class helped to strengthen their understanding of a topic;
3. If they had any unanswered questions after any class and why that might be the case.

“This will allow us to compare the old and new approaches. But there are already striking differences,” Gassaway says. “The peer-led classes are more engaging and infused with a bit of humor; patients participate frequently in the open discussions and ask questions that are of concern to them,” she says. “And when you are helping people with these kinds of injuries, there is no better motivator than someone who is living it well and leading a happy and productive life.”

The goal is to equip patients with the knowledge, skills and confidence to recognize early warning signs of any medical issues so they can address them quickly and avoid return visits to the hospital. But it’s also meant to provide the foundation to manage their care effectively so they can be active in community life.

The grants have also paved the way for a randomized, controlled trial now under way that will compare outcomes (for example, the ability to self-manage conditions at home, emergency room or hospital visits, and involvement in the community) when patients receive frequent peer support versus those who receive less. A total of 160 patients are enrolled in the study and assigned to an intervention or control group randomly. “We are pioneering a new approach with peer interaction,” Gassaway says. “Patients are able to relate to and share experiences with others who have dealt with similar adversity and learned to live active, productive and happy lives.”

Shepherd Center’s collaboration with Craig Hospital in Denver to form a National Center of Excellence has also opened opportunities for additional input on enhancing educational materials and to disseminate information. Together, the two hospitals are exploring options for creating a secure patient portal; this virtual resource will give patients and caregivers one-stop access to credible, up-to-date information, prescription refill requests and messaging.

For more information, see MyShepherdConnection.org or contact, Julie Gassaway, MS, RN, director of health and wellness research at 1-404-350-7637 or Julie_Gassaway@shepherd.org.
Shepherd Center’s Clinical Research Program Celebrates 30 Years of Success

BY LESLEY M. HUDSON, MA, SCIMS PROJECT DIRECTOR

As Shepherd Center celebrates its 40th anniversary year in 2015, the Virginia C. Crawford Research Institute, which started as the Clinical Research Program in 1985, is celebrating its 30-year milestone. As we take a look back over the past three decades and review some of the most significant milestones, it is clear that our humble beginnings have paved the way for significant strides in research related to spinal cord injury, brain injury and multiple sclerosis.

The first milestone in the history of research at Shepherd Center was the awarding of the Spinal Cord Injury Model System (SCIMS) grant in 1982. Coinciding with the occupancy of the newly constructed Shepherd Spinal Center at 2020 Peachtree Road in Atlanta, this grant, in the amount of $250,000 per year, paved the way for the future development of a research program at Shepherd. Throughout the following few years, staff who were interested in research activities came to me, as one of the SCIMS project directors, to ask whether that grant could help them get started on research they were interested in conducting. Unfortunately, only a limited amount of the work that needed funding was able to be incorporated into the SCIMS grant, and in 1985, a formal request was made to hospital administration for operational funds that could serve as seed money for expanded research efforts. This money eventually permitted some pilot work to take place, and also provided support for the work needed to write other grant applications and expand funding for research across the board.

In 1985, the Clinical Research Department was established, using the SCIMS grant as the centerpiece, and allowing for much-needed operational dollars to expand and apply for funding in a variety of areas. I served as the founding director of this department. The Dole Foundation was instrumental in launching a significant project on employment after injury.

Also in that year, James Krause, Ph.D., joined the research staff. His national reputation resulted in several federal grants and expanded the Shepherd portfolio. Additional private foundations came on board with smaller grants, usually of one-year duration. While this was progress, the next push was determined to be for larger support, over multiple years, to create a broader and more secure foundation upon which to build the research program.

Between 1985 and 1995, several important developments in Shepherd Center research occurred:

- SCIMS grants were awarded for 1985-1990 and 1990-1995, at an increase to $500,000 per year.
- The Assistive Technology Center opened, providing multiple research project opportunities.

CONTINUED ON NEXT PAGE
Parastep research began. This study used functional electrical stimulation (FES) to enable independent, unbraced standing and short-distance walking by qualified subjects.

MS research began with the founding of the Shepherd Harvard MS Research Institute.

Momentum was building quickly, and in 1995, Michael Jones, Ph.D., joined Shepherd Center’s staff as vice-president of research and technology. Shortly thereafter, the Virginia C. Crawford Research Institute (CRI) was founded, and that new identity brought expanded possibilities for funding and collaboration. The next decade was marked by a series of significant steps forward:

- SCIMS grants were awarded for 1995-2000 and 2000-2006, at $500,000 per year.
- Shepherd Center was one of five sites in the nation selected to conduct a major clinical trial to determine if body-weight-supported treadmill training helped to stimulate walking.
- A partnership with the University of Georgia launched a biomedical research and education initiative to study central nervous system injuries and illnesses.
- Shepherd Center and the Georgia Institute of Technology received funding to establish a national Rehabilitation Engineering Research Center (RERC). This effort continues today and has resulted in a $15 million for research to date.
- The Marcus Foundation contributed $3.2 million to clinical trials of ProCord, a procedure that used cells from the patient’s own body to promote SCI recovery.

Over the years, Shepherd Center established itself in several key areas within the rehabilitation research community. The critical mass of new patients admitted each year, as well as those being followed for years after discharge, provided a valuable resource for collaboration with other research entities. Also, the growing reputation for clinical excellence, and the capacity to conduct accurate research, on time, and within budget made Shepherd Center more likely to be awarded research grants, in particular at the federal level. Shepherd Center was now very competitive in this area.

**Closing out the 30-year period** being highlighted from 2005-2015, Shepherd Center distinguished itself in a variety of research endeavors:

- The first diaphragmatic pacing stimulation (DPS) device was implanted in a Shepherd Center patient.
- The Lokomat, a treadmill integrated with robotics, arrived for use in both therapy and research.
- Armed to Succeed, a program of research into the best drug treatment for acquired brain injury began.
- Shepherd Center researchers received an unprecedented five new grants from the National Institute on Disability and Rehabilitation Research (NIDRR) in 2008.
- Shepherd Center participated in the Geron/Asterias acute SCI stem cell trial.
- Exoskeleton research began with a Vanderbilt collaboration and a Parker Hannifin partnership.
- The Hulse Spinal Cord Injury Lab was established.
- PCORI, the Patient-Centered Outcomes Research Institute, funded a peer support and patient education project at Shepherd.
- The Robert W. Woodruff Foundation awarded a grant to fund the Transition Support Program at Shepherd.
- SCIMS grants were awarded for 2006-2011 and 2011-2016, at $500,000 per year.

Total federal funding received for this program, the founding research award with which this story started, is $16 million and counting.

Since 1985, the level of extramural funding for the Shepherd Center Clinical Research Program and Crawford Research Institute has risen from $250,000 to its current total of more than $4 million.
Remembering important tasks or recent interactions with people can be a challenge for anybody. For people recovering from and living with the effects of a brain injury, these everyday tasks can be even more difficult. That’s why clinicians at Shepherd Pathways, Shepherd Center’s post-acute brain injury rehabilitation program, often teach patients how to use tools and techniques for aiding memory. These tools include common consumer devices such as cell phones and tablets.

Building on these clinical practices, a research and development team at Shepherd Center has recently developed its own memory application (“app”) called EyeRemember, which runs on a wearable device called Google Glass. Researchers have begun testing the app, gathering helpful feedback from patients with brain injury, as well as their caregivers and therapists.

The research team’s three members are part of the Glass Explorer program, and include clinical research scientist John Morris, Ph.D., speech-language pathologist Tracey Wallace, MA, CCC-SLP, and Android developer Scott Bradshaw, BSCS. The project is being funded by a Glass Accessibility Award the team received from Google in 2014.

EyeRemember helps people with memory difficulties keep track of people in their circle – family, friends,
therapy team members and possibly others with whom the user interacts on a regular basis. The EyeRemember app works in conjunction with Bluetooth low-energy (BLE) beacons – small transmitters about the size of a car key fob – that must be worn or carried by friends, family, therapists and others in the user’s community. The app uses the Bluetooth capabilities built into Glass to regularly scan for other BLE beacons in the vicinity.

The user, or user’s caregiver, must first assign a beacon to individuals in the user’s circle. When the user gives the command for EyeRemember to create a new contact, the app initiates a scan of BLE beacons in the vicinity. When one is detected, it offers the user the opportunity to attach contact information to the beacon by entering a name, relationship information and a photo. After the user creates the contact, he or she can add notes about that person, or possibly things the user wants to tell that person.

The next time the beacon for an individual contact enters the vicinity of the Glass wearer, the beacon will be identified by the EyeRemember app. The contact information “card” for that individual will appear automatically on Glass, showing a photo, name and relationship for the contact. The user can then select that card to view existing notes or add new ones.

“EyeRemember is still in the testing phase. So far, clinicians and patients have been very receptive to the prototype.”

— Tracey Wallace, MA, CCC-SLP, Speech-Language Pathologist

“We’re committed to going forward with our research and development efforts on Glass,” Dr. Morris says. “We are beginning to gather important data on app interfaces for wearable displays – whether on Glass or watches or wrist bands – for people with brain injury and their clinicians, especially for memory remediation. And, we think that Glass-like wearable hardware worn on the head is likely to mature rapidly into a robust consumer technology.”

To read more about EyeRemember and to see how it works, visit, http://bit.ly/1CtqwX4.

Shepherd Center researchers are testing a memory app for use with Google Glass and other wearable technologies.
Mobile devices now come with a range of built-in accessibility features to help people with disabilities use their smartphones or tablets. But now there are so many that people may not know which ones will work for their needs, or are too complex to set up by themselves.

“The devices themselves have become so powerful, and the variety and number of user-configurable settings can be daunting to a user with a disability.”

— Ben Lippincott, Project Director

Thanks to two $50,000 grants from the AT&T Corporate Accessibility Technology Office (CATO), the Rehabilitation Engineering Research Center for Wireless Technologies (Wireless RERC) – a partnership between researchers in Shepherd Center's Virginia C. Crawford Research Institute and Georgia Tech – is offering Wireless Independence Now workshops that show people with disabilities how to set up and use the accessibility features on their phones and tablets.

“There is a huge awareness gap for consumers trying to set up a device for their needs,” says Ben Lippincott, project director, industry and consumer education/outreach/support, Wireless RERC at Shepherd Center. “The devices themselves have become so powerful, and the variety and number of user-configurable settings can be daunting to a user with a disability.”

Some of these features allow users to simply wave a hand over the screen to unlock it, use voice commands to send texts, email or surf the Internet, or enable a switch controller for those with no upper extremity movement.

“The cell phone is a very liberating device,” says John Morris, Ph.D., project director for user-centered Research at the Wireless RERC. “It can allow people with disabilities to enjoy greater social participation and give them access to technology that can be critical to employment.”

The 90-minute workshops – free to attendees regardless of their service provider – give an overview of the accessibility and assistive technology features found on the latest versions of Apple's iOS 8 and Google's Android 5.0. The workshops last 30 minutes and consist of hands-on training where attendees can ask questions about their own phones, or use the latest versions of new phones.

Lippincott and a team from CATO have created five different presentations that highlight accessibility features to different disability needs, such as those with mobility/dexterity, hearing, vision or cognitive impairments.

In 2014, Lippincott says they held 17 workshops in six cities and reached over 450 people. In 2015, with the second grant, the team hopes to visit 10 cities and reach over 2,000 people. Cities scheduled so far include San Diego, Los Angeles, Phoenix, New York, Dallas and Austin.

For updates, visit wirelessrerc.org.
Returning to work after sustaining a spinal cord injury requires workplace accommodations and/or job training – depending on the age at which the injury occurs, according to a long-running study conducted by researchers in the Spinal Cord Injury Model System (SCIMS) at Shepherd Center. These findings are important to both patients with spinal cord injury (SCI) and organizations, such as Shepherd Center and other rehabilitation facilities that develop programs to promote post-injury employment. SCIMS researchers, under the direction of senior research scientist James Krause, Ph.D., have gathered and analyzed return-to-work data for more than 30 years with funding from the National Institute on Disability and Rehabilitation Research. They have focused on the processes and predictors for post-injury employment, distinguishing between people who transitioned to new employment after SCI and those who retained work with their pre-injury employers.

These are some of the key conclusions their research has revealed:

- Transition to new employment is highest among those youngest at the time of injury and decreases in a relatively linear pattern with increasing age. It may take several years for sufficient training or education to successfully start new employment.
- Those 45 and older at the time of injury rarely transition to new employment. Rather, when they do work after SCI, it almost always is with the pre-injury employer either at the same job or a new job.
- While SCI is more prevalent in younger people, the mean age is rising steadily. This information is important for facilities whose rehabilitation programs include an emphasis on returning patients to employment. Training for jobs different than those held before injury is likely to be more successful in younger individuals.
- Job retention, as defined by returning to the pre-injury employer, rarely occurs among those in the youngest age group, but increases to higher levels among those in the late 20s and early 30s. Relatively high rates occur among those in the oldest age groups at injury. Individuals injured in the younger age bracket have not developed the element of work longevity with pre-injury employers. For them, retraining and the pursuit of new employment will likely prove more successful.
- For those in the oldest age groups, post-injury employment is almost exclusively associated with a return to the pre-injury employer, magnifying the importance of working with pre-injury employers to help accommodate individuals with SCI, whenever possible. Overcoming architectural and logistical barriers to the access of these individuals to their pre-injury workplace is the key here, as the likelihood of them being able to successfully accomplish the duties of their pre-injury jobs is high.

Thus, post-injury employment follows two different tracks: The first is the job transition model and the second is the job retention/return-to-work model. Each of these has a different relationship with age at injury onset, which needs to be considered when developing the most appropriate strategies to promote employment.
Active Research Projects

Full descriptions of the following studies are available online at shepherd.org/research.

ASSISTIVE TECHNOLOGY

Mobility RERC: Evaluation of Factors Affecting Activity & Participation Levels of Wheelchair Users (Stephen Sprigle, PhD; Michael Jones, PhD; Chris Maurer, MPT, ATP) [312]

Rehabilitation Engineering Research Center (RERC) on Wireless Technologies (Michael Jones, PhD; James Mueller, MA; John Morris, PhD; Ben Lippincott, BS; Helena Mitchell, PhD, Ed Price, MS) [410]

The Use of Wheelchairs, Wheelchair Cushions, and Other Mobility Assistive Devices in Everyday Life (Stephen Sprigle, PhD, PT; Sharon Sonenblum, ScM) [463]

Comparison of Pressure Relief Behaviors Between Persons with and without Recurrent Pressure Ulcers (Sharon Sonenblum, PhD; Stephen Sprigle, PhD) [494]

Modeling Pressure Ulcer Susceptibility (Sharon Sonenblum, PhD; Stephen Sprigle, PhD) [495]

Physiological Changes During Pressure Reliefs (Sharon Sonenblum, PhD; Stephen Sprigle, PhD) [496]

Systematic Assessment of Caregiving Skill Performance by Individuals with Tetraplegia and their Caregivers (John Morris, PhD) [587]

Clinical Evaluation of Seating and Mobility Devices and Support Surfaces (Chris Maurer, MPT, ATP; Stephen Sprigle, PhD) [591]

Pressure Relief Behaviors and Weight Shifting Activities in Persons with SCI (Sharon Sonenblum, PhD, Stephen Sprigle, PhD) [609]

CLINICAL TRIALS/MULTIPLE SCLEROSIS

A Phase 1 Safety Study of GRNOPCI in Patients with Neurologically Complete, Subacute, Spinal Cord Injury (David Apple, MD; Ismari Clesson, RN, CCRP; Michelle Tidwell, RN, BSN) [446]

A Dose-Blind, Multicenter, Extension Study to Determine the Long-Term Safety and Efficacy of Two Doses of BG00012 Monotherapy in Subjects with Relapsing-Remitting Multiple Sclerosis (Ben Thrower, MD; Michelle Tidwell, RN, BSN) [486]

An Extension Protocol for MS Patients who Participated in the Genzyme-Sponsored Studies of Alemtuzumab Protocol#CAMMS03409 (Ben Thrower, MD; Carlyn Kappy, RD, LD, CCRP) [514]

JCV Antibody Program in Patients with Relapsing Multiple Sclerosis Receiving or Considering Treatment with Tysabri:

STRATIFY-2” BIOGEN IDEC Protocol # 101JC402 (Ben Thrower, MD; Rachel Betzler, CCRP) [516]

A Multicenter, Observational, Open-Label, Single-Arm Study of Tysabri in Early Relapsing-Remitting Multiple Sclerosis in Anti-JCV Antibody Negative Patients - Biogen #101MS407 – STRIVE (Ben Thrower, MD; Nell Klein, RN, CCRN, CCRP) [564]

A Phase 2 Double-Blind, Placebo Controlled Multi-Center Study to Evaluate the Efficacy and Safety of TecInaTM in Subjects with Secondary Progressive Multiple Sclerosis - Opexa#2012-00 (Ben Thrower, MD; Carlyn Kappy, RD, LD, CCRP) [572]

Study of the Efficacy of Functional Electrical Stimulation in People with MS to Inform Clinical Application (Deborah Backus, PT, PhD; Kevin McCully, PhD) [575]

Assessment and Rehabilitation of Fitness-to-Drive in individuals with Multiple Sclerosis (MS) NMSS Grant (Deborah Backus, PT, PhD; Ben Thrower, MD; Steve Macchiocci, MD; Ismari Clesson, RN, CCRP) [576]

Mitochondrial Capacity: A Predictor of Functional Status in People with MS (Kevin McCully, PhD; Deborah Backus, PhD, PT) [600]
The Effect of Functional Electrical Stimulation on Neural Function in People with MS: Measurements of Changes in Spasticity (Manning Sabatier, PhD; Deborah Backus, PhD, PT) [602]

A Multicenter, Open-Label, 12-Month Observational Study Evaluating the Clinical Effectiveness and Impact on Patient-Reported Outcomes of Oral Tecfidera™ (dimethyl fumarate) Delayed-Release Capsules in Patients With Relapsing Forms of Multiple Sclerosis After Suboptimal Response to Glatiramer Acetate® Biogen Idec 109MS404 RESPOND (Sherrill Loring, MD; Michelle Tidwell, RN, BSN) [606]

A Multicenter, Retrospective, Observational Study Evaluating Real World Clinical Outcomes in Relapsing-Remitting Multiple Sclerosis Patients Who Transition from Tysabri® (natalizumab) to Tecfidera® (dimethyl fumarate) – Biogen 109MS412 – Strategy Study (Sherrill Loring, MD; Deborah Backus, PT, PhD; Elizabeth Gonzales) [630]

Impact of Massage Therapy on Fatigue, Pain and Spasticity in People with Multiple Sclerosis (Deborah Backus, PT, PhD; Christine Manella, PT, LMT, MCMT; Anneke Bender, PT; Mark Sweatman, PhD; Elizabeth Gonzales) [631]

Norovirus Infection in Rehabilitation Inpatients With Neurogenic Bowel Dysfunction: A Pilot Study (Amy E. Kirby, PhD, MPH; Ismari Clesson, RN, MSCN, CCRP; Tammy King, RN; Sarah Culberson, RN; Katherine Reese) [632]

A Phase 2, Randomized, Double-Blind, 6-Sequence, Placebo-Controlled, 2-Period Multicenter Crossover Study to Evaluate the Safety and Efficacy of CTP-354 in Subjects with Spasticity due to Spinal Cord Injury – Concert Pharmaceuticals # CP354.2001 (David Apple, MD; Ismari Clesson, RN, MSCN, CCRP) [633]

The ACP Clinical Research Network and the OPT-UP Program (Deborah Backus, PT, PhD; Ben Thrower, MD; Elizabeth Gonzales, CCRP) [647]

The Effect of Functional Electrical Stimulation Spinal Excitability in People with MS (Manning J Sabatier, PhD; Deborah Backus, PT, PhD) [652]

Pilot Study Evaluating the Impact of Functional Electrical Stimulation Cycling on Fatigue in People with Moderate to Severe MS (Deborah Backus, PT, PhD; Marina Moldavskiy) [653]
Psychological Status During Inpatient Rehabilitation and One Year After Onset: Stress, Coping, and Expectation-Hope for Recovery (James Krause, PhD; David Apple, MD) [408]

Evaluating the Effects of an Activity-Based Therapeutic Exercise Program for Individuals with Spinal Cord Injury (Michael Jones, PhD; Rebecca Washburn, MS; Nicolas Evans, MHS, ACSM-HFS; Laura Vazquez, MPH, Keith Tansey, MD, PhD; Deborah Backus, PT, PhD) [418]

SCIREHAB - Improving Outcomes Through Practice-Based Evidence (Deborah Backus, PT, PhD; David Apple, MD) [421]

The Effect of Combined Resistance and Plyometric Training on Locomotor Recovery Following Incomplete Spinal Cord Injury (Nicolas Evans, MHS, ACSM-HFS) [455]

Mobile Music Touch (MMT): Effects of Tactile Music Instruction System on Hand Rehabilitation (Deborah Backus, PT, PhD; Gil Weinberg, PhD; Ellen Yi-Luen Do, PhD; Thad Starner, PhD; Kevin Huang) [474]

The Brain Motor Control Assessment (BMCA) – Using Standard Electromyographic Techniques to Test Supraspinal Control of Spinal Cord Function in Spinal Cord Injury (Keith Tansey, MD, PhD; Deborah Backus, PhD, PT; Leslie VanHiel, BME, MSPT; Joy Bruce, MSPT, ABD, NCS) [483]

Measurement of Simultaneous H-Reflexes in Multiple Lower Extremity Muscles of Subjects With or Without SCI During Rest and Stepping in the Lokomat® (Keith Tansey, MD, PhD; Deborah Backus, PT, PhD; Leslie VanHiel, MSPT; Joy Bruce, MSPT, ABD, NCS) [488]

Rehabilitation and Research Training Center on Secondary Conditions in Individuals with SCI (RRTC) (Deborah Backus, PT, PhD) [502]

A Comparison of Robotic Body Weight Supported Locomotor Training and Aquatic Therapy for Individuals with Chronic Motor Incomplete Spinal Cord Injury (Keith Tansey, MD, PhD; Leslie VanHiel, BME, MSPT, CCRC) [532]

Comparison of Upper Extremity Muscle Activation Patterns During Grasping Task in Persons with Tetraplegia and Able-Bodied Participants (Deborah Backus, PT, PhD) [530]

A New Measure of Neurological and Behavioral Recovery after SCI: Intra- and Inter-Rater Reliability (Keith Tansey, MD, PhD) [536]

Assessing Upper Extremity Muscle Activation Patterns Across Time During a Grasping Task in Persons with Tetraplegia (Deborah Backus, PT, PhD; Casey Riley, PT, DPT) [545]

Evaluation of Muscle Metabolism in Spinal Cord Injury with Near-Infrared Spectroscopy (Kevin McCully, PhD; Deborah Backus, PT, PhD; Melissa Erickson) [551]

A Multicenter, Randomized, Double-Blind, Placebo-Controlled, Parallel Group Study to Evaluate the Efficacy, Safety, and Pharmacokinetics of SUN13837 Injection in Adult Subjects with Acute Spinal Cord Injury. ASUBIO#ASBI-603 (Keith Tansey, MD, PhD; Ismari Clesson, RN, CCRP; Michelle Tidwell, RN, BSN) [558]
Optimizing Electrical Sensory Stimulation to Generate a Walking Pattern in Spinal Cord Injured Humans (Keith Tansey, MD, PhD; Jason White, MEE; Sandy Alexander, DPT; Joy Bruce, MSPT, ABD, NCS; Leslie Van Hiel, BME, MSPT, CCRC) [583]

Strength and Spontaneous Recovery of Voluntary and Reflexive Cough in Patients Following Traumatic Spinal Cord Injury (Debra Eldred, CCC-SLP; Deborah Backus, PT, PhD) [592]

Measuring Upper Extremity Motor Control and Mechanics in Tetraplegia Using a Powered Robotic Orthosis (Keith Tansey, MD, PhD; Lauren McColough, PT) [593]

Neurophysiological Study of Neuropathic Pain After Spinal Cord Injury (John Kramer, PhD; Keith Tansey, MD, PhD) [601]

Responsiveness of the Capabilities of Upper Extremity Test (CUE-T) (Deborah Backus, PT, PhD) [610]

Pilot Study - Health and Fitness Benefits of an Aquatic Cardiovascular and Resistance Training Program for Individuals with Spinal Cord Injury (SCI) (Elizabeth Sasso, PT, DPT, MS; Sarah Caston, PT, DPT, NCS; Brad Willingham, MS, CEP) [613]

Transcutaneous Spinal Cord Stimulation to Modify Spasticity and Function in SCI Part I: Lumbar Stimulation (Joy Bruce, MSPT, PhD; Keith Tansey, MD, PhD; Bradley Farrell, PhD; Barry McKay) [624]

Transcutaneous Spinal Cord Stimulation to Modify Spasticity and Function in SCI Part II: Cervical Stimulation (Joy Bruce, MSPT, PhD; Keith Tansey, MD, PhD; Bradley Farrell, PhD; Barry McKay; Lauren McColough, DPT) [625]

Indego® Exoskeleton: Assessing Mobility for Persons with Spinal Cord Injury (SCI) (Donald P. Leslie, MD; Clare Hartigan, PT, MPT; David Apple, MD; Ismari Clesson, RN, MSCN, CCRP) [627]

Dose-Response Effects of Whole Body Vibration on Spasticity and Walking in SCI (Edelle Field-Fote, PT, PhD; Eva Widerstrom-Noga, DDS, PhD; Neva Kirk-Sanchez, PT, PhD; Bradley Farrell, PhD; Lauren McColough, PT, DPT)

Treating Upper Limb Function and Impairment or Function Alone (Deborah Backus, PT, PhD; Sarah Woodworth, MOT, OTR/L; Marina Moldavskiy, BS) [635]

Optimizing the Pendulum Test for Measurement of Spasticity after SCI (Edelle Field-Fote, PT, PhD; Somu Ray) [642]

Association Between Brain-Derived Neurotrophic Factor Polymorphisms and Long Term Rehabilitation Outcome After Spinal Cord Injury (Randy Trumbower, PT, PhD; Temple Moore, OTR/L) [650]

Effects of Transcranial Magnetic Stimulation on Motor Control in People with Spinal Cord Injury (Barry McKay; Edelle Field-Fote, PT, PhD; Brad Farrell, PhD; Leslie VanHiel, PT, DScPT) [655]

Traumatic Brain Injury Model Systems Form II Project (GAMBIS) (Ronald Seel, PhD) [171]

Biopsychosocial Factors that Predict TBI Post-Acute Rehabilitation Outcomes (NIDRR; Ronald Seel, PhD, Steve Macciocchi, PhD, Shepherd Center) [433]

Improving Outcomes in Acute Rehabilitation for Traumatic Brain Injury (Susan Horn, PhD; John Corrigan, PhD; Ronald Seel, PhD) [454]

Individualized Planning for the First Year Following Acute Rehabilitation (John Corrigan, PhD, ABPP, Ron Seel, PhD) [459]

Assessing Safety Risk After Traumatic Brain Injury (Ron Seel, PhD; Steve Macciocchi, PhD; Craig Velozo, PhD) [473]

Safe@Home: A Self-Management Program for Individuals with Traumatic Brain Injury and Their Families (Ron Seel, PhD; Stephen Macciocchi, PhD; Virginia Martin, M.Ed., CCC-SLP, CCM; Nicole Thompson) [627]

The Brain Motor Control Assessment (BMCA): Using Standard Electromyographic Technique to Measure Motor Control Following Stroke (Ford Vox, MD; Barry McKay) [617]
PAIN MANAGEMENT

Care of the Chronic Pain Patient in an Outpatient Setting to Validate Efficacy of Ketamine Infusion: A Prospective Study (Monique Gaillard, RN; Marsha Hanson, RN, BSN; Della Reeves, MA) [557]

A Randomized, Double Blind, Three Arm Study of the Effectiveness and Safety of Three Bolus Injections of Ziconotide (Prialt) in Individuals with Chronic Pain (Erik Shaw, DO; Ismari Clesson, RN, CCRP) [597]

A Phase 3, Open-Label, Single-Arm Study To Assess The Safety Of Hydromorphone Hydrochloride Delivered by Intrathecal Administration - CNS Therapeutics #CNS-HYD202US (Erik Shaw, DO; Ismari Clesson, RN, CCRP) [604]

Patient Registry of Intrathecal Ziconotide Management (PRIZM): An Open-Label, Long-Term, Multi-Center, Observational Study of PRIALT® (ziconotide) Solution, Intrathecal Infusion, in Patients with Severe Chronic Pain – Jazz Pharmaceutical Protocol #13-001 (Erik Shaw, DO; Ismari Clesson, RN, CCRP) [605]

A Randomized Controlled Study to Evaluate the Effectiveness of the Precision Spinal Cord Stimulator System at Sub-Perception Amplitude Boston Scientific Protocol #A4046 (Erik Shaw, DO; Ismari Clesson, RN, CCRP; Nell Klien, RN) [643]

Quantitative Assessment of Acute Spinal Cord Stimulation: Understanding Mechanisms of Neuromodulation (Erik Shaw, DO; Bradley Farrell, PhD; Barry McKay, BS; John Kramer, PhD) [646]

OUTCOMES RESEARCH

A Patient-Centered Approach to Successful Community Transition After Catastrophic Injury (Michael Jones, PhD; Julie Gassaway, RN, MS) [603]

NEW RESEARCH PROJECTS INITIATED ANNUALLY

![Graph showing the number of new research projects initiated annually from 1996 to 2014.](image)
Publications


CONTINUED ON NEXT PAGE
**PROFESSIONAL PRESENTATIONS AND PUBLICATIONS BY STAFF**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PRESENTATIONS</th>
<th>PUBLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1996</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1998</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>2002</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>2004</td>
<td>84</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>112</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>140</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>112</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>140</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>140</td>
<td>0</td>
</tr>
</tbody>
</table>


Presentations


Backus D, Burdett B, Manella C, Hawkins L, Munoz R, Gonzales E. Benefits of Functional Electrical Stimulation Cycling in People with Mobility Restrictions Due to MS. Presented at the Consortium of Multiple Sclerosis Centers Annual Conference, Dallas, TX.

Backus D. Benefits and Barriers to Exercise in People with MS. Presented at the Consortium of Multiple Sclerosis Centers Annual Conference, Dallas, TX.

Backus D. Current research applying exercise in MS in “An Interdisciplinary Update on Exercise in Multiple Sclerosis: State of the Art and Practical Applications.” Presented at the American Congress of Rehabilitation Medicine Annual Conference, Toronto, Canada.

Backus D. Overview of various neurological injuries or disease in “Evidence-based Strategies for Helping Those with Neurologic Disability Navigate the Road to Health and Wellness.” Presented at the National Wellness Conference, Minneapolis, MN.

Backus D. People with MS who are Wheelchair Dependent can Exercise, too. Presented at the Consortium of Multiple Sclerosis Centers Annual Conference, Dallas, TX.

Backus D. Preparing Consumers of Rehabilitation Research. Presented at the Consortium of Multiple Sclerosis Centers Annual Conference, Dallas, TX.

Backus D. The role of the researcher in designing studies to effect change in “Creating Change in Health Policy: Demonstrating the Value of Rehabilitation in the US and Canada.” Presented at the American Congress of Rehabilitation Medicine Annual Conference, Toronto, Canada.

Backus D. Spinal Cord Stimulation (tSCS) to Robotic Locomotor Training: A Test of Concept Study. Presented at the Science and Robotics Symposium, Grand Rapids, MI.

Bickett S, Willis CA. Identifying and addressing publishing and presenting barriers: a discussion between new and seasoned librarians. Presented at the Georgia Health Sciences Library Association Annual Meeting, Adairsville, GA.


Dugger C. Adolescent spinal cord injury rehabilitation; international similarities and differences of rehabilitation outcomes. Poster presentation at the International Spinal Cord Society Annual Scientific Meeting, Maastricht, The Netherlands.

Evans N, Nash M, French J, Bickel S. Innovative Strategies to Promote Exercise Participation and Adherence Among Individuals with Mobility Impairments. Symposium presentation at the American Congress of Rehabilitation Medicine Annual Conference, Toronto, Canada.


Evans N. Overcoming barriers to participation in health and wellness programs for people with neurologic disability in “Evidence-based Strategies for Helping Those with Neurologic Disability Navigate the Road to Health and Wellness.” Presented at the National Wellness Conference, Minneapolis, MN.

Field-Fote E. Exciting recovery: augmenting practice with stimulation to optimize outcomes. Presented at Sensorimotor Rehabilitation: at the Crossroads of Basic and Clinical Sciences, Montreal, Canada.


Field-Fote E. To practice or not to practice? That is the question of specificity. Eugene Michels Forum presentation at the American Physical Therapy Association Annual Meeting, Las Vegas, NV.


Gassaway J. Mobile solutions in rehabilitation and AT services. Panel participation at the M-Enabling Conference, Washington, DC.


Gassaway J. Mobile technology facilitates experiential learning and improved patient-reported outcomes in SCI rehabilitation. Poster presentation at the Mobile Health Technology Conference, Boston, MA.


Hartigan C. Indego Clinical Trials. For Persons with Spinal Cord Injury (SCI) and Persons with Stroke (CVA) as part of a collaborative (Craig/RIC/Kessler/Mt Sinai/VA Bronx/Shepherd) two-part Symposium on Exoskeletons presented at the American Congress of Rehabilitation Medicine Annual Conference, Toronto, Canada.

Hartigan C. Indego Exoskeleton. Presented at OT World, Leipzig, Germany.

Hill J. Pressure Ulcers in SCI. Presented at Symposium on Advanced Wound Care, Orlando, FL.


Jones ML, Evans N. Activity-Based Therapy for Recovery of Walking in Individuals with Chronic Spinal Cord Injury. Workshop presentation at the 2014 Congress of the European Society for Physical and Rehabilitation Medicine, Marseille, France.

Jones ML, Evans N. Activity-Based Therapy for Recovery of Walking in Individuals with Chronic Spinal Cord Injury: Results from a Randomized Trial. Presented at the 2014 Congress of the European Society for Physical and Rehabilitation Medicine, Marseille, France.


Jones ML, Gassaway J. Supporting community transition after spinal cord injury rehabilitation: A PCORI-supported systems change initiative. Invited Grand Rounds presentation at the Lakeshore Foundation/University of Alabama-Birmingham, Birmingham, AL.

Jones ML, Hartigan C, Clesson I. The state of spinal cord injury research – A never ending story. Presented at the State Board of Workers’ Compensation Annual Conference, Atlanta, GA.

Kandilakis C, Farris R, Maxwell C. **Indego Exoskeleton.** Presented at the Forbes Innovation Summit, Indianapolis, IN.

Kandilakis C, Farris R. **Indego Clinical Trials.** Group (Craig/RIC/Kessler/Mt Sinai/VA Bronx/Shepherd) Exoskeleton Symposium presented at the American Spinal Injury Association Annual Conference, San Antonio, TX.


Kandilakis CR. **Indego: A Wearable Robotic Exoskeleton Device.** Presented at the International Symposium on Life Care Planning, Pre-Conference Workshop, Atlanta, GA.

Klich U. **Biofeedback.** Presented at Understanding Pain and Spasticity after Neurologic Injury Conference, Atlanta, GA.


McKay WB. **Workshop on Brain Motor Control Assessment.** Presented at the International Society for Restorative Neurology and Asian Prosthetic and Orthotic Scientific Meeting, Taipei, Taiwan.

Morris J, Mueller J, Jones ML. **Hearing aid compatibility of cellphones: Results from a national survey.** Presented at the International Conference on Technology and People with Disabilities, San Diego, CA.

Morris J. **Mobile Apps and People Who are Deaf or Hard of Hearing.** Presented at the M-Enabling Conference, Washington, DC.


Pihera A, Atkins S. **Recreation Therapy as a Part of the Interdisciplinary Treatment Team in Physical Medicine & Rehab.** Presented at the Southeastern Recreational Therapy Symposium, Myrtle Beach, SC.

Reynolds MA, McCully K, Backus D. **Functional electrical stimulation cycling improves muscle metabolism in non-ambulatory people with multiple sclerosis.** Presented at the American College of Sports Medicine Annual Meeting, San Diego, CA.

CONTINUED ON NEXT PAGE
Seel RT, Macciocchi SN, Velozo C. Development and Validation the Safety Assessment Measure for Persons with TBI. Paper presented at the International Brain Injury Association 10th World Congress on Brain Injury, San Francisco, CA.

Seel RT, Macciocchi SN, Velozo C. Predicting Unsafe Events in the Home and Community Following Moderate and Severe TBI. Paper presented at the International Brain Injury Association 10th World Congress on Brain Injury, San Francisco, CA.

Seel RT, Macciocchi SN, Velozo CA. Safety Assessment in the Home and Community following Moderate to Severe Traumatic Brain Injury. Presentation at the Emory Center for Injury Control, Brown Bag Lunch Series, Emory University, Atlanta, GA.

Seel RT. ACRM Evidence and Practice Committee: Mission, Objectives and Working with the APM&R. Invited Presentation and Discussion at the Archives of Physical Medicine and Rehabilitation Editorial Board Meeting, Toronto, Canada.

Seel RT. Patient Level of Effort in TBI Inpatient Rehabilitation. Presentation in a symposium on “Evidence-Based Management of Secondary Conditions in Traumatic Brain Injury Inpatient Rehabilitation” with Bogner J, Seel RT, Hammond FM, Horn SD at the American Congress of Rehabilitation Medicine Annual Conference, Toronto, Canada.

Seel RT. Reporting Methods and Evidence in Observational Studies. Presentation in a symposium on “Developing and Reporting Research Evidence That Makes a Difference in Systematic Reviews” with Seel RT, Heinemann AW, Chan L, Kean J at the American Congress of Rehabilitation Medicine Annual Conference, Toronto, Canada.


Wood K. Coming out of the Speech Closet: An interdisciplinary approach to inpatient rehabilitation. Presented at Mid-South Conference for Communication Disorders, Memphis, TN.
Gary R. Ulicny, Ph.D.
President and CEO

Wilma Bunch
Vice President of Facilities
Services/Risk Manager

Mitchell J. Fillhaber
Senior Vice President of Corporate Development and Managed Care

Stephen B. Holleman, MBA, CPA
Chief Financial Officer

Lorie Hutcheson
Vice President of Human Resources

Michael L. Jones, Ph.D.
Vice President of Research and Technology/Chief Information Officer

Sarah Morrison, PT
Vice President of Clinical Services

Scott H. Sikes, MBA, CFRE, FAHP, CFP®
Vice President of Development and Volunteer Services of Shepherd Center Foundation, Inc.

Donald P. Leslie, M.D.
Medical Director

Brock K. Bowman, M.D.
Associate Medical Director, Assistant Medical Director, Spinal Cord Injury Program

Herndon Murray, M.D.
Medical Director, Spinal Cord Injury Program

Andrew D. Zadoff, M.D.
Medical Director, Respiratory and Critical Care Services

Ben Wade Thrower, M.D.
Medical Director, Andrew C. Carlos Multiple Sclerosis Institute at Shepherd Center

Kush Sing, M.D.
Medical Director, Radiology

Carol Terry, M.D.
Medical Director, Laboratory

David DeRuyter, M.D.
Associate Medical Director, Critical Care Services

Carlos Lopez, M.D.
Medical Director, Infectious Diseases

Accredited by The Joint Commission
Accredited by the Commission for the Accreditation of Rehabilitation Facilities (CARF) for:

- Brain Injury Residential Rehabilitation Programs (Adult)
- Spinal Cord System of Care (Adult)
- Spinal Cord System of Care (Children and Adolescents)

Named a Best Hospital in America 2014 and Best Hospital in Atlanta 2014 by U.S. News & World Report.

Designated an Official MS Center by the National Multiple Sclerosis Society – Georgia Chapter.

Designated as a Model System of Care for spinal cord injury by the U.S. Department of Education's National Institute on Disability and Rehabilitation Research.

Shepherd Center Clinical Laboratory is accredited by the Commission on Laboratory Accreditation (COLA).

Editor: Katie Malone, MS
Designer: Edward Tharp

Contributing Writers: Amanda Crowe, MA, MPH, and Michele Cohen Marill

Contributing Photographers: Louie Favorite, Dean Hesse, and Gary Meek

Contributing Staff: Charles Elander, Clare Hartigan, Lesley Hudson, Jeff Lewis, and Christine Willis
LOCATIONS

Shepherd Center (main campus)
2020 Peachtree Road, NW
Atlanta, Georgia 30309
404-352-2020
shepherd.org

Shepherd Pathways
Post-acute treatment for acquired brain injury
1942 Clairmont Road
Decatur, Georgia 30033
404-248-1667
shepherdpathways.org

Irene and George Woodruff Family Residence Center
Complimentary housing provided to families of newly-injured patients who live more than 60 miles from Shepherd Center
2020 Peachtree Road, NW Atlanta, Georgia 30309

Shepherd Pain Institute
Comprehensive treatment for chronic pain
2020 Peachtree Road, NW Atlanta, Georgia 30309

Andrew C. Carlos Multiple Sclerosis Institute at Shepherd
Comprehensive treatment for MS
2020 Peachtree Road, NW Atlanta, Georgia 30309

Virginia C. Crawford Research Institute Endowment Fund

➤ Apple Family Research Fund
➤ Betty Ann and Hugh Inman Research Fund in Honor of Alana Shepherd
➤ Cannon Harmon, Jr. Spinal Cord Injury Research Fund
➤ Carter’s Inc. Research Fund
➤ Claire D. Smith Research Fund in Memory of J. Lucian Smith
➤ Ellen and C. Duncan Beard Research Fund
➤ Felburn Foundation Research Fund
➤ Green Family Urologic Research Fund in Memory of Dr. Thomas S. Parrott
➤ Martha M. Dykes Spinal Cord Injury Research Fund in Honor of Fran Whitaker
➤ Mickey McQueen Webb Research Fund in Memory of Thomas Dwight Webb III
➤ PricewaterhouseCoopers Research Fund

➤ Research Fund in Honor of the 2002 Legendary Party Committee
➤ Sally and McKee Nunnally, Jr. Research Fund in Memory of Charles E. Day and H. McKee Nunnally
➤ Travis Roy Foundation Research Fund

Multiple Sclerosis Research & Program Development Endowment Fund

➤ The Andrew C. Carlos Multiple Sclerosis Research Fund
➤ The Eula & Andrew C. Carlos Endowed Chair in MS Research
➤ Martha M. Dykes Multiple Sclerosis Research Fund in Honor of Marsha Hardegree
➤ Mighty Distributing Systems Multiple Sclerosis Research Fund
➤ James S. Smith Multiple Sclerosis Research & Program Development Fund

Giving

If you would like to make a gift to support research at Shepherd Center, please contact the Shepherd Center Foundation at 404-350-7305 or visit give.shepherd.org.