

JOURNAL

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SUMMER 2013

IN THIS ISSUE

NEW CME AVAILABLE

- 4 Sexual Functioning After Traumatic Brain Injury: Recent Evidence and Implications for Rehabilitation

OBJECTIVES

After reading this article, the reader should be able to:

- List three types of sexual problems that occur in about 1/3 of persons with TBI.
- Describe the difficulty that persons with TBI may have in discussing their sexual difficulties with health professionals.
- Identify three factors that affect sexual functioning after TBI.
- Describe two changes in the rehabilitation setting that could be used to address sexual functioning after TBI.

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FEATURES

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TIRR Memorial Hermann Brings Researchers Together to Expand Collaboration

When construction of the new TIRR Memorial Hermann Research Institute is complete at the end of this summer, all of the hospital's research programs will come together under one roof for the first time in the institution's history. The investigators expect the move to foster discussion, exchange of ideas and cross-pollination between research projects and clinical care.

"Historically, our research programs have developed their research protocols independent of each other," says **Mark Sherer, Ph.D., A.B.P.P., F.A.C.R.M.**, senior scientist and director of research at TIRR Memorial Hermann and a clinical professor in the departments of Physical Medicine and Rehabilitation at Baylor College of Medicine and UTHealth Medical School. "Because of lack of space on Campus, they were housed in several locations, including leased space outside the Texas Medical Center."

When Dr. Sherer was recruited in 2007, one of his first goals was to find new ways to encourage cross-pollination among the researchers themselves and also between the researchers and the hospital's clinical team. "We had the idea of a research institute and we knew we wanted it to be in the medical center, but we had no idea that the possibility of renovating a building so close to the hospital would arise."

At the time, TIRR Memorial Hermann owned a vacant 42,600-square-foot building adjacent to the main hospital facility. Funds raised through the Memorial Hermann Foundation's

successful Revolutionizing Neuroscience campaign helped make the renovation of the building a reality.

"The availability of a building so close to the hospital gave us the opportunity to bring all of our researchers working on their various projects together to promote synergy between investigators from different disciplines and programs, creating an integrated Campus where we can address all the critical components of research and care in a single location," says **Gerard Francisco, M.D.**, chief medical officer at TIRR Memorial Hermann, chair of the department of Physical Medicine and Rehabilitation at UTHealth Medical School and director of the UTHealth PM&R Motor Recovery Laboratory at TIRR Memorial Hermann. "In most institutions research is conducted in laboratories named after the lab's director, which encourages work in silos and discourages collaboration. Early on, we made the decision to change the status quo by naming our labs according to the type of research under way and by designing the building's layout to encourage communication. Putting researchers with different backgrounds and interests together and encouraging them to work

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FEATURED IN THIS ISSUE

David Arciniegas, M.D.

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MESSAGE FROM THE CMO

Innovation begins with basic science research and clinical investigation.



Gerard E. Francisco, M.D., CMO

Through the research we conduct at TIRR Memorial Hermann, we change lives by using evidence-based treatment to improve outcomes, offering hope and maximizing independence for individuals whose lives have been interrupted by injury or illness. By changing lives, we change our society.

The opening of the new TIRR Memorial Hermann Research Institute marks a renewal of our commitment to validate current treatments and technology and discover new solutions that meet the needs of individuals with impairments, activity limitations and participation restrictions. The new building brings together under one roof four well-established research programs - Independent Living Research Utilization, the Brain Injury Research Center, the Spinal Cord Research Program and the UTHealth

PM&R Motor Recovery Lab at TIRR Memorial Hermann. In the coming months, new labs will be added as we expand basic science research, clinical trials and investigations focused on outcomes, the availability of health services and the incorporation of technology into rehabilitation.

Our ultimate objective remains the same: to provide holistic rehabilitative care that addresses the physical, social, psychological and spiritual needs of our patients from the inpatient experience through community reintegration. In partnership with UTHealth Medical School, we're creating a culture in which research is an integral part of patient care. Research collaboration will give rise to other kinds of collaboration. With a critical mass of engaged researchers interacting in one location adjacent to our hospital, we expect some surprises.

Gerard E. Francisco, M.D.

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Summer 2013

We have opportunities for outstanding rehabilitation professionals. If you are interested in joining our team at U.S. News & World Report's No. 3 rehabilitation hospital, contact Monica Kinnard, recruitment consultant, at 713.797.7281 or Monica.Kinnard@memorialhermann.org. All available opportunities can be viewed at memorialhermann.org.

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A News Interview Leads to an International Music Therapy Exchange Program

In 2011, neurologic music therapist **Maegan Morrow, M.T.-B.C.**, was interviewed about the pioneering techniques she and her colleague **Amy Marroquin, M.T.-B.C.**, used while providing care for former Congresswoman Gabrielle Giffords during her inpatient treatment at TIRR Memorial Hermann. The article, which appeared in *The Telegraph*, a daily newspaper published in London and distributed throughout the United Kingdom and internationally, laid the groundwork for a collaborative exchange program between the rehabilitation hospital, Sam Houston State University's Music Therapy Program and the Université Paul Valéry Faculté des Lettres in Montpellier, France.

"The exchange program has developed in a roundabout way," Morrow says. "A couple in England read the article and brought it to the attention of their daughter, Elizabeth Clark, a music therapy student at the Université Paul Valéry. Elizabeth, a real go-getter, contacted me immediately and said she wanted to come study music therapy with us. TIRR Memorial Hermann made the necessary arrangements, and Elizabeth interned with us for four months, from August to December 2011."

During her stay in Houston, Clark met Karen Miller, director of music therapy at Sam Houston State University, and Hayoung Lim, Ph.D., director of graduate studies in music therapy at SHSU, where both Morrow and Marroquin earned their degrees. The three women discussed the possibility of an exchange program between SHSU and Université Paul Valéry. Further discussions between the two institutions and assistance from the French Consulate in Houston led the Université Paul Valéry to invite Morrow, Marroquin, Miller and Dr. Lim to Montpellier to present a weeklong series of master



Left to Right, Prof Pierre-Luc Bensoussan, Maegan Morrow, Dr. Hayoung Lim, Amy Marroquin, Karen Miller, Dr. Jon-Pierre Blayac, Melanie Maurin

classes in neurologic music therapy to their students.

Neurologic music therapy is defined as the therapeutic application of music to cognitive, sensory and motor function deficits caused by neurologic disease. The 165 students who attended the master classes held in March 2013 came from across France, Belgium, Luxembourg and Italy. They learned about neurologic music therapy techniques that address speech and language rehabilitation, sensory motor training, developmental disorders and cognitive rehabilitation.

"Our main objective in working with our patients is to stimulate and rebuild new connections in the brain for memory, speech and motor activities," says Morrow, who has practiced at TIRR Memorial Hermann for 10 years. Marroquin, a 13-year staff member at the rehabilitation hospital, adds, "Our techniques are evidence based and founded on a neuroscience model of music perception and production, and the influence of music on functional changes in different areas of the brain. We align our plan of music therapy with each patient's program of physical therapy, occupational therapy and

speech therapy to provide support for the other disciplines. In some cases, patients respond to music therapy before they respond to other treatment modalities."

TIRR Memorial Hermann has formalized the internship program, and a second student, Bastien Gournay, will arrive from Université Paul Valéry in October 2013 for a four-month internship.

Morrow and Marroquin are also partnering with Dr. Lim and Miller to develop a clinical research program to further study the use of neurologic music therapy to help aphasia patients recover speech. The two therapists are currently working with researchers in the UTHealth PM&R Motor Recovery Laboratory at TIRR Memorial Hermann to hone their research skills.

"While much has been written about neurologic music therapy in the literature, there's room for the knowledge base to be expanded," Marroquin says. "The work we did with Congresswoman Giffords has opened doors for us internationally. That's not something I would have ever imagined for myself, but we have the experience and training for it and we're successful in our field." ♦

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Sexual Functioning After Traumatic Brain Injury: Recent Evidence and Implications for Rehabilitation

By Angelle M. Sander, Ph.D.



Angelle Sander, Ph.D.

In the 1980s and 1990s, several studies documented sexual dysfunction in persons with traumatic brain injury (TBI). Problems were noted in all aspects of sexual functioning, including frequency of sexual activity,¹⁻³ decreased desire/drive for sexual activity,^{1,4-6} decreased arousal,^{1-3,6} and difficulty reaching orgasm.^{1-4,6} Subjective dissatisfaction with sexual functioning was also documented.^{1,3,5,7} While these studies provided some evidence that sexual functioning should

be attended to in persons with TBI, the conclusions were limited by small sample sizes, use of convenience or clinic samples, measures with unknown validity and predominantly male samples.

In 2007, the TBI Model Systems (TBIMS), funded by the National Institute on Disability and Rehabilitation Research, initiated a collaborative study on sexuality after TBI. TIRR Memorial Hermann was the lead center for this study, with Dr. Angelle Sander as the principal investigator. Six other model systems sites contributed data to this project: Carolinas Rehabilitation, Wayne State University/Rehabilitation Institute of Michigan, Craig Hospital, Rehabilitation Institute of Chicago and Mayo Clinic. The design was a prospective longitudinal cohort study. This study has resulted in three peer-reviewed studies to date and

numerous local and national presentations. The findings have advanced our understanding of the incidence and types of sexual dysfunction after TBI, differences between men and women, evolution of sexual problems over time and factors that predict sexual dysfunction. This article will describe the key findings of that study and discuss the implications for rehabilitation of persons with TBI.

In an article published in *Archives of Physical Medicine and Rehabilitation*, Sander and colleagues⁹ used a well-validated questionnaire, the Derogatis Interview for Sexual Functioning-Self-Report (DISF-SR)¹⁰ to compare the sexual functioning of 223 persons with TBI (165 men, 58 women) at one year after injury to the Derogatis normative sample. As can be seen in Table 1, a substantial proportion of persons with TBI scored in

the impaired range of sexual functioning. Women scored significantly below the normative mean on all subscales of the DISF-SR, while men scored significantly below the mean on all except the arousal scale. Women with TBI scored significantly below men on the sexual cognition/fantasy and arousal subscales. Over a fourth of the sample (29.2 percent) reported being dissatisfied with sexual functioning.

This study also investigated the comfort level of persons with TBI in discussing sexual functioning with their doctors or other health professionals. It is encouraging that 68 percent of participants indicated that if they were experiencing sexual difficulties, they would bring it up at their next doctor's visit. On the other hand, 22 percent of the sample reported that they would only discuss the problems if directly asked by the physician, and 10 percent reported that they would not discuss it under any circumstances. While 53 percent of participants reported that they would be comfortable discussing sexual functioning with their medical providers, 40 percent indicated that they would feel embarrassed and 7 percent were unwilling to discuss it. The reasons for discomfort varied and are shown in Table 2.

In a second study from the TBIMS project on sexuality, Hanks, Sander and colleagues¹¹ investigated sexual func-

tioning over time (six months to 12 months) in a sample of 182 persons with TBI. For the group as a whole, there was no significant change in sexual functioning from six to 12 months. Twenty to 30 percent of participants scored in the impaired range on the DISF-SR at each of the time periods. Analysis of individual scores revealed that several individuals showed reliable improvement over time, while others showed deterioration in sexual functioning.

In a final study resulting from the TBIMS collaboration, Sander et al.¹² studied predictors of sexual dysfunction at one year post injury in a sample of 255 persons with TBI. Older age, female gender, greater injury severity and lower social participation were predictive of sexual dysfunction. Dissatisfaction with sexual functioning was predicted by older age and depression.

There are several clinical implications of these studies. First, impairment in at least one area of sexual functioning is a problem for about one-fourth to one-third of persons with TBI, and this does not tend to improve over time. A subsample of persons with TBI will be hesitant to bring these problems up to their physicians or other healthcare professionals. To prevent the negative impact of sexual problems on relationships and self-esteem, screening

for sexual problems should be integrated into the clinical assessment of at least one discipline present in rehabilitation settings (e.g., social work or occupational therapy). Patients may not be aware of problems during their inpatient stays; therefore, this assessment should take place in outpatient as well as inpatient settings. Education about the potential impact of TBI on sexual functioning should be incorporated into rehabilitation for persons with TBI, just as it is for persons with spinal cord injury. Creating an atmosphere of openness and permission to discuss sexuality in the rehabilitation setting is crucial. Sensitivity training for staff may be necessary to accomplish this. While not all persons with TBI or their caregivers may be ready to discuss sexuality during their inpatient stays, they can at least be provided with written information and encouraged to follow up with their physicians if problems are noted.

Consumer fact sheets on sexuality and TBI, co-authored by Dr. Sander and Kacey Maestas, can be downloaded in English (http://www.msktc.org/lib/docs/Factsheets/TBI_Sexuality_and_TBI.pdf) and Spanish (http://www.msktc.org/lib/docs/Factsheets/Spanish_Factsheets/TBI_Sexuality_Sp.pdf)

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Table 1

Percentage of the Sample with Impaired Sexual Functioning on the DISF-SR Scales

DISF-SR scale	Percentage with Impaired Sexual Functioning*		
	Females n (%)	Males n (%)	Total Sample n (%)
Sexual cognition/fantasy	20 (34.5)	14 (8.5)	34 (15.2)
Sexual arousal	23 (39.7)	40 (24.2)	63 (28.3)
Sexual behavior/experience	20 (34.5)	20 (12.1)	40 (17.9)
Orgasm	23 (39.7)	53 (32.1)	76 (34.1)

*Impaired Sexual Functioning is defined by a T-score < 30 (i.e., < -2.0 SD from mean)

Reproduced from: Sander AM, Maestas KL, Pappadis MR, Sherer M, Hammond FM, Hanks R. Sexual functioning 1 year after traumatic brain injury: findings from a prospective traumatic brain injury model systems collaborative study. *Arch Phys Med Rehabil* 2012;93:1331-7.

Table 2

Reasons for Discomfort in Discussing Issues of Sexual Functioning with Medical Providers

Reason for Discomfort	n (%) reporting*
Just too embarrassed	33 (33.7)
These are personal matters that you should not discuss with people	25 (25.5)
Afraid something may be very wrong and are afraid to find out the reason	19 (19.4)
Not comfortable with doctor or medical professional	9 (9.2)
Afraid that others would find out	5 (5.1)
You feel your doctor would think less of you	2 (2.0)
Other	5 (5.1)

*Of the subsample that was embarrassed or uncomfortable discussing issues of sexual functioning with medical providers; subsample n = 98.

Reproduced from: Sander AM, Maestas KL, Pappadis MR, Sherer M, Hammond FM, Hanks R. Sexual functioning 1 year after traumatic brain injury: findings from a prospective traumatic brain injury model systems collaborative study. *Arch Phys Med Rehabil* 2012;93:1331-7.

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for distribution to patients and their families. Clinicians should be aware that older persons, women and persons who are socially isolated are at greater risk for sexual dysfunction.

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Dr. Sander is director of the Brain Injury Research Center at TIRR Memorial Hermann and an associate professor of physical medicine and rehabilitation at Baylor College of Medicine.

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together is an experiment of sorts. We hope it will change the way research is done in our field.”

Lex Frieden is director of Independent Living Research Utilization (ILRU), one of several programs that will relocate to the new research institute. “Years ago, I studied behavioral ecology to learn how people work together as individuals in groups and how behavior is shaped by environment,” says Frieden, who is a professor of biomedical informatics and professor of rehabilitation at UTHealth Medical School and professor of rehabilitation at Baylor College of Medicine. “There’s a large literature about how synergy is created by bringing people together in the same space and context. ILRU is now located in leased off-campus space one floor above the Brain Injury Research Center, which will also move into the research institute. Even that single floor is a barrier to communication. In the new building we’ll work together in the same space, sharing the same

elevator, coffee room and copier. There will clearly be opportunities for new relationships to develop. The history of rehabilitation is replete with collaboration, which has led to breakthroughs in treatment and community reintegration. I expect that same legacy to apply to our move to the new building.”

Heather Taylor, Ph.D., senior scientist and director of the Spinal Cord Research Program and an assistant professor of pediatrics at UTHealth Medical School, considers the timing of the move opportune. “Knowing what people are doing in our own backyard and how we can leverage their knowledge and skills to further our individual and collaborative research goals offers us a tremendous opportunity,” she says. “The physicians I work with who specialize in spinal cord injury are very interested in research, both in pursuing individual projects and in ensuring that their practice is informed by leading-edge knowledge from research. I find that interest in collaboration very exciting, and our move to the Institute

will develop it further. We’re on the verge of phenomenal growth in our research programs.”

Dr. Sherer expects the collaboration to bring research to the bedside faster. “As researchers, we tend to think that knowledge is available for dissemination only at the end of a project, once the data have been analyzed and the article is written and published,” he says. “But even if data collection isn’t complete, we’ve already discovered new knowledge that can be shared with clinicians to the benefit of our patients. We’ve also begun moving beyond the traditional way we develop research projects – asking for input from the clinical team, developing a proposal, collecting data and analyzing and publishing it – to continuous two-way communication throughout the entire investigation process. Our new proximity to the clinical team will allow us to share our insights and put them to work more quickly and effectively to advance the care and health of our patients.” ♦

Behavioral Neurology and Neuropsychiatry in Brain Injury Rehabilitation: A Collaborative Care Model



Victor H. Chang, M.D.



David B. Arciniegas, M.D., F.A.N.P.A., F.A.P.M., C.B.I.S.T.

Victor Chang, M.D., and David B. Arciniegas, M.D., have developed an innovative collaborative care model for inpatient brain injury rehabilitation in which behavioral neurology and neuropsychiatry (BNNP) subspecialists are embedded members of the rehabilitation team and partner with physiatrists to lead the team's efforts to deliver comprehensive neurorehabilitation services to persons with acquired brain injuries and their families.

Dr. Arciniegas, who is the Beth K. and Stuart C. Yudofsky Chair in Brain Injury Medicine and professor of psychiatry, neurology and physical medicine and rehabilitation at Baylor College of Medicine, joined TIRR Memorial Hermann in September 2012 as senior scientist and medical director for brain injury research. Prior to beginning his work in Houston, Dr. Arciniegas held a faculty chair in neurocognitive disease at the University of Colorado School of Medicine (UC-SOM) and served for many years as medical director of the Brain Injury Unit at HealthONE Spalding Rehabilitation Hospital in Aurora, Colo. At that hospital, he successfully developed and implemented a collaborative care model similar to that which he and Dr. Chang have developed at TIRR Memorial Hermann.

In anticipation of his relocation to

Houston last fall, Dr. Arciniegas worked with Dr. Chang – who was recruited earlier this year from UC-SOM to UTHealth Medical School and serves as clinical director of the Brain Injury and Stroke Program and medical director of case management at TIRR Memorial Hermann – on a plan to introduce the collaborative care model at TIRR Memorial Hermann. “As a subspecialist in BNNP, Dave brings complementary expertise in the evaluation and neurorehabilitative management of brain injury and stroke to the work of our team,” Dr. Chang says. “The detailed information he provides about the structural and functional neuroanatomy of acquired brain injuries and the effects of those injuries on brain-behavior relationships usefully guides treatment planning and medical decision-making. He also integrates an understanding of each patient's pre-injury history and psychosocial context into the evaluation of that patient's post-injury neurobehavioral presentation. His clinical approach emphasizes the importance of developing a comprehensive view of pre-injury, injury-related and post-injury factors on symptoms and outcomes following brain injury. In other words, he reminds us that our focus is not just on brain injury but also on the person who was injured and the context in which injury and rehabilitation occur. These reminders allow us to better define the causes of cognitive, emotional, behavioral and sensorimotor disturbances in our patients and provide treatments that address them more effectively.”

When a patient with TBI is admitted to TIRR Memorial Hermann, Dr. Chang performs a comprehensive rehabilitation medicine evaluation and begins the treatment planning process. As a part of that process, Dr. Arciniegas performs a BNNP consultation and collaborates on the development of treatment plans. “Subspecialists in BNNP integrate compre-

hensive evaluation of developmental, neurological, medical, psychiatric, medication, substance and family histories with detailed neurological and mental status examinations, laboratory findings, neuroimaging and data from other rehabilitation team members to generate our diagnostic impressions and treatment recommendations,” Dr. Arciniegas says. “Our training in neuroanatomy, neurochemistry, neurophysiology and general medicine complements the training in neurorehabilitation of our colleagues in PM&R and enables effective interdisciplinary collaboration. By providing BNNP consultations to our psychiatry colleagues early in the inpatient neurorehabilitation process, we enhance the work of our entire rehabilitation team and contribute usefully to the team's collective efforts to improve the lives of persons with brain injuries and families receiving care at TIRR Memorial Hermann. Both Drs. Arciniegas and Chang note that BNNP services are available in only a few inpatient rehabilitation hospitals in the United States, and that this model of PM&R-BNNP collaborative care is unfamiliar to most rehabilitation physicians and teams. “For the model to be effective, a physiatrist has to be comfortable with another clinician coming in and contributing a different perspective on a case,” says Dr. Chang, noting that he and Dr. Arciniegas, based on their association at the University of Colorado, bring a pair of well-matched professional styles that ready the stage for their work together at TIRR Memorial Hermann. “Some might regard the knowledge and skills of a psychiatry-trained brain injury specialist and a brain injury-focused subspecialist in BNNP to be quite overlapping. In our experience, the similarities and differences in our training backgrounds and experiences are synergistic. Working in this kind of collaborative care model

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TIRR Memorial Hermann Expands Its Pediatric Rehabilitation Program



Glendaliz Bosques, M.D.

When **Glendaliz Bosques, M.D.**, joined the medical staff of TIRR Memorial Hermann and Children's Memorial Hermann Hospital as chief of pediatric rehabilitation medicine in early

2013, she forged a new link between two renowned institutions. Among her first goals was the establishment of a Pediatric Rehabilitation Clinic, which is now open to pediatric outpatients every Tuesday from 1 to 5 p.m. at TIRR Memorial Hermann.

"The clinic serves the long-term follow-up needs of pediatric patients with chronic conditions related to disability," says Dr. Bosques, who is an assistant professor in the department of Physical Medicine and Rehabilitation at UTHealth Medical School. "I provide care for young patients with complex health challenges, including spinal cord injury, brain injury, spina bifida, cerebral palsy, brachial plexus injuries and other conditions related to disability."

As part of TIRR Memorial Hermann's expansion across the Greater Houston metropolitan area, Dr. Bosques' goals include developing a more comprehensive therapy program for pediatric rehabilitation throughout the Memorial Hermann system. She also hopes to establish an aggressive inpatient rehabilitation program for children at TIRR Memorial Hermann.

"There's still a treatment gap for children ranging from newborn to 13 years of age who have undergone trauma or have acute neurological conditions that are not served by a comprehensive inpatient rehabilitation program," she says. "My No. 1 priority is to ensure that all children with disabilities have



appropriate access to therapies and equipment throughout the entire continuum of care, from inpatient to outpatient treatment."

Her work will complement existing programs at TIRR Memorial Hermann Pediatric Outpatient Rehabilitation at Kirby Glen and the rehabilitation hospital's new facility at Memorial Hermann Memorial City Medical Center, which also offers pediatric rehabilitation. To achieve her goals she is currently forging relationships across the city with trauma specialists, general neurologists, pediatricians, critical care physicians, pulmonologists and psychiatrists, as well as conducting inpatient consults at Children's Memorial Hermann Hospital and Shriners Hospital for Children in Houston.

Dr. Bosques, a first-generation physician in her family, learned about rehabilitation in medical school at the University of Puerto Rico School of Medicine in San Juan, from which she graduated *magna cum laude* in 2003. "I've always been interested in children,

and in college I had a strong interest in pediatric genetics, which I thought would allow me to explore issues related to children with special needs," she says. "But I was impressed by the passion and commitment of a physical therapist I met in college. I wanted to be the doctor that works with physical and occupational therapists. On a more formal basis, I discovered the field of rehabilitation in medical school during a required rotation. Psychiatry allows me to take a more hands-on role with patients, their families and their community. In general, children heal quickly, and I enjoy working with them. You need to establish a relationship with pediatric patients very quickly, especially younger children. I find this both stimulating and challenging."

Dr. Bosques' clinical and research interests are in the area of advanced rehabilitation of paralytic diseases in children, including traumatic and non-traumatic etiologies. Her practice also focuses on brain injury and stroke; nerve injuries, including neonatal brachial plexus palsy; spina bifida; spasticity management; botulinum toxin injections for spasticity; and intrathecal baclofen pump management.

In her spare time she's involved with professional groups, including the American Academy of Physical Medicine and Rehabilitation (AAPMR) and the American Association of Physiatrists (AAP). She currently chairs the pediatric section of the American Spinal Injury Association (ASIA).

"Every child has incredible potential," she says. "I'm committed to using my new position to help kids maximize their function regardless of what has happened to their bodies." ♦

Behavioral Neurology continued from page 7

creates a patient care environment that encourages question-asking, prompts us to educate ourselves and each other and continuously improves the clinical effectiveness of our team.”

Dr. Arciniegas observes that having multiple experts address the complexities of the cognitive, emotional and behavioral manifestations of persons with brain injuries has always been a strength of rehabilitation teams. “The more light you shine on the problem, the more likely we are to find successful treatment approaches for our patients,” he says. “Because the neurobehavioral manifestations of brain injuries are complicated, patients and families rely on those providing their care to share their clinical

insights with each other and to collaborate on diagnosis and treatment planning. That’s why the model of collaborative care that we’ve developed is so effective. Victor and I practice what we teach our patients and their families about the importance of interdisciplinary collaboration, the necessity of effective information sharing and the value of teamwork. Through these processes, we are able to understand the challenges experienced by our patients more clearly and to work with them to provide treatments that meet their needs.”

Dr. Chang’s inpatient service at TIRR Memorial Hermann provides the initial point of convergence for the collaborative care model developed by the two physicians. “If it proves to be a useful and clinically productive model, then our

hope is to bring other BNNP specialists into the mix and disseminate the model throughout the inpatient and outpatient programs at our hospital,” Dr. Arciniegas says. “With appropriate Institutional Review Board approval, we aim to evaluate this model of inpatient rehabilitation service delivery, to identify the types of patients who are best served by it and to compare the clinical outcomes of those receiving it with those afforded by traditional models of inpatient rehabilitation. We want to create a model that is reproducible elsewhere and, through dissemination of information about it, to engage other physicians and institutions in our studies of this approach to advancing patient care and brain injury medicine.” ♦

On Achieving Pathway to Excellence Designation

More than 5,700 hospitals in the United States are registered with the American Hospital Association. As of April 2013, only 106 of them, including acute care and rehabilitation hospitals, had earned the coveted American Nurses Credentialing Center (ANCC) Pathway to Excellence® designation. In March 2013, TIRR Memorial Hermann joined the handful of healthcare organizations recognized by the ANCC for positive practice environments where nurses excel.

A Pathway to Excellence hospital is a champion of high-quality nursing practice. The designation improves nurse satisfaction, helps retain choice nursing staff and leaders, and shows that TIRR Memorial Hermann cultivates inter-professional teamwork.

Achieving Pathway to Excellence designation requires dedication and persistence. In 2007, we began an internal campaign to encourage our nurses to attain the C.R.R.N. credential. At that time only 4 percent of our eligible registered nurses were certified rehabilitation registered nurses. Today,

that number is 48 percent, and 90 percent of the nursing management team at TIRR Memorial Hermann holds the credential. We believe that our focus on nurse credentialing laid the foundation for our success in achieving the Pathway to Excellence designation.



Certification is the gold standard for nursing. When you hire a C.R.R.N., you know you’ve hired a nurse with a passion for rehabilitation. To qualify for the certification, nurses have to work in the

rehabilitation setting for two years and sit for an intensive exam that tests their knowledge of rehabilitation as it relates to the laws of disability, nursing theory and clinical care. Those who pass join the ranks of the many proud nurses who add the credential to their names.

When achieving the Pathway to Excellence designation became a goal for us, we also implemented many nursing process changes for the benefit of our patients and staff. Patient care is our No. 1 priority, and in the day-to-day hospital setting, our greatest challenge was finding the time to work on the application. We’re grateful to **Allison Reimers, R.N.**, our education resource specialist, who organized the project, managed it and kept us on track with deadlines.

We submitted our application, a seven-volume, 10-inch-thick document, in October 2012. Three independent reviewers ensured that we met the criteria and intent of the standards. A month later we were notified that our *Pathway to Excellence* continues on page 11

TIRR Memorial Hermann Extends Its Reach Across Houston

As healthcare reform challenges organizations to provide high-quality care to large populations of patients, TIRR Memorial Hermann is creating a comprehensive, integrated rehabilitation network reaching beyond the Texas Medical Center to outlying communities where people live and work. Last November, the rehabilitation hospital opened new outpatient clinics at Memorial Hermann Memorial City Medical Center and Memorial Hermann Northwest Hospital. A third clinic will open at Memorial Hermann The Woodlands Hospital in October 2013.

The new clinics further extend services that have been offered at TIRR Memorial Hermann Adult and Pediatric Outpatient Rehabilitation since the southwest Houston facility opened in 2001. “They’re a logical extension of our goal to help our patients return to the community after disabling injury or illness and live their lives to the fullest extent possible,” says **Sandra Lloyd, R.N.**, director of business development and director of adult and pediatric outpatient rehabilitation at TIRR Memorial Hermann. “Rehabilitation happens in the community, not just in the hospital. Providing a comprehensive range of therapeutic services to adults and children in outlying communities makes rehabilitation more convenient for our patients.”

TIRR Memorial Hermann Adult and Pediatric Outpatient Rehabilitation at Memorial City and TIRR Memorial Hermann Outpatient Rehabilitation at Memorial Hermann Northwest Hospital offer physical therapy, occupational therapy, speech-language pathology, neuropsychology and social work. The two clinics also have occupational therapy low-vision specialists, a physical therapy geriatric-certified specialist and a Herdman’s vestibular-competent physical therapist on staff. Both facilities offer lymphedema management by occupational therapists certified in lymphedema as part of a growing cancer



Aquatic therapy at Memorial City

rehabilitation program.

“We have a robust cancer service line at our hospital,” says Keith Alexander, CEO of Memorial City Medical Center. “With the addition of rehabilitation services, we now have the full complement of oncology programs. About a third of the patients who come to us for rehabilitation are referred by physicians who are closely aligned with Memorial Hermann, but the remaining two-thirds are referred from other hospitals, including MD Anderson. Their patients like the convenience of rehabilitation closer to home.”

As part of its comprehensive oncology program, the Memorial City clinic has launched a pilot survivorship wellness program, which offers fitness and wellness memberships, group fitness classes, recovery and health promotion programs and support groups. “People who have had cancer or are still undergoing treatment are living a lot longer, which has focused attention on survivorship issues,” says **Jessica De La Rosa, P.T., D.P.T., N.C.S.**, rehabilitation clinic manager at Memorial City Medical Center and

Memorial Hermann Northwest. “Our goal is to provide a comfortable environment for cancer survivors to exercise, along with the educational component and support.”

The Memorial City clinic, which treats pediatric patients age 8 and older, also offers aquatic therapy in an onsite pool. “Aquatics gives our therapists another tool to use in implementing new ideas and treatment interventions,” De La Rosa says. “Clients can start working on strength and balance in the pool and then transition to land.”

TIRR Outpatient Rehabilitation on the Campus of Memorial Hermann Northwest offers the same services to the northwest Houston community. “The presence of TIRR Memorial Hermann on our Campus addresses emerging needs in the community and has brought new energy and focus to our inpatient rehabilitation unit,” says Gary Kerr, hospital CEO. “The addition of neuropsychology to our program has expanded the services we offer to people with neurological disorders, including those

The new clinics further extend services that have been offered at TIRR Memorial Hermann Adult and Pediatric Outpatient Rehabilitation since the southwest Houston facility opened in 2001. “They’re a logical extension of our goal to help our patients return to the community after disabling injury or illness and live their lives to the fullest extent possible.”

with medically complex issues related to recovery from traumatic brain injury, stroke, intracranial hemorrhage and other conditions. The organization of our system’s rehab clinics under TIRR Memorial Hermann is raising the standard of rehabilitative care across the entire population that Memorial Hermann serves.”

All employees in the outpatient facilities complete their training and orientation at one of the previously established TIRR Memorial Hermann outpatient facilities, which ensures continuity in quality of care delivered.

TIRR Memorial Hermann will open a third outpatient clinic at Memorial Hermann The Woodlands Hospital in October, followed by an 18-bed inpatient unit in February 2014. The Woodlands clinic will also offer the TIRR Memorial Hermann Challenge Program, a comprehensive community reintegration program for brain injury survivors age 14 and older. The program has a 30-year track record of success in helping individuals return to community activities - work, school or volunteering - or to a higher level of independence.

“Establishing a network of clinics across the city where people can receive the same quality of care closer to home has been a long-term goal for us,” says Sandra Lloyd. “Our clients no longer have to get up at four or five in the morning and negotiate Houston traffic only to arrive at their rehab session exhausted. They can get what they need - from basic rehabilitation to very complex and specialized treatment - close to home.” ♦

Pathway to Excellence continued from page 9 documentation had been accepted. After acceptance, the ANCC asked our nurses for their opinions in a formal survey. Participation of 50 percent was required; 94 percent of our nurses responded. Seventy-five percent of the responses must be positive; we received more than 90 percent positive responses on 24 of the 26 questions. Six weeks after the survey closed, we received notification that we had earned the Pathway to Excellence designation.

therapy. By recognizing our nurses’ achievements and working with them to seek education and certification, we have empowered them to gain confidence, build camaraderie and raise the bar.

Healthcare is a competitive environment. The Pathway to Excellence designation validates the expertise of our nursing team. It lets our patients know that we have unsurpassed nursing care and are leaders in the recruitment and retention of top nurses. We’re not resting on our laurels. We’ve already



A study completed in 2007 by the Association of Rehabilitation Nurses (ARN) reported improved outcomes associated with certification in the field of rehabilitation. Our nursing staff is a shining example of the relationship of credentials to quality of care. As our percentage of credentialed nurses increased during the journey to Pathway to Excellence, our rates of ventilator-associated pneumonia, unassisted falls, catheter-associated urinary tract infections, bloodstream infections and hospital-acquired pressure ulcers decreased.

Receiving a national nursing designation is an exciting event. In a rehabilitation hospital, much of the focus of care is on

begun preparation for renewing the designation in three years. The best way to keep momentum going is by setting even higher goals. ♦

TIRR Memorial Hermann’s Pathway to Excellence documentation was selected by the ANCC as a case study entitled “A Model for Transformation of Clinical Service Resulting in a Positive Practice Environment,” presented at the International Forum on Quality and Safety in Healthcare held in London, England, in April 2013.

Profiles in Caring: Sheng Li, M.D., Ph.D.



Sheng Li, M.D., Ph.D.

Sheng Li, M.D., Ph.D., belongs to a rare breed of rehabilitation physicians whose careers in medicine are focused on applying research conducted in the lab directly to

patient care. When he received his medical degree at Beijing Medical University in China, and finished his residency in traumatic orthopedics at Jishuitan Hospital in Beijing, he set out on a winding path that led to his dual appointment as director of the TIRR Memorial Hermann Neurorehabilitation Research Laboratory and attending physician providing inpatient and outpatient care.

“I chose medicine because I’m interested in science and wanted to help people, particularly those with disabilities related to movement,” Dr. Li says. “My core interest has always been movement, and that has guided my career decisions.”

After finishing a master’s in exercise science at the University of Toledo in Ohio, he went on to complete his doctorate in kinesiology at Pennsylvania State University in 2002. “While I was doing research in movement and biomechanics at Penn State, I recognized the importance of integrating knowledge of neuro-control of movement into my work.” In pursuit of that goal, he completed a post-doctoral fellowship in neurorehabilitation at the Rehabilitation Institute of Chicago and Northwestern University, focusing primarily on stroke rehabilitation.

In 2004, Dr. Li accepted a faculty position as an assistant professor in physical therapy at the University of Montana in Missoula, where he began investigating the connection between voluntary breathing and movement. “On the day I arrived in Montana, I was tired and

wanted to relax after many plane flights and long hours of travel,” he recalls. “When I was in a very relaxed state using a technique of deep breathing and meditation, I noticed that my fingers extended during slow, deep inhalations. At first I thought something was wrong with my fingers, but I tried it several more times, always with the same phenomenon. When I realized that finger extension was connected to the inhalation, I felt I had made a new and important discovery that might be clinically applicable to the recovery of hand function after stroke.”

He collected more data and applied for grant funding to continue his research. At the same time, as he delved deeper into disability, he began to feel a disconnect between his research and the patient experience, and decided to pursue additional clinical training through a residency in physical medicine and rehabilitation. He applied to the Baylor College of Medicine/UTHealth Medical School PM&R Alliance. Residency program director Gerard Francisco, M.D., who is now chair of the department of PM&R at UTHealth Medical School and chief medical officer at TIRR Memorial Hermann, assured Dr. Li that the program could accommodate his research interests.

In 2008, while still at the University of Montana, Dr. Li was awarded a \$905,736 National Institutes of Health R01 grant for research in respiratory-motor coupling and possible clinical applications. That same year he was accepted into the Baylor/UTHealth PM&R Alliance’s residency program. To ensure that Dr. Li had protected time to continue research on the NIH-funded project during his residency training, Dr. Francisco helped him transfer to the Clinical Investigator Pathway.

Since his arrival at UTHealth and TIRR Memorial Hermann he has coauthored 12 peer-reviewed journal articles. His research on respiratory-motor coupling and clinical applications has appeared in the *Journal of Neurophysiology*,¹ *Motor Control*² and *Journal of Pain Research*,³

and he was recently invited by the *Journal of Visualized Experiments*⁴ to publish a video article on his work with a new electrical stimulation protocol called breathing-controlled electrical stimulation (BreEstim). In 2011, he received a \$90,000 NIH R24 grant under subcontract with the Rehabilitation Institute of Chicago for research on clinical application of high-density surface EMG. The aim of the study is to localize motor points of biceps using high-density sEMG and to compare effectiveness of EMG-guided botulinum toxin injection with conventional methods. Dr. Francisco is co-principal investigator. In 2013, Dr. Li received a \$25,000 award from Mission Connect, a program of TIRR Foundation, for equipment purchase.

As he delved deeper into disability, he began to feel a disconnect between his research and the patient experience, and decided to pursue additional clinical training through a residency in physical medicine and rehabilitation.

“Electrical stimulation therapy uses small electrodes to send electrical currents through the skin to target certain muscle groups,” he says. “It has a broad range of applications in rehabilitation to achieve functional and therapeutic goals, from spasm relaxation to pain management. Based on recent discoveries about the systemic effects of voluntary breathing and the physiological interactions among body systems during voluntary breathing, we invented the BreEstim protocol to augment the effects of electrical stimulation in patients with neuropathic pain and spasticity. In BreEstim, a single-pulse electrical stimulus is triggered and delivered to the target area when the air flow rate of each individual breath reaches a certain threshold.”

The protocol is grounded in the distinction between autonomic or reflexive

breathing, as in sleep, and voluntary breathing, as used for speech. To talk or sing, humans voluntarily suppress autonomic breathing by activating the cortical respiratory center of the brain. These same cortical and subcortical areas that are activated during voluntary breathing are also involved with muscle tone, posture, mood, pain, speech and other functions. Using this knowledge, Dr. Li and his colleagues discovered interactions between the respiratory and motor systems, specifically the finger extension-inhalation coupling.

“Like other physician-scientists in physical medicine and rehabilitation, I’m dedicated to performing clinical research that aims toward a better understanding of the pathophysiological mechanisms of disease, with the goal of developing novel or alternative treatment options,” says Dr. Li, whose laboratory is focused on spasticity management primarily following stroke and neuropathic pain management after spinal cord injury, amputation and stroke.

His future research will be focused on the clinical application of breathing-controlled electrical stimulation in spasticity management and neuropathic pain management. “Our preliminary data in these two areas are very promising, and we’re in the early stages of collecting more evidence. If breathing-controlled electrical stimulation proves to be useful, we’ll apply it to clinical care.

“The ultimate goal of research is to benefit patients,” he adds. “Physician-scientists are in an excellent position to perform translational research because we understand patient needs and can bring research from the bench to the bedside quickly.” ♦

¹Li S, Rymer WZ. Voluntary Breathing Influences Corticospinal Excitability of Nonrespiratory Finger Muscles. *J Neurophysiol* 2011;105:512-521.

²Li S, Park WH, Borg AM. Phase-dependent respiratory-motor interactions in reaction time tasks during rhythmic voluntary breathing. *Motor Control* 2012;16:493-505.

³Li S, Melton DH, Berliner JC. Breathing-controlled electrical stimulation could modify the affective component of neuropathic pain after amputation: A case report. *J Pain Res* 2012;5:71-75.

⁴Li S. Breathing-controlled Electrical Stimulation (BreEStim) for Management of Neuropathic Pain and Spasticity. *J Vis Exp* 2013;71:e50077,doi:10.3791/50077.

ON THE PODIUM

Arciniegas, DB. Attention and Memory Impairments Following Mild Traumatic Brain Injury: New Perspectives on an Old Problem. The 26th Annual William A. Spencer Memorial Lectureship to the Baylor College of Medicine/UTHealth Medical School Physical Medicine & Rehabilitation Alliance, Houston, Texas, February 2012.

Arciniegas, DB. Neuropsychiatric Assessment During Inpatient Rehabilitation After Traumatic Brain Injury. Invited lecture at the International Conference on Recent Advances in Neurorehabilitation (ICRAN), Valencia, Spain, March 2013.

Arciniegas, DB. Advances in the Management of Traumatic Brain Injury. Symposium presented at the 166th Annual Meeting of the American Psychiatric Association, San Francisco, California, May 2013.

Armstrong G, Yen J, Shah M, **Li Sheng.** Can hemiparetic stroke survivors accurately perceive their effort during physical exertion? Invited presentation at the Association of Academic Physiatrists Annual Meeting, New Orleans, Louisiana, March 2013.

Davis LC. Returning to work after traumatic brain injury: Challenges and strategies to maximize effectiveness. Presented at the 29th Annual Conference of the Texas Brain Injury Alliance, Austin, Texas, April 2013.

Sherer M, Maestas KL, Sander AM, Pastorek NJ, Havins WN. Know Thy TBI: Accuracy of Self-reported PTA in



Lynne Davis, Ph.D.



Mark Sherer, Ph.D.



Margaret A. Struchen, Ph.D.



Allison Clark, Ph.D.

Persons with TBI. Paper presented at the Santa Clara Valley Brain Injury Conference, San Jose, California, March 2013.

Struchen MA, Clark AN. Traumatic Brain Injury and Implications for Practice. Invited presentation at the 2013 Military Social Work Conference, Civilian Social Work with Military Veterans: Implications for Practice and Education, Austin, Texas, April 2013.

Struchen MA. Facilitating social integration after traumatic brain injury: Social communication and community interventions. Invited presentation at the 28th Annual Western Michigan Brain Injury Network Symposium, Grand Rapids, Michigan, April 2013. ♦

ACCOLADES

The **TIRR Memorial Hermann Pharmacy department** and individual pharmacists were recently honored for their contributions to the profession of pharmacy in Texas.



The department received the University of Houston College of Pharmacy Health-System Pharmacy of the Year award recognizing excellence in mentoring pharmacy students in their hospital pharmacy rotations. In addition, the University of Texas College of Pharmacy recognized **Dehuti Pandya, Pharm.D., B.C.P.S.**, as the Houston-Galveston Region Outstanding Clinical Preceptor and **Susan Loughlin, Pharm.D., B.C.P.S.**, as the Houston-Galveston Region Outstanding Primary Care Preceptor. **Sarah Lake-Wallace, Pharm.D.**, was named a fellow of the Texas Society of Health-System Pharmacists at the organization's annual meeting held in Austin in April.



Sarah Lake Wallace, Pharm.D.

the many outstanding pharmacists practicing in the Houston-Galveston region," says **Lou Cuellar, F.A.S.H.P.**, administrative director of pharmacy and clinical support services. "They truly exemplify pharmacists who are continually striving to provide the best care for our patients. Dehuti and Susan are exceptional practitioners as well as educators, preceptors and mentors. It's an honor for them to be recognized by their students, who will take into their practice the knowledge they've gained and the critical thinking skills they've mastered. We're also very proud that Sarah was among the first group of seven in Texas to be named a fellow of the Texas Society of Health-System Pharmacists."

"Our pharmacy team is honored to be chosen to receive the Health-System Pharmacy of the Year award from among

David Arciniegas, M.D., was appointed to the editorial board and named special features editor-pharmacology of the *Journal of Head Trauma Rehabilitation*, a peer-reviewed journal that provides information on the clinical management and rehabilitation of persons with brain injuries, and the official journal of the Brain Injury Association of America. ♦

IN PRINT

Chang S-H, **Francisco GE**, Zhou P, Rymer WZ, **Li S**. Weakness, spasticity, force variability and spontaneous motor unit discharges of resting spastic-paretic biceps brachii in chronic stroke. *Muscle & Nerve* 2013;doi: 10.1002/mus.23699 [e-pub 21 April 2013]



Lourdes Cuellar, R.Ph., F.A.S.H.P.

Wharton Healthcare Management Alumni Association.

Sander AM, Maestas KL, Nick TG, **Pappadis MR**, Hammond FM, Hanks RA,



Monique Pappadis, C.H.E.S., C.C.R.P.

Rehabilitation 2013;28:186-194.

Hanks RA, **Sander AM**, Millis SR, Hammond FM, **Maestas KL**. Changes in sexual functioning from six to twelve months following traumatic brain injury: A prospective TBI Model Systems multicenter study. *Journal of Head Trauma Rehabilitation* 2013;28:179-185. ♦

POSTER PRESENTATIONS

Euliarte MA, Thomas L. Targeted Interventions for Compliance with Hand Hygiene Measures in the Rehabilitation Setting. Virtual poster presented at the American Nurses Association Nursing Quality Conference, Atlanta, Georgia, February 2013.

Loughlin SM, Lake-Wallace SE, Thomas LW, Cuellar LM. Process Improvement Team



Lisa Thomas, R.N., C.R.R.N.

Takes a Shot at Influenza in Rehabilitation Patients. Presented at the Texas Society of Health-System Pharmacists Annual Seminar, Austin, Texas, April 2013. **Pandya D, Lake-Wallace SE, Cuellar LM**. Capturing Pharmacy Interventions Without the Use of an External Documentation Database. Presented at the American Society of Health-System Pharmacists Midyear Clinical Meeting, Las Vegas, Nevada, December 2012. ♦

MESSAGE FROM THE CEO

We're very pleased to welcome our researchers to their new offices and labs in the TIRR Memorial Hermann Research Institute. For the past year, through my



Carl E. Josehart, CEO

office window I've watched the transformation of a long-vacant building into an innovative structure that will bring our dream of enhanced research collaboration to fruition.

The walkway connecting our two buildings is a visible reminder of the link between scientific discovery and advances in patient care - and of our commitment to close the loop between the two endeavors. At TIRR Memorial Hermann we believe

that a questioning attitude about everything we do keeps our focus on continuing to push toward new and better ways to improve outcomes for the people we serve.

In many ways, our new research institute is a grand experiment. While we've envisioned many of the benefits that will arise from closer collaboration between researchers, we also expect to be surprised by the new pathways to discovery that arise as bright minds interact and personal and professional relationships develop. When synergy is at work, we're on fertile ground for the discovery of hidden connections between topics that appear unrelated.

Advances in medicine have encouraged physicians and researchers to focus on increasingly narrow specialties and subspecialties to keep up with rapidly

advancing knowledge. In the design of the new research institute we endeavored to strike a balance between allowing for sufficient concentration of knowledge to make practice meaningful, while at the same time recognizing that effective rehabilitative research and care must also be holistic. We've designed our new research institute to mix things up a bit, allowing for both concentration and flexibility in discovery. As we work to advance the health of our patients, it's an exciting time to be at TIRR Memorial Hermann.

Carl E. Josehart
*Chief Executive Officer
TIRR Memorial Hermann
System Executive for Rehabilitation
Services
Memorial Hermann Health System*



For the 24th consecutive year, TIRR Memorial Hermann ranks as one of the "Best Rehabilitation Hospitals" in America, according to the *U.S. News & World Report* Best Hospitals rankings for 2013-14.

TIRR Memorial Hermann ranked No. 3 nationally in rehabilitation.

"Our consistent ranking as one of the top rehabilitation hospitals in the country is a testament to the dedicated professionals at TIRR Memorial Hermann, who commit daily to making our patients' lives

better," said Carl Josehart, CEO of TIRR Memorial Hermann.

"While we are honored to be recognized as one of the three best rehabilitation hospitals in the nation by *U.S. News & World Report*, the acknowledgment that means the most to us is that of our patients and their families who place their trust in our hospital and staff."

"Every day, the staff at TIRR Memorial Hermann works tirelessly to provide its patients with the best rehabilitative care possible," said

President and CEO Dan Wolterman. "We are extremely proud of the recognition that they continue to earn. Our patients and their families can expect nothing but the highest level of care and compassion when they choose TIRR Memorial Hermann."

In addition to its top national ranking, TIRR Memorial Hermann also ranks No. 5 among all hospitals in the Houston metro area, and is rated the 8th best hospital in Texas.



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About TIRR Memorial Hermann

TIRR Memorial Hermann is a 119-bed nonprofit rehabilitation hospital, a network of outpatient therapy clinics, a rehabilitation medical home and a network of inpatient rehabilitation units. Founded in 1959, the Texas Medical Center facility has been named one of America's Best Hospitals by *U.S. News & World Report* for 23 consecutive years. Rehabilitation teams at the hospital provide services for individuals with spinal cord injuries, brain injuries, strokes, amputations and neurodegenerative diseases.

TIRR Memorial Hermann is creating a comprehensive, integrated rehabilitation network beyond the Texas Medical Center to outlying communities where people live and work. TIRR Memorial Hermann Adult and Pediatric Outpatient Rehabilitation at Memorial City and TIRR Memorial Hermann Outpatient Rehabilitation at Memorial Hermann Northwest Hospital further extend services that have been offered at TIRR Memorial Hermann Adult and Pediatric Outpatient Rehabilitation since the southwest Houston facility opened in 2001. A third clinic will open at Memorial Hermann The

Woodlands Hospital in October 2013. TIRR Memorial Hermann is one of 12 hospitals in the not-for-profit Memorial Hermann Health System. Memorial Hermann is known for world-class clinical expertise, patient-centered care, leading-edge technology and innovation. The system, with its exceptional medical staff and more than 20,000 employees, serves Southeast Texas and the Greater Houston community.

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