



# Discovery to Recovery

CLINICAL AND RESEARCH HIGHLIGHTS AT HSS: FOCUS ON PEDIATRICS | FALL 2011

## Pediatric Rehabilitation:

# Helping Children Move

Children come to Hospital for Special Surgery with a wide range of chronic and acute bone, joint, and autoimmune diseases, developmental delays, and injuries. Whether children need a series of complicated surgeries or short-term outpatient rehabilitation therapy to get their mobility back on track, pediatric rehabilitation therapists teach them to move with confidence.

Special Surgery's pediatric rehabilitation therapists provide nearly 18,000 sessions of inpatient and outpatient physical, occupational, and speech therapy each year. Often, children are rehabilitating after surgery at HSS, where orthopedic surgeons perform some 2,500



Pediatric physical therapist Magdalena Oledzka, PT, MBA, PCS, works with a child.

surgeries each year for children and adolescents. "We teach children how to move again after surgery, and help them regain strength," says HSS pediatric physical therapist Maureen Suhr, PT, DPT.

Because HSS is uniquely specialized in helping patients with

musculoskeletal challenges move without pain, its therapists care for many children with similar surgeries and conditions, even those that are rare elsewhere. This experience provides them with unsurpassed expertise in a full range of bone, joint, and autoimmune issues.

## CA Technologies Rehabilitation Center

In the fall of 2011, HSS will open its 7,000 square foot, state-of-the-art CA Technologies Rehabilitation Center at the Lerner Children's Pavilion, improving access to pediatric rehabilitation services for surgical patients and children in the community who need outpatient therapy. Therapists, parents, and children consulted with the architects to design a beautiful, child-centered space that will help children make the most of their rehabilitation.

The Center was made possible through a generous \$5 million gift from CA Technologies, an IT management software and solutions company. It includes a physical therapy gym; therapy rooms for children to work on fine motor skills; rooms for speech therapy; quiet areas for children with sensory needs; an occupational therapy gym with a room for sensory integration therapy; an equipment clinic specializing in wheelchair and mobility needs; and the full range of virtual reality toys and software that are used as therapy tools. ●

## Location of Spinal Fusion Key to Young Athletes' Success

The location of a spinal fusion – the most common surgery for adolescent idiopathic scoliosis (AIS) – can make a significant difference in a young person's ability to return to sports, finds a recent study conducted by a team of HSS surgeons.

"Many of the kids who develop AIS, an abnormal curve of the spine, worry about the effect surgery will

have on their athletic activities," says Roger Widmann, MD, chief of Pediatric Orthopedic Surgery at HSS. "To address this concern, we took a retrospective look at 42 patients who had undergone spinal fusion and the factors that might play a role in surgical outcome."

During spinal fusion, surgeons realign the spine and weld together one or more levels of vertebrae.

The HSS team found that the higher the level of the lowest fused vertebrae, the greater the potential for return to high level sports. In fact, with each vertebra lower down the spine the fusion occurred, patients became significantly less likely to return to sports. "This information lets us help patients and their families have realistic expectations," says Dr. Widmann.

To learn more, Dr. Widmann, Peter Fabricant, MD, and others in the HSS scoliosis service are now conducting a prospective study in which patients undergoing spinal surgery for AIS are followed from the time they seek treatment. The study is funded with a grant from the Orthopedic Research & Education Foundation. ●

## Center of Excellence for Young Patients

Hospital for Special Surgery is unlike any other hospital – we are the only independent academic medical center in the world exclusively focused on providing orthopedic and rheumatology care for adults and children. This unique specialization means that all 3,500 members of the HSS family – including doctors, nurses, rehabilitation therapists, imaging professionals, and scientists – are focused on promoting high quality musculoskeletal health through patient care, teaching, and research.

We believe that our specialization gives us an obligation to be the best in the world at what we do, which drives our motivation each day. Data show that we are succeeding. We have the lowest mortality rate of the top-ranked orthopedic programs in the country. In both 2009 and 2010, New York State recognized HSS as the only hospital with a hip surgical site infection rate that was statistically better than the state average. We have been ranked first in the nation for orthopedics and second for rheumatology in the 2011 *U.S. News & World Report* “America’s Best Hospitals” issue.

This issue of *Discovery to Recovery* highlights our pediatric team. Specialists among specialists, each member of this team is truly expert at helping children thrive. HSS was founded as a children’s hospital in 1863. Today, children and their families come to us from around the world to receive care because of our expertise gained from experience – what is rare elsewhere is common here. Our surgeons perform 2,500 orthopedic surgeries each year for children and adolescents. Each year, young patients make more than 22,000 non-surgical visits to our doctors, and nearly 18,000 visits to our pediatric physical, occupational, and speech therapists.

The Hospital is in the midst of a major physical expansion, and pediatrics is at the forefront. This fall, we will open the new 7,000 square foot CA Pediatric Rehabilitation Center at the Lerner Children’s Pavilion, made

possible through a generous gift from CA Technologies. In mid-2012, we will open the new Lerner Children’s Pavilion on the fifth floor, a child- and family-centered hospital within a hospital. Our staff provides children with cutting edge treatments in orthopedics and rheumatology. Now we will be able to do so in a beautiful, modern environment.

Because the culture of HSS is one of innovation, those who care for children at HSS are not satisfied with providing the best pediatric orthopedic and rheumatology care in the world. They strive to advance pediatric musculoskeletal medicine through a myriad of research studies.

In this issue of *Discovery to Recovery*, we profile our pediatric research, including studies that help keep children safe throughout the surgical process. We feature our rehabilitation therapists’ and biomechanical engineers’ use of advanced technology to measure movement in the Motion Analysis Lab, providing surgeons with important data to help families make the best treatment decisions.

You will read about a new imaging technique developed by HSS scientists to locate and measure growth plate injuries; two studies that measure long-term outcomes of spinal fusion surgery for teenagers with scoliosis; new advances in juvenile arthritis that help children avoid surgery; and an HSS pediatric rheumatologist’s cutting edge discoveries in immune cell activation in lupus. While research at HSS covers many topics, all of our scientists work to improve the health and mobility of our patients, both children and adults. This shared goal is another quality that makes HSS unique.

Louis A. Shapiro  
President and CEO

Thomas P. Sculco, MD  
Surgeon-in-Chief

Steven R. Goldring, MD  
Chief Scientific Officer

### News & Notes

## HSS Welcomes Pediatric Hip Expert

Earnest L. Sink, MD, known for his work in treating complex hip conditions in infants through young adults, has joined Hospital for Special Surgery as co-director of its nationally recognized Center for Hip Preservation and a member of the HSS Pediatric Orthopedic Service, creating a unique model transitional program for hip care.



Earnest L. Sink, MD

“Since hip disease starts in childhood and often continues into young adulthood, teens will experience no interruption of care as they mature,” he explains.

Dr. Sink comes from The Children’s Hospital in Denver, where he was director of the Hip Preservation Program and associate professor at the University of Colorado at Denver and the Health Sciences Center.

The HSS Center for Hip Preservation provides individuals suffering from hip pain with proper diagnosis and treatment through

innovative diagnostic imaging techniques, a full complement of non-operative and surgical approaches, and less invasive surgical procedures including arthroscopic surgery.

Dr. Sink’s practice focuses on hip disorders and dysplasia in infants through young adults. He sees referrals from around the country for the most difficult conditions. His practice includes Perthes disease, slipped capital femoral epiphysis (SCFE), and impingement.

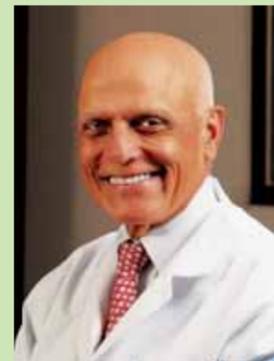
“I’m excited to be working with Dr. Bryan Kelly and the other members of the Center, where we can evaluate patients and recommend treatment tailored for each individual’s hip,” says Dr. Sink. “Since I have a different skill set than Dr. Kelly, we can offer a greater range of treatment than each of us alone.”

Having studied hip surgery techniques under the world-renowned Reinhold Ganz, MD, at the University of Berne in Switzerland, he has performed more than 200 hip surgical procedures annually, including hip osteotomy, Ganz or periacetabular osteotomy (PAO), and surgical hip dislocation.

“As a leader in the pediatric orthopedic community for hip preservation, Dr Sink is a great addition to our comprehensive family-centered pediatric team,” says Roger Widmann, MD, chief of Pediatric Orthopedic Surgery at HSS. ●

## Dr. Chitranjan Ranawat Leads Hip Society

HSS orthopedic surgeon Chitranjan S. Ranawat, MD, professor of Clinical Orthopedic Surgery at Weill Cornell Medical College, was elected president of the Hip Society for the 2010/2011 term, culminating his four years of service on the Society’s Board of Directors. The Hip Society provides a forum to exchange and advance knowledge of hip disorders. Membership is open to orthopedic surgeons and engineers worldwide. Under Dr. Ranawat’s leadership, the Hip Society held its annual summer meeting at HSS in 2010.



Chitranjan S. Ranawat, MD

Dr. Ranawat began his career at HSS in 1966 as a hand surgeon. His two sons, Anil Ranawat, MD, and Amar S. Ranawat, MD, are also orthopedic surgeons at Special Surgery, a unique achievement.

Dr. Ranawat’s practice specializes in hip and knee surgery. A renowned surgeon, he was presented with the Knee Society’s 2011 Lifetime Achievement Award at the 2011 annual meeting of the American Academy of Orthopaedic Surgeons. He is the founding president of the Knee Society.

Dr. Ranawat is committed to research, education, and philanthropy, at HSS and around the world. He has published over 230 articles and began studying patient outcomes in a systematic way through the creation of a patient registry in the late 1980s. He takes pride in his teaching and estimates that he has touched the lives of over 250 fellows and residents through his career.

Above all, Dr. Ranawat believes in giving back. As chairman of the Ranawat Orthopedic Research Foundation, since 1986 Dr. Ranawat and his team have trained nearly fifty Indian orthopedic surgeons through a fellowship program and education course, a majority of whom have returned to India to practice orthopedic surgery. Dr. Ranawat will hold his tenth annual education course in India in January 2012, with about 450 delegates in attendance.

The Ranawat family has given generously to HSS over the years. Dr. Ranawat says, “If you have it – intellectually, surgically, professionally, philanthropically – share it.” ●

## Advances in Imaging Help Heal Growth Plate Injuries

A new technique for obtaining images of growth plate injuries in children can now help guide treatment decisions. Developed by a team of HSS scientists and clinicians, the technique provides computer-generated 3D models obtained from MRI that surgeons can use in the operating suite to achieve optimal results.

In healthy children, new bone tissue develops from the growth plate, or physis, which is located at either end of the long bones. Physeal bars – bony tissue that forms across the growth plate after trauma – can result in either a deformity or a shortened limb. If the bar covers less than 50 percent of the growth plate, surgical removal can restore normal bone growth.

“Understanding exactly where the physeal bar is located with respect to other structures, as well as the extent of the bar, is crucial to a good outcome,” explains Roger Widmann, MD, chief of Pediatric Orthopedic Surgery at HSS. Traditional imaging techniques, usually CT scans, do not



New 3D models of growth plate injuries obtained from MRI offer greater precision and speed with less radiation than CT imaging.

provide exact information about the boundaries and size of the physeal bar. To ensure that all abnormal tissue is removed, surgeons have had to remove a small margin of normal growth plate.

The new mapping technique clearly

shows the bony bar’s outline and its location on the growth plate with a high degree of accuracy that was recently confirmed in a clinical research study conducted by Dr. Widmann, Hollis G. Potter, MD, chief of Magnetic Resonance Imaging, and five other HSS colleagues. “MR imaging allows the physeal bar to be seen from multiple planes, something we can’t get from CT imaging,” explains co-author Matthew F. Koff, PhD, assistant scientist in the Research Division at HSS. Because MRI does not use ionizing radiation, it is safe for young children. Another advantage is speed. Once the MRI is complete, surgeons can access the model within fifteen minutes. ●

## Doing Well a Decade After Spinal Fusion Surgery

A recent HSS study published in *Spine* found that teenagers who have spinal fusion surgery for adolescent idiopathic scoliosis have good clinical outcomes ten years after surgery, reassuring teenagers who may require this surgery.

“The standard belief was that the area of the spine just below the surgery would wear out because of the increased stress that the fusion would put on that part of the spine,” says Daniel Green, MD, an HSS pediatric orthopedic surgeon who led the study with many HSS collaborators. “We found that the area of the spine adjacent to the fusion was pretty healthy and didn’t show any major degeneration on MRI ten years after surgery.”

Scoliosis is a condition in which the spine is curved. For years, doctors treated scoliosis by implanting rods along the spinal column. In the late 1990s, surgeons began using a new generation of spine implants to weld parts of the spine together as a way to restore alignment. This surgery corrects the spine in a much more natural, physiologic way, but doctors continue to be

concerned about long-term outcomes of spine fusion surgery.

Investigators reviewed all spinal fusions performed by four scoliosis surgeons at HSS during a six-year span. They identified 20 people who agreed to return for follow-up tests and MRIs. A comparison of pre- and post-operative MRIs revealed that the surgery did not cause degeneration at the adjacent disc ten years later. Patients led active, pain-free lives.

“There is a lot of research being conducted and investment being made looking for new technologies that do not use fusion,” Dr. Green says. “This study suggests, however, that at least at ten year follow-up, thoracic fusion patients are doing very well.” ●



Clayton Robertson says that his tennis game has improved following spinal fusion surgery for scoliosis at HSS.

## New Treatments in Juvenile Arthritis Let Kids be Kids

Juvenile arthritis (JA) is an umbrella term to describe the 15 to 20 conditions that cause arthritis in childhood. While symptoms vary by condition and child, children with JA often experience a range of symptoms including joint swelling, stiffness, and pain. At HSS, our pediatric rheumatologists are expert at diagnosing and treating children with juvenile arthritis who may have been misdiagnosed at other, less specialized hospitals. Fortunately, advances in science have dramatically improved the outcomes they can achieve.

Over the past decade, treatment of children with JA has changed dramatically. Thanks to a new class of drugs called biologics, along with established therapies and a more aggressive approach to early diagnosis and intervention, today children with arthritis function well.

For many years, pediatric rheumatologists relied on nonsteroidal anti-inflammatory drugs, analgesics, steroids, and Disease-Modifying Anti-Rheumatic drugs (DMARDs) to reduce inflammation and control painful symptoms. Biologic drugs



HSS pediatric rheumatologist Thomas Lehman, MD, has seen care for children with juvenile arthritis advance dramatically in the past ten years, thanks in part to a new class of drugs called biologics.

act differently from other DMARDs, by blocking damaging messages from the body’s immune system.

“These medications allow us to treat kids who in the past might have progressed to severe joint damage and a lifetime of disability.

Now we can prevent that from happening,” says Thomas Lehman, MD, chief of the Division of Pediatric Rheumatology at HSS. Since arriving at Special Surgery in the late 1980s when the Hospital performed as many as eight or nine total hip replacements annually in children with juvenile arthritis, Dr. Lehman says now it’s unusual to perform one per year. Moreover, when properly monitored, biologic drugs can help patients avoid the liver toxicity, growth problems, and cosmetic issues that can occur with other therapy.

### Looking to the Future

Now clinical researchers are exploring the next generation of advances in JA, including identifying which children benefit most from aggressive treatment in the early stages of the disease. Making this distinction

is important since only a small percentage of children with JA have self-limiting disease that requires a different course of treatment. Early work with genetic markers is yielding promising results.

In a recent study, clinical investigators found a gene that helped predict which patients would experience a flare-up of arthritis symptoms when they stopped taking a commonly prescribed DMARD, and which ones would remain well. More data is needed before these findings have practical applications, but large-scale studies are ongoing, and Dr. Lehman expects this tool will be available within five years.

As members of the Childhood Arthritis and Rheumatology Research Alliance (CARRA), Dr. Lehman and colleagues at Special Surgery contribute specimens to these studies from patients who have given their consent to help in this research. “We’re also working with pediatricians in the community to help identify children with JA as early as possible,” Dr. Lehman says. “Early recognition and prompt, aggressive treatment are key.” ●

# THE P

## HAPPENINGS AROUND THE HOSPITAL



### Nutrition Outreach for Children **^** and Families

Thanks to the HSS nutrition outreach program, S.N.E.A.K.E.R.©, children and families in New York City are learning about making healthy food choices, consuming enough calcium, and the value of physical activity. S.N.E.A.K.E.R. (Super Nutrition Education for All Kids to Eat Right) was developed by the HSS Public and Patient Education Department in 2003 in response to the many children screened under the HSS Pediatric Outreach Program (POP) who needed nutrition education. S.N.E.A.K.E.R. uses interactive workshops, bilingual cookbooks, and an interactive website to reach over 11,000 children at 24 NYC schools and community organizations. “With obesity increasing in children nationwide, we are reaching some of our most at-risk populations with these important health messages,” says Laura Robbins, senior vice president, Education & Academic Affairs.

### HSS Through a Child’s Eyes **v**

Research tells us that children and adults with realistic expectations of surgery will obtain better outcomes. To help prepare our pediatric patients and their families for their time at Special Surgery, the Division of Pediatrics has created the “Video Guide to Pediatric Orthopedic Surgery,” which can be viewed at [www.hss.edu/pedsortho](http://www.hss.edu/pedsortho). The engaging video, made possible by generous support from the The Reiss Family Foundation/ Bonnie and Richard Reiss, follows a child through the full surgical process, from pre-surgical screening through recovery. “Such preparation will help minimize stress for parents and children by teaching them what to expect, which will lead to the best possible hospital experience and surgical outcomes,” says HSS chief of Pediatric Medicine Lisa Ipp, MD.



### < Going Where the Children Are

The Pediatric Outreach Program (POP) was initiated almost 25 years ago as an effort to diagnose musculo-skeletal problems in young children in underserved medical communities in New York City, in order to prevent or limit future disabilities. Examinations are performed in the school with a team of physicians, residents, nurses, and bilingual staff. Over 25,000 children have been examined, and 16 percent have been referred for further evaluation and treatment. “Too often, parents are unable to bring their children to HSS for their orthopedic evaluations and care. POP goes to where the children are – in schools,” says Dr. Leon Root, MD, chief of Pediatric Orthopaedics emeritus, who has led the program since 1987 with assistance from the Education & Academic Affairs Division.

# PULSE

## Safe Imaging Done Right the First Time >

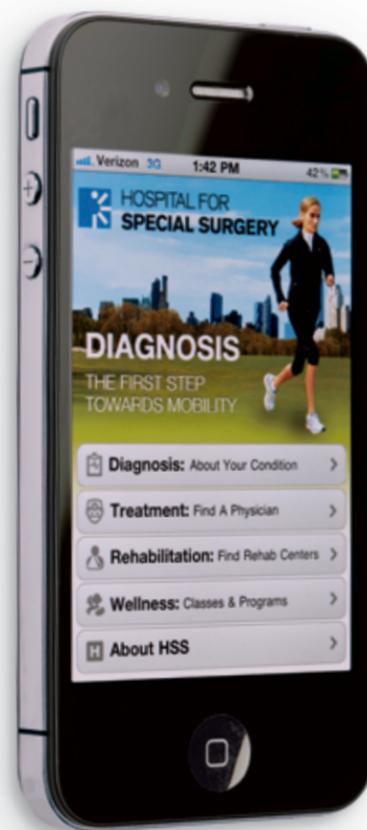
“X-rays and CT scans help provide diagnoses that help save lives and initiate early and appropriate intervention, but patient safety is the utmost importance,” says Helene Pavlov, MD, FACR, HSS radiologist-in-chief. The HSS Department of Radiology and Imaging limits radiation exposure of all patients, especially children, through the use of non-radiation imaging techniques, such as MRI and sonogram (ultrasound), whenever possible. When x-rays are necessary, says Dr. Pavlov: “We do it

right the first time.” In fact, the HSS x-ray repeat rate of only 3.5 percent is well below the national and regional area averages of 8 percent (national) and 6.2 percent (regional). To further protect our patients, HSS radiologic technologists always use proper shielding and narrowing of the radiation beam (collimation) to limit the exposed area.



## < Up and Running

When a routine sonogram at 22 weeks showed that one of the twin babies Melissa Goldman was carrying had clubfoot, the family sought the help of David M. Scher, MD, a pediatric orthopedic surgeon at HSS. Newborn Ethan was placed in a series of casts for several weeks, underwent a tiny Achilles tendon incision, and then wore a brace to maintain the correction.



## < HSS in the Palm of Your Hands

Special Surgery has added an iPhone app to its already well-established presence in the interactive digital world. An active participant in Twitter, Facebook, and YouTube, HSS has a network of people from around the world who access information on HSS news, events, research, and health information through social media. The iPhone app will expand and enrich this network, helping users find physicians and read their profiles, make appointments, search conditions, find a rehabilitation center, consult class schedules, and contact the hospital right from their iPhones or iPads. Patients, family members, or visitors are also able to get directions to a physician's office, as well as navigate the hospital campus.

When he was ready, Ethan was eager to move, and at 16 months he walked for the first time, taking more than 30 steps. Today, at the age of two, he runs and climbs right alongside his twin brother Harrison. “Everyone at HSS – from Dr. Scher to all the support staff – helped turn a nightmare into a dream-come-true,” says Ms. Goldman.

# Safer Anesthesia for Kids

Each year, some 2,500 children and adolescents come to Hospital for Special Surgery for its unparalleled expertise in pediatric orthopedic surgery. One of the key members of the medical team is the pediatric anesthesiologist, who monitors the child's medical needs throughout the surgical process, ensuring that

Kathryn DelPizzo, MD, assistant attending pediatric anesthesiologist. "You need to relate to both the child and the parents in a stressful situation."

### The Benefits of Regional Anesthesia for Children

"Something that's been special at HSS for a very long time – for



HSS pediatric anesthesiologist Kathryn DelPizzo, MD, helps a child prepare for surgery.

the child remains safe and comfortable both during surgery and afterwards, during recovery.

"As a pediatric anesthesiologist, you are not only anesthetizing the child, you are caring for the parents as well. Often, parents are more nervous than the child," says

at least 20 years – is that most patients who come here for surgery, including children, have regional anesthesia," says Victor Zayas, MD, director of Pediatric Anesthesiology.

Regional anesthesiology is an umbrella term for techniques that block sensation at the site of surgery without having to put the

entire body to sleep. And, because orthopedic surgery is typically focused on a specific limb – excepting spine cases – regional anesthesia is often the ideal option at HSS.

"With regional anesthesia, patients require less overall anesthesia, they wake up faster after surgery, there's less nausea, and they usually don't need as much narcotic medicine for pain after surgery," says Dr. Zayas.

Spinal anesthesia, also called neuraxial, is the most common form of regional anesthesia, involving numbing the lower extremities. Neuraxial anesthesia may be used for a child undergoing surgery on the hip or leg. A local anesthetic is injected near the spinal cord and nerves that connect to the spinal cord to block pain from an entire region of the body. During the procedure, an epidural catheter is inserted which can be used for pain management after surgery.

Another technique, sometimes used in combination with spinal anesthesia, is a peripheral nerve block. In this case, the specific limb or extremity being operated on is numbed. This ultrasound-guided technique is typical for upper extremity surgery in the hand, elbow, and shoulder, and is sometimes used in foot and knee surgeries. Medication supplied through a catheter provides pain relief during the child's hospital stay without the need for narcotics.

### New Research Advances

Special Surgery's pediatric anesthesiologists conduct research to identify the safest and most effective methods of providing anesthesia and pain relief for children.

Dr. DelPizzo is the principal investigator on a study of neuraxial anesthesia in children ages five to 14 who had surgeries at HSS to evaluate outcomes following neuraxial anesthesia in pediatric patients, specifically the rate of complications such as headaches and transient neurologic symptoms. To date, of the 175 patients surveyed following surgery as part of the study, none have reported any complications or side effects.

Another study, completed in December 2008, looked at the safety and efficacy of using the painkiller acetaminophen intravenously in pediatric patients. Not only does intravenous (IV) acetaminophen act faster than when taken orally or rectally, it also has less variable rates of absorption (which can affect plasma levels and expose small infants to potential toxicity). HSS pediatric anesthesiologists tested the administration of IV acetaminophen in teenagers undergoing spine surgery for idiopathic scoliosis.

This multi-phase, multi-center investigation has led to approval of IV acetaminophen by the U.S. FDA, and HSS will shortly begin using it for those children who cannot take medicines orally. ●

## In the News

### Discovery Attracts New Funding for Pediatric Rheumatologist

Theresa Lu, MD, PhD, associate scientist in the Autoimmunity and Inflammation Program at HSS, has received second grants from both the National Institutes of Health (NIH) and the Lupus Research Institute (LRI) to support her laboratory research to advance the care of people with autoimmune conditions, including lupus, juvenile arthritis, and rheumatoid arthritis. Dr. Lu is one of only about 200 pediatric rheumatologists in the United States and one of only a handful who conduct basic research.

Dr. Lu is working to reduce immune cell activation and abnormal antibody generation in people with autoimmune disease by manipulating the blood vessels that feed the lymph node in these patients. In people with healthy immune systems, the immune cells in lymph nodes generate protective antibodies in response to infection. In people with autoimmune disease, immune cells become activated in response to their own body, generating abnormal antibodies directed at the body's own tissues and causing damage to internal organs.

Dr. Lu received her first LRI grant in 2005 and her first NIH grant in 2006. These awards, and additional support from The William T.

Morris Foundation, funded her exploration of mechanisms that jump-start and fuel normal and faulty autoimmune responses. She ultimately found that lymph node cells called dendritic cells, which were already known to stimulate immune cells, also cause the blood vessels to grow during immune responses. This was a new way of thinking of dendritic cells – as cells that control the lymph node environment.

Dr. Lu's new NIH grant supports research to investigate what happens in the stage following immune cell activation, when the blood vessels stop growing and become more stabilized. Dr. Lu and colleagues are examining how this period of blood vessel stabilization supports antibody generation, testing the hypothesis that interfering with blood vessel stabilization will reduce abnormal antibody generation in autoimmune diseases like lupus.

"We're hoping we can interrupt the process of inappropriate autoimmune response by manipulating the environment the autoimmune cells are sitting in. This would be a new approach to treating lupus, rheumatoid arthritis, and other autoimmune diseases, and could



Theresa Lu, MD, PhD

complement existing approaches that target the immune cells directly but often not effectively. We want to make a difference for our patients," says Dr. Lu. "HSS is very special in fostering great science that will lead to better understanding of – and treatments for – musculoskeletal and autoimmune diseases." ●

# Motion Analysis Lab: The Science of Movement

In the Leon Root, MD, Motion Analysis Lab, physical therapists and biomechanical engineers use high-tech computerized systems to measure patients' movements. "The Motion Analysis Lab brings together physical therapists, engineers, and surgeons to investigate the origin and progression of musculoskeletal disease and to evaluate conservative and surgical treatment options for patients," says Howard Hillstrom, PhD, the Lab's director.

All studies conducted in the Motion Analysis Lab are designed to help our patients move more efficiently and comfortably. Research ideas come directly from work with patients, and studies are designed with the goal of improving patient outcomes. "We try to improve patient care through research," says Lisa Drefus, PT, DPT, a pediatric physical therapist who conducts research in the Lab. "Research in the Lab answers practical clinical questions – what works best for a child."

## Watching Kids Move

David Scher, MD, a pediatric orthopedic surgeon and co-medical director of the Motion Analysis Lab, treats many children with cerebral palsy (CP), an umbrella term for a group of non-progressive conditions of the brain that affect movement, posture, and gait. Says Dr. Scher: "I could not accomplish what I do for my patients with CP without the resources of the Motion Analysis Lab."

Children with CP often have interrelated symptoms in many regions of their bodies. Their inefficient gait patterns may be improved through various combinations of surgery and physical therapy. To confirm diagnosis and guide treatment selection, their pre-surgical diagnostic process routinely includes a three hour clinical movement analysis, or "gait analysis," in the Lab.

Following a detailed physical exam to assess range of motion and muscle strength, therapists attach small reflective markers and apply wires to each relevant muscle (using dynamic electromyography or EMG) to quantify how the child moves in three dimensional (3D) space. The child walks back and forth across the Lab while being videotaped from both the side and front with high definition video cameras and a 3D twelve-camera motion capture system, providing therapists and physicians with data

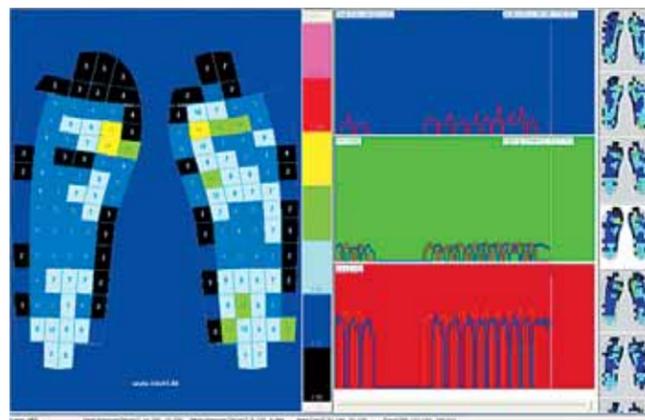
on how the child moves from the side, front, and top-down perspectives.

The gait analysis reveals the child's cadence (rate of steps), velocity (speed), length of step, and swing time (how long the leg is in the air during each step). EMG signals measure when each muscle turns on and off during each phase of walking.

To determine the forces driving their movement, children's kinetics are measured as they walk over specialized scales embedded within the floor, known as "force plates." There is also a matrix of small force sensors called a "plantar pressure measuring device" that can quantify pressures on the sole of a foot as the child walks. Dr. Scher relates this tool to "computerized foot-prints in the sand."

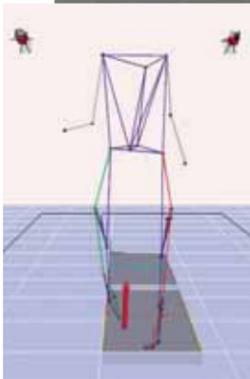
## Research to Improve Mobility

Gait analysis provides valuable data for HSS physicians, engineers, and physical therapists who conduct collaborative gait research in the Lab. This research includes children and adults with CP, arthritis, and many other diseases



As part of a gait analysis in the Motion Analysis Lab, computers generate color-coded maps to illustrate plantar pressure on the sole of a child's foot (left), and graphs that show the forces and powers generated in each joint as the child walks (right).

and injuries that affect movement. Typically, research stems from surgeons' and therapists' clinical observations, and asks some form of this question: Does a surgery or treatment result in a measurable improvement in the patient's ability to move efficiently?



The studies described below analyze movement in children with cerebral palsy, Blount's disease, and typically developing toddlers. In every case, the goal is to help our pediatric patients move with increased ease.

## In CP: The Ankle-Knee Connection

Therapists are collaborating with physicians on several studies in the Lab to determine which surgical treatments have good outcomes for children with cerebral palsy. When surgery is performed on ambulatory children with CP, the goal is to optimize their gait by helping them walk more efficiently and comfortably.

In one study, Lisa Drefus is working closely with Dr. Scher and others to determine whether

children with hemiplegia (CP on one side of the body) need surgery on both the ankle and the knee, or whether their knee problem could resolve once the ankle and foot are correctly aligned through ankle surgery alone.

Often, children with hemiplegia

receive two surgeries, but clinicians question if altered knee patterns are the result of a compensation pattern from the foot position. If this were the case, knee motion would improve without surgery once the foot position was fixed.

Left: A gait analysis in the Motion Analysis Lab provides precise measurements of a child's movement, which will help physicians formulate treatment options and evaluate outcomes.

Below left: A 3D twelve-camera motion capture system obtains details of a child's gait patterns as she walks.

Early data show that parameters may exist that will help surgeons identify which patients' knee patterns are compensatory vs. a true impairment.

## After Blount's Surgery

Children with Blount's disease typically have abnormal alignment at their knee joint, which results in a bow-legged gait that can be corrected through surgery. After surgery, the children look normal, but it is unknown if surgery has positive functional effects in addition to aesthetic effects.

To discover if Blount's surgery improves the way children walk, a multidisciplinary team of HSS investigators, led by Roger Widmann, MD, chief of Pediatric Orthopedic Surgery, was formed that includes physicians, engineers, physical therapists, and an exercise physiologist. The team will conduct a series of pre- and post-surgical gait tests, a patient self-assessment questionnaire, and an energy efficiency exam that measures oxygen consumption (VO2 Max testing). Working together, investigators hope to discover if Blount's surgery improves functional ability.

## Answering Age-Old Questions

Should typically developing toddlers wear stiff or flexible shoes when learning to walk? Parents and pediatricians have long debated this question, but there were no data on the subject until Dr. Hillstrom, Dr. Scher, and HSS pediatric physical therapists Melanie Buckland, PT, DPT, ATP, and Corinne Slevin, PT, DPT, MS, conducted a Stride Rite-sponsored comparative gait analysis on toddlers in the early stages of walking. Children participated in gait tests that measured stability, walking, and foot pressures while barefoot and in four different shoes that varied in flexibility. Researchers found that early walkers may walk faster, fall less, and exhibit plantar loading similar to being barefoot while wearing a flexible shoe.

Should toddlers with flexible flat feet wear in-shoe orthotics? The Lab is seeking funding to research this widely debated question and to learn if orthotics help children with flexible flat feet move with less pain or discomfort as they grow into adults. ●

## Recognition from Around the World

### Kudos

**Donald Bartel, PhD**, was the 2011 recipient of the Orthopaedic Research Society (ORS)/American Orthopaedic Association's Alfred R. Shands, Jr. Award for lifelong achievement and contributions to orthopedics research.

**Richard Bockman, MD, PhD**, served on the steering committee and chaired a session on "Facilitating Productive Collaborations" for the Federation of American Societies for Experimental Biology (FASEB)-sponsored research symposium on "Engaging Basic Scientists in Translational Research," held at the Howard Hughes Medical Institute.

**Adele Boskey, PhD**, Starr Chair in Mineralized Tissue Research, was invited to serve on the Editorial Board of *Calcified Tissue International*.

**Mathias Bostrom, MD**, has been named to the presidential line for the Orthopaedic Research Society and will assume the presidency in 2015. Dr. Bostrom will be the fifth president named from HSS and will join the company of past presidents **Timothy Wright, PhD**, F.M. Kirby Chair in Orthopaedic Biomechanics, **Joseph Lane, MD**, and **Adele Boskey, PhD**. **Mary Goldring, PhD**, Ira W. DeCamp Fellow in Musculoskeletal Genetics, will serve as president in 2014.

**Mary Crow, MD**, Joseph P. Routh Professor of Rheumatic Disease, served on study sections for NIH/National Institute of Arthritis and Musculoskeletal and Skin Disease (NIAMS) Training Grants, NIAMS Centers of Research Translation, and the Scleroderma Foundation.

**Eve Donnelly, PhD**, received the Young Investigator Award at the 10th International Conference on the Chemistry and Biology of Mineralized Tissues, held in Carefree, Arizona.

**Christopher Dy, MD**, received a new one-year Planning Award via the Weill-Cornell Medical College NIH Clinical and Translational Science Center to establish a multicenter collaborative hip fracture registry.

**Doruk Erkan, MD**, and **Michael Lockshin, MD**, co-chaired the Antiphospholipid Syndrome Clinical Research Task Force International Summit in Miami. Dr. Erkan also presented the Department of Medicine Grand Rounds at Coney Island Hospital on "Antiphospholipid Syndrome: What Should Medicine Interns and Residents Know?"

At the Segal North American Osteoarthritis Workshop (SNOW) held in Chicago to address "Meeting the Challenges for Developing Disease and Symptom Modifying Treatments for Osteoarthritis," **Mary Goldring, PhD**, chaired a session on "Identifying the Therapeutic Targets for OA"; **Steven Goldring, MD**, discussed "Identifying Targets for Intervention in Bone"; and **Hollis Potter, MD**, discussed "Imaging Tools to Assess Joint Structures."

**Steven Goldring, MD**, was an invited lecturer at the Van Andel Research Institute in Grand Rapids, Michigan.

**Howard Hillstrom, PhD**, participated as faculty in the Canada and United States Bone and Joint Decade Young Investigators Initiative in Toronto, Canada.

**Xiaoyu Hu, MD, PhD**, received a one-year Novel Award from the Weill Cornell Medical College Clinical and Translational Science Center to research "Suppression of Cytokine Expression and Inflammation by Gamma Secretase Inhibitors."

**Carl Imhauser, PhD**, received a new one-year award from Stryker to research "Load-sharing in Replaced and Remaining Compartments of Uni-Knee Arthroplasty."

**Josephine Isgro, MD**, received a Career Development and Basic Science Fellowship from the S.L.E. Lupus Foundation to explore with her mentor, **Alessandra Pernis, MD**, a target for a new lupus therapy using statins, medications typically used to lower cholesterol.

**Thomas Lehman, MD**, received a two-year research grant from the National Institutes of Health (NIH)/National Institute of Arthritis and Musculoskeletal and Skin Diseases, in collaboration with Duke University, to study "Childhood Arthritis and Research Alliance Network: Accelerating Toward an Evidence Based Culture in Pediatric Rheumatology."

**Robert Marx, MD**, was appointed to the Board of Directors of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS).

The Orthopaedic Research and Education Foundation awarded Resident Clinician Scientist Training Grants to two HSS orthopedic surgery residents: **Dennis Meredith, MD**, received a one-year grant to study "Micro-CT Analysis of Bone Mineral Compositions and Microarchitecture in a Bisphosphonate-Treated Patient Cohort with Fragility Fractures." **Denis Nam, MD**, received a one-year award to study "Fluid Pressure Induced Osteolysis-Osteoclast Activation and Bone Resorption in Total Joint Arthroplasty."

**Rock Positano, DPM, MSc, MPH**, was appointed Deputy Chairman of the New York College of Podiatric Medicine Board.

**Hollis Potter, MD**, was inducted as a senior fellow into the International Society for Magnetic Resonance in Medicine (ISMRM), and served as a member of the Biomedical Imaging Technology (BMIT) Study group for NIH.

**Cathleen Raggio, MD**, received a new one-year award from Amgen to study the "Effect of RANK1 Inhibition and ALN Treatment of OIM/OIM Mice" and was named to the Osteogenesis Imperfecta Foundation's Medical Advisory Council.

**Scott Rodeo, MD**, was named associate editor of the *Journal of Orthopaedic Research*.

**Jane Salmon, MD**, Collette Kean Research Chair, was an invited speaker at the Division of Women's Health at King's College, London, and the Women's Health Clinical Academic Group Leadership, King's Health Partners.

**Peter Torzilli, PhD**, served as a member of the National Institute of Biomedical Imaging and Bioengineering Study Section on Special Emphasis Training and Career Award Grants.

**Clifford Voigt, MD**, received a new one-year Basic Science Grant from the Gladden Orthopedic Society to study "A Novel Bone-Tendon Model to Evaluate the Axial Strain on Ligament Healing at the Bone Tunnel Interface."

**Scott Wolfe, MD**, presented Grand Rounds at SUNY Downstate on "Adult Traumatic Brachial Plexus Palsy: Evidence, Experience and Expectations," and at Roosevelt Hospital on "Distal Radius Fractures: What Can't Be Fixed with a Volar Plate." ●

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## Pediatric Research: Improving Kids' Health

**N**on-surgical pediatricians work closely with surgeons to monitor the pre- and post-surgical health of all children and adolescents who have surgery at HSS. "Our role is to get the child as healthy as possible, both prior to surgery and during the recovery process, to maximize the surgery's success," says Lisa Ipp, MD, chief of Pediatric Medicine.

Because pediatricians monitor the holistic health of each child, including nutrition, pain, and infection prevention, their work is highly collaborative. Their research reflects their diverse clinical experiences and their constant goal of keeping children healthy and safe.

HSS pediatricians conduct research to determine if current practices are useful in improving

patient outcomes or reducing risk. "We test current practices to improve patient care going forward," says Dr. Ipp, who has studied the efficacy of two commonly used pre-surgical screening tests for teenagers with scoliosis. In one study, Dr. Ipp and colleagues found a high rate of aortic root and valve abnormalities not normally found in children without scoliosis, pointing to the need to continue screening for these conditions.

In another study, pediatrician Stephanie Perlman, MD, collaborated with Steven Magid, MD, chair of the Quality Research Center at HSS, and others to evaluate pediatric medical alerts in the Hospital's electronic prescription system. Alerts are automated warnings that inform prescribers of possible contraindications or side effects.

Because alerts are not always relevant to individual patients, prescribers make judgment calls on whether to override or follow each alert.

The study found that clinicians with specialized pediatric training and those without (i.e., orthopedic physicians who also treat children) approach alerts in different ways. Pediatricians more often overrode the alerts, perhaps due to their specialized training. Based on the study's findings, some unnecessary alerts were removed from the system. "We want to make the system helpful and efficient for prescribers, with the goal of patient safety," says Dr. Perlman.

"In all of our research studies, there are both medical and surgical collaborators," says Dr. Ipp.

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"This reflects how we take care of children and adolescents at HSS – we're a great team." ●



## Our Physicians Our Therapists

# SHARED SUCCESS

### **John Blanco, MD** **Lisa Drefus, PT, DPT**

Same-day anterior (front) and posterior (back) surgery is historically the approach for correcting severe, rigid scoliosis curves beyond 90 degrees, but it was too risky for Xiu Qin Chen (see other side), who was medically fragile.

Her HSS physician, John Blanco, MD, an associate attending orthopedist specializing in pediatric spine surgery, decided to perform the complex procedure in two stages – anterior surgery, then posterior surgery, with about 10 recovery days in between. “She had a severe and stiff scoliosis of a magnitude that we do not commonly see,” recalls Dr. Blanco.

For a year, Xiu Qin’s surgery preparation was facilitated by a multispecialty team at HSS, including rheumatologists, social workers, nutritionists, and physical therapists, including Lisa Drefus (above).

Surgeons initially released Xiu Qin’s ligaments and discs on the front of her spine to increase the flexibility of her scoliosis. The next week, surgeons attached two metal rods to her spine, using hooks and screws to correct the curvature, and bone graft material to ensure spinal fusion.

One day post-op, Xiu Qin stood three inches taller, her life renewed. “By sharing expertise across the Hospital,” says Dr. Blanco, “we can achieve the best possible outcomes for our patients.”



## Our Patients

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# WALKING STRONG

### **Xiu Qin Chen**

Diagnosed in China with scoliosis at age 14, Xiu Qin Chen suffered from impaired mobility and constant pain. Compromised medical resources in her region precluded appropriate care.

“We knew Xiu Qin should have surgery, but it was too risky,” explains her mother. “I wished for my daughter to have a healthy and happy life.” A parent’s hope for her child became possible when they immigrated to New York and learned of the expertise at HSS.

Extremely underweight and frail, 15-year-old Xiu Qin received a comprehensive evaluation by a multidisciplinary team at HSS, including pediatric

orthopedic surgeon John Blanco, MD, and pediatric physical therapist Lisa Drefus, PT, DPT (see other side). She underwent two complex surgeries a year later, following an intense regimen of nutritional support, physical therapy, and rheumatologic care. Immediately after her second surgery, Xiu Qin stood and took independent steps – her progress was remarkable.

Now 18, Xiu Qin is a successful high school student with stamina for NYC pastimes – like strolling through the park after school. “I owe my second life to Dr. Blanco,” says Xiu Qin, “and to everyone who helped me at HSS.”