

NEW YORK-PRESBYTERIAN Columbia Orthopaedics

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Fall 2006

Microsurgery Extends Across Specialties

Evolving over the course of a quarter-century, the Columbia University Microsurgery Research and Training Laboratory at NewYork-Presbyterian Hospital is a state-of-the-art teaching facility for fellows and postgraduate surgeons from around the world.

Opportunities to employ microsurgical tissue transfer techniques have greatly expanded since their inception about 40 years ago, gaining widespread use in plastic, reconstructive, and trauma surgery. Advances have been propelled by radical and sometimes high-profile reconstructive procedures to restore lost extremities, for example, or to separate Siamese twins.

"Microsurgery is not covered in general surgical training or in subspecialty training," said Melvin Rosenwasser, MD. "It requires a different set of techniques that have to be mastered so that there will be a high degree of success in saving, for example, amputated body parts, or in doing transplantations."

Because microsurgical skills transfer readily across specialties, the laboratory at NewYork-Presbyterian/Columbia reflects a cross-disciplinary mission to teach basic techniques and, more recently, a research orientation. After the laboratory was founded in 1980 by pediatric orthopaedic surgeon Harold M. Dick, MD, courses were initially offered only to orthopaedic residents. But outreach to other fields, a goal of the program

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Researchers Awarded Grants for Treatment Of Musculoskeletal Diseases

Each year, the Orthopaedic Research and Education Foundation (OREF) awards grants to important initiatives in the study and treatment of orthopaedic diseases. This year, Columbia University College of Physicians and Surgeons received more grants than any other institution. This was an impressive feat. The research grants are based on the merits of the proposal and there is strong competition among universities nationwide. The grants included 1 of 3 career development awards, 1 of 7 research grants, and 1 of 8 resident research grants.

Earning 3 of a possible 20 major OREF research grants in 5 categories—15% of the total—is a tribute to the strength of the institution, particularly as the proposals represent unique and diverse areas of investigation. The grants awarded support research seeking to increase understanding of the molecular mechanisms of osteolysis after total joint replacement, creating alternatives to current anti-inflammatory drugs in shoulder

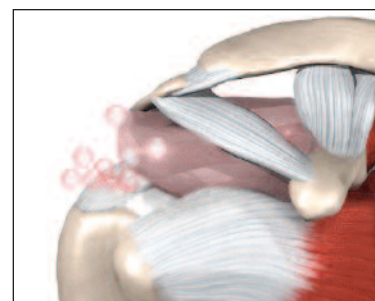


Figure courtesy of Theodore A. Blaine, MD.

Rotator cuff tendinitis/bursitis.

The pink spheres show molecules of inflammation being made by the bursa in response to the rotator cuff tear. Columbia researchers at NewYork-Presbyterian Hospital are studying specific molecular events that drive inflammation and pain in the shoulder joint.

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Researchers Lead Multicenter Study of Basal Joint Arthritis Of the Thumb

Basal joint arthritis of the thumb is a complex disease, the most common form of symptomatic hand osteoarthritis to require surgical intervention. The Orthopaedic Hand and Trauma Service at NewYork-Presbyterian Hospital/Columbia University Medical Center is conducting a prospective study that will elucidate risk factors and improve the timing and selection of treatment modalities for this debilitating disorder.

The multicenter study, sponsored and funded by the American Society for Surgery of the Hand, was proposed and designed by Melvin Rosenwasser, MD, and Robert Strauch, MD. It will create a data registry that can be mined to address a host of issues that have accumulated around one of the most frequent and painful forms of osteoarthritis.

the science,” said Dr. Rosenwasser. Treatment choice frequently depends on anecdote, custom, and physician preference. A rigorous prospective multicenter study will generate the numbers of cases required to determine best practice for any particular patient.

“We’re going to be looking at the different ways it’s treated across the country, and see if we can come up with some recommendations as to what the best treatment might be,” said Dr. Strauch.

CMC arthritis is a common complaint at a strategic location that not only inflicts considerable pain but also affects mobility, movement, and function. One study estimated that symptoms afflict about 2.4% of adults 25 to 75 years old. The disease affects 4 to 5 times as many women as men, and another study estimated that 42% of women and 25% of men aged 47 to 76

involves rest, immobilization, non-steroidal anti-inflammatory drugs, and physiotherapy. Some studies have shown that these measures often obviate the need for surgery. If they fail, other nonsurgical treatment possibilities include splints and intra-articular cortisone injections, which may be used together. Recently, sodium hyaluronate injections, which have a favorable safety profile in terms of adverse effects, have been used in place of cortisone. Recent research by Drs. Strauch and Rosenwasser has tended to validate its long-term effectiveness.

Numerous surgical interventions for advanced CMC arthritis have been developed over the course of decades, each able to claim certain advantages toward eliminating pain and preserving movement and pinch strength. Trapeziectomy, or removal of the afflicted carpal bone, is the primary procedure, and individual pathology may call for further measures to stabilize or reconstruct. Modifications of trapeziectomy include the “anchovy” procedure, in which a tendon is harvested to be put in place of the lost bone. Dr. Strauch’s innovative operation, tendon interposition arthroscopy with suture anchor, represents another such variation. Though sometimes called for, trapezometacarpal fusion can eliminate pain but restricts motion. Implant arthroscopy has lost favor, owing to postoperative complications. Other procedures have also been developed.

Although the pathogenesis of CMC arthritis and its treatments have long been studied, little research that meets contemporary evidence-based standards is available, while some studies yield conflicting messages. It remains unknown, for example, which cases call for trapeziectomy alone instead of more sophisticated ligament reconstruction.

“We’ve done basic research on basal joint arthritis for many years and written many papers with regard to the anatomy and biomechanics,” said Dr. Rosenwasser. “We’ve done a lot of that background work, sort of in preparation for this larger clinical, prospective look at what happens with patients and the varying options, to see which,

“[CMC arthritis] affects millions of Americans, and becomes a very painful and disabling condition for people who are very vigorous and active in every other way.”

—Melvin Rosenwasser, MD

Basal joint arthritis of the thumb, also known as carpometacarpal (CMC) arthritis, has spawned numerous treatments and surgical interventions, but the associated research has been mainly small-scale case reports. “The treatment protocols over the years have not stood the test of time, in terms of the rigor of

will show signs of basal joint arthritis on X-ray. “It affects millions of Americans,” said Dr. Rosenwasser, “and becomes a very painful and disabling condition for people who are very vigorous and active in every other way.”

Although there is no cure for CMC, the first line of treatment usually

A rigorous prospective multicenter study will generate the numbers of cases required to determine best practice for any particular patient.

if any, show clear superiority.”

The most notable feature of the study is its comprehensive and systematic collection and analysis of data to be gathered from patients with CMC who are diagnosed and treated at participating centers in North America. The prospective investigation will not specify or interfere with the interventions decided upon by the physician and patient, but it will closely monitor both patients and treatment modalities.

“We’re trying to organize multicenters across the country, generating some large numbers that we might be able to get useful data out of,” said Dr. Strauch. After enrollment, patients will provide history, physical exam, and X-rays, and will respond to questionnaires at baseline, at regular intervals during the course of a year, and annually thereafter. Demographic analysis will include family and social history, including incidence of basal joint arthritis over 2 generations. Data will be collected on trauma or overuse of the thumb and standard measurements employed to assess range of motion and other mechanical variables. A standard staging system for radiographic analysis will be implemented. The cost-effectiveness of treatments will also be assessed, including calculations that adjust for the quality of life.

Treatment plans and programs for CMC arthritis tend to cling to life many years after most physicians are no longer using them, said Dr. Rosenwasser. Information that will come out of the new multicenter study, he expects, will rapidly find its way into both the professional and patient spheres through the

NewYork-Presbyterian Columbia Orthopaedics

is a semi-annual newsletter published by NewYork-Presbyterian Hospital. The articles in this newsletter represent the work of the Columbia University faculty at NewYork-Presbyterian Hospital/Columbia University Medical Center, who are at the forefront of research and practice in the diagnosis, treatment, and rehabilitation of musculoskeletal conditions in adults and children.

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Clarification: The radiographic image displayed on page 1 of the Spring 2006 Issue of this newsletter, as part of an article about Total Hip Resurfacing, should have been attributed to Thomas Schmalzried, MD.

current lines of communication such as the Internet. “It will not be anecdotal, or a small series,” he said, “or based on someone’s particular way of doing something, but much more objective.”

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Innovative Treatment and Pioneering Research Enhances Recovery for Injured Athletes

As a subspecialty, sports medicine is relatively new. However, through the establishment of the Center for Sports Medicine within the Department of Orthopaedics at NewYork-Presbyterian Hospital/Columbia University Medical Center has already established itself as a leader in the field.

Until the late 1980s or early 1990s, sports medicine was not a highly specialized field. Professional sports teams, as well as scholastic and college athletic departments, relied largely on general practitioners and/or orthopaedists to treat sports-related injuries. Amateur athletes—the weekend sports participants dubbed “weekend warriors” by the profession—were often told to give up their sports hobbies after sustaining an injury.

incredibly complex and multidisciplinary field that involves surgery, therapy, rehabilitation, nutrition, preventive medicine, and more. There has been a real expansion of knowledge on how to care for athletes in the past decade.”

Established in the mid-1990s, the Center for Sports Medicine at NewYork-Presbyterian/Columbia offers the full gamut of sports medicine and physical therapy services to college and professional athletes as well as amateurs. The Center’s comprehensive program for shoulder, elbow, and knee injuries has led to the development of cutting-edge surgical techniques for joint repair, including the “transosseous equivalent” repair technique for rotator cuff injuries researched and refined under the leadership of Christopher S. Ahmad, MD,

New York Yankees outfielder Hideki Matsui, who broke his hand during a game last spring, was recently treated at the Center for Sports Medicine at NewYork-Presbyterian/Columbia.

“In the old days, orthopaedic surgeons would scoff and say, ‘We all do sports medicine,’” noted William N. Levine, MD, adding that from 1950 to 1998, Columbia University athletes were treated by physicians at another area hospital. “Today, there is greater recognition that sports medicine is an

and Dr. Levine. In conjunction with the Hospital’s Orthopaedic Hand and Trauma Service, under the leadership of Melvin Rosenwasser, MD, the Center has also pioneered new techniques for the repair of complicated hand injuries. Dr. Rosenwasser, in fact, recently operated on New York

Yankees outfielder Hideki Matsui, who broke his hand during a game last spring. In addition, Dr. Levine and his colleagues have developed new approaches for instability surgery, which have improved outcomes following major shoulder trauma.

“All of the physicians and surgeons within the Center interact closely with other specialists within the Hospital,” said Stuart J. Hershon, MD, who has served as the team physician for the Yankees since the late 1980s. “As a result, our athlete patients have access to the best care.”

The Center’s mission is to limit the downtime of its athletic patients and restore their performance to preinjury levels via the most efficient means. Indeed, the vast majority of athletes referred into the Center are treated nonoperatively. According to Louis U. Bigliani, MD, the Center also works with athletes and consults with athletic trainers and local sports medicine practitioners on preventive measures designed to avoid injury and/or surgery. These include stretching exercises and techniques for managing athletic injuries through strength and conditioning programs.

The Center’s efforts are not limited to professional athletes, however. Its clinicians have treated performing artists—dancers and musicians—with orthopaedic injuries, and they have also worked with college and high school athletes. Research at the Center has even made historically complex procedures such as total joint replacement more available to—and less problematic for—older, “weekend warriors.” According to Dr. Levine, surgeons at the Center just recently repaired the anterior cruciate ligament of a 53-year-old amateur basketball player and performed total joint replacement on the shoulder of an 81-year-old man who injured himself playing paddleball with his grandson.

“When I was still in training in the early 1990s, we wouldn’t have dreamt of doing these types of procedures on these types of patients,” noted Dr. Levine.

“Major innovations have improved

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New Technology Enables Physicians to Treat Children With Rare Thoracic Disease

Children with thoracic insufficiency syndrome (TIS) now have access to a revolutionary surgical technology that can extend their lives—the vertical expandable prosthetic titanium rib, or VEPTR. Leading the way in the development and refinement of this technology is Morgan Stanley Children’s Hospital of NewYork-Presbyterian/Columbia University Medical Center, site of the first and only multidisciplinary VEPTR program in New York.

Defined as “the inability of the thorax to support normal respiration or lung growth,” TIS can result from the fusion of ribs in the presence of congenital scoliosis (curvature of the spine); it may also occur in other disorders that deform the ribs and spinal column, such as Jarcho-Levin syndrome. It is a rare condition, occurring in less than 4,000 children in the United States each year. The deformed thorax of a child with TIS may not grow sufficiently to allow the lungs to attain normal adult size, causing life-threatening respiratory problems in some patients.

“VEPTR gives the lungs room to grow, and that can save the life of a child with TIS,” said Michael G. Vitale, MD.

The VEPTR device consists of a telescoping rod with a hook on either end. The hook attaches to the child’s ribs, pushing open the chest cavity while straightening the spine. Thus, placement of the VEPTR device helps manage 2 problems at once, expanding the ribcage and correcting scoliosis (Figure). After the initial surgical placement, which also may involve separation of the fused ribs, the child returns for surgery at 6-month intervals to adjust the telescoping mechanism or, occasionally, to replace the VEPTR, to keep up with the child’s growth. Adjustments continue until the chest cavity is large enough to support adult lung size, typically between ages 8 and 15. These procedures—termed

expansion thoracostomies or thoracoplasties—can be initiated as early as 6 months of age and as late as age 13 years.

“Traditionally,” Dr. Vitale noted, “TIS was treated with fusion of the vertebrae, but with this method, the lungs couldn’t develop fully. VEPTR allows the lung to grow, and also provides a faster recovery time.”

“[The vertical expandable prosthetic titanium rib] allows the lung to grow, and also provides a faster recovery time.”

—Michael Vitale, MD

“Before VEPTR, we had no way of dealing with the entire chest wall,” added David P. Roye, MD. “Straightening the spine without growing the ribcage was not enough. Now we can straighten the spine while we increase room in the rib cage for the lung.”

Use of VEPTR is so new, it is not possible to assess fully its long-term effects. Outcomes to date, however, have been very good. Surgeons at Morgan Stanley Children’s Hospital of NewYork-Presbyterian conducted its first VEPTR placement in the spring of 2005, and results since then have been consistently positive. The Hospital team is conducting ongoing clinical research to establish the improvement in pulmonary function and quality of life seen with the VEPTR. The key to success, according to Dr. Vitale, is the Hospital’s “true multidisciplinary pediatric program.”

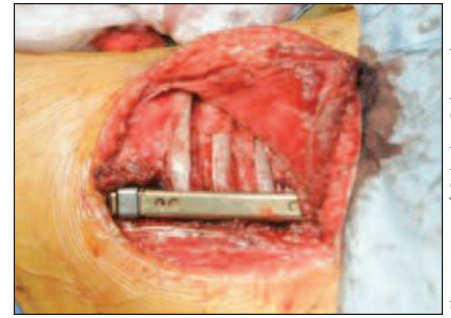


Photo courtesy of Columbia Orthopaedics.

Figure. Placement of a vertical expandable prosthetic titanium rib during pediatric expansion thoracostomy.

“The care of children with TIS is complex and requires pediatric pulmonary, pediatric ICU, pediatric general surgery, and plastic surgery, not to mention imaging services and the pediatric OR staff and anesthesiology,” added Dr. Roye. “The comprehensive services at the Hospital make us an ideal site for pediatric VEPTR procedures.”

The parents of children treated at the Hospital praise the program. One parent, Lynn Yusi, said that VEPTR placement and adjustment “couldn’t have gone better,” for her daughter, Jenna. “Jenna is functioning in every way like a normal child,” noted Ms. Yusi. Now that Jenna has undergone initial placement of the VEPTR and 2 adjustment procedures, she added, “if you weren’t told about her condition, you would never know.”

“This is a lifesaving procedure that is also very straightforward and manageable for families,” said Dr. Vitale.

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Microsurgery

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from the beginning, became plausible and desirable as procedures for tissue transfer proliferated. Today, most surgical specialties make some use of microsurgery. Urological surgeons employ it for fine anastomotic work; gynecological surgeons use it for fertility procedures such as restoration after tubal ligation; ear, nose and throat surgeons use micro techniques to operate on the middle and inner ear in procedures that were unknown just a few years ago; neurosurgeons use microsurgery, often in conjunction with various technologies, in work both on peripheral nerves and in brain operations.

Because the fundamental skills for microsurgery are common to all these disciplines, the Microsurgery Research and Training Laboratory has developed a basic program in which surgeons can learn and practice on live animal models, avoiding the pitfalls of self-instruction. Emphasis on mental preparation, concentration, self-discipline, and patience are emphasized and integrated into acquisition of technique as students develop abilities to work with the small vessels and nerves through the surgical microscope.

"The skills learned here can be applied to every part of the body," said Yelena Akelina, DVM, MS. Working with students on a one-on-one basis, she imparts microsurgical skills to some 70 surgeons annually.

The briefest, introductory course offers 14 hours of instruction over 2 days and covers use of the surgical microscope, instrumentation, and basic suturing technique. Surgeons practice end-to-end arterial and venous anastomoses on the femoral artery of the living rat, and they also learn and practice peripheral nerve repair.

A more advanced 40-hour basic microsurgery course offers additional

instruction in suturing techniques, including forehand, backhand, and one-way-up suturing. Students also learn the technique of interpositional vein graft and end-to-side anastomosis. This course includes instruction in creating free tissue flaps, vasovasostomy, and tubal reconstructions.

"They all are learning essentially the techniques of putting tubes together," said Dr. Rosenwasser, "either tubes that carry blood or nerve elements, and they transport that to the problem set that they have in their own field."

Students work at first with inanimate objects before learning to apply techniques to the living rat. Dr. Akelina and Robert Strauch, MD, have created a series of videotapes to provide students with an introductory set of lessons.

In recent years, the laboratory has expanded to include a special course that trains about 40 researchers annually in the basic techniques of rodent surgery. In part this is a response to the recent boom in genetics research that involves widespread use of transgenic mice. A wide spectrum of scientists and research personnel from medical and pharmaceutical institutions benefits from learning microsurgical skills.

Dr. Akelina noted that while surgeons come to the task with a specific operation in mind, research scientists approach the experience with a different, problem-solving mind-set. "A surgeon from a medical specialty knows why he is learning specific micro skills. He needs to go tomorrow and operate on a human hand. When researchers come and learn the skill, they start thinking how to apply it."

Training in Rodent Microsurgery is offered as a 2-day simple or 3-day complex course. Students begin by learning instrumentation and practice on a non-animal PVC-rat made of latex. Dr. Akelina teaches the 3 R's of small animal research: *refinement* of technique, *reduction* in the numbers of animals



Instructor Yelena Akelina, DVM, MS (right), trains Richard Kim, MD (left), in the Microsurgery Research and Training Laboratory at NewYork-Presbyterian/Columbia.

used, and *replacement* of animal with non-animal procedures when plausible.

The microsurgery laboratory itself undertakes original research. Recent projects include investigations into the biomechanics of nerve repair and the potential benefits of artificial conduits to shield repaired nerves from fibrous scar tissue. Dr. Rosenwasser noted that the research takes place in full accordance with Institution Review Board (IRB) ethical standards: "We're doing IRB-controlled lab research for the purpose of answering some questions that are significant in clinical medicine."

A separate mission for the laboratory, he noted, is to raise awareness of ethical standards as they apply to experiments done on small laboratory animals. The laboratory has developed a core curriculum to teach the various operative skills—vessel cannulation, I.V. placement, wound closure—in ways that foster safe, efficacious, and humane treatment.

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Sports

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the quality of care for athletes, giving us improved outcomes and faster recovery times,” added Dr. Hershon. “Improved arthroscopic techniques, sophisticated imaging capabilities. Our Center gives all athletes—professionals and amateurs—access to these services.”

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impingement, and evaluating a bisphosphonate coating on total joint devices that may serve to combat the processes that lead to eventual failure.

The OREF career development award, which is the largest grant awarded by the OREF and provides funds over a 3-year period, went to Francis Y. Lee, MD, MS, PhD. His OREF award is allowing him to explore the role of signaling pathways induced by ultra-high molecular weight polyethylene particle wear that result in activation of bone cells and osteolysis. Dr. Lee was a recipient of the OREF resident research award in 1995, the OREF research grant in 2004, and the AAOS-OREF clinician scientist traveling fellowship award. Dr. Lee has been promoting and mentoring translational research by orthopedic residents.

“We are attempting to dissect the molecular pathways of bone resorption induced by wear particles in order to develop new drugs to prevent this process or better materials that are less likely to induce these molecular signals,” explained Dr. Lee, who is a specialist in musculoskeletal tumors and pediatric orthopedic surgery, including spine

deformity and complex developmental orthopedic disorders. His research grew directly out of his work at the Center for Orthopaedic Research, where a variety of translational studies are being conducted on musculoskeletal disorders.

“The Center for Orthopaedic Research has 2 important missions. One is to provide research and educational environments for students, residents, fellows, and faculty members at Columbia, and the other is to develop new therapeutic approaches built on translational studies,” Dr. Lee said. He noted that some of the recent initiatives at the Center for Orthopaedic Research, which were established by Louis U. Bigliani, MD, Professor and Chairman of the Columbia Department of Orthopaedic Surgery, in 2003 to promote basic and translational research by orthopedic residents and faculty members, have included studying osteoblast biology, isolating the molecular mechanism of bone regeneration, and evaluating the process of osteochondral healing.

The OREF research grant went to Theodore A. Blaine, MD. The 2-year award will fund the study of alternatives for current anti-inflammatory drugs in shoulder impingement syndrome, a focus that was again made possible by the translational research being pursued at the Center for

Orthopaedic Research. In this case, the focus has been the molecular events triggered by shoulder impingement.

“We will be evaluating inflamed tissue from the bursa and isolate specific cytokines and other molecules that are expressed in patients with impingement of the shoulder,” Dr. Blaine explained. “If we know which molecules are driving the inflammation, we can develop strategies to suppress those molecules with targeted therapies that might be more effective and perhaps better tolerated than the ones we have now.”

In fact, the current anti-inflammatory drugs are highly nonspecific. Non-steroidal anti-inflammatory drugs, which are the most commonly prescribed for joint inflammation, affect a variety of other tissues, including the gastrointestinal tract. Although the development of cyclooxygenase-2 inhibitors reduced the risk of gastrointestinal complications, they were no more effective, and they have recently been the subject of controversy because of their association with cardiovascular complications.

“We have already isolated cytokines upregulated in shoulder impingement that have not been previously described. If we can isolate early events in the molecular signaling pathways, we may

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be able to prevent the cascade of signals before inflammation is clinically significant," Dr. Blaine explained. Although the subjects of this research are the specific molecular events that drive inflammation and pain in the shoulder joint, the findings may well be relevant to inflammatory processes at other joints.

An OREF resident award was granted to a proposal to explore the role of a bisphosphonate coating on total joint devices. The award was given to Sanjeev J. Suratwala, MD. The grant is for 1 year, and the project has been supervised by Dr. Lee. Bisphosphonates, which inhibit osteoclast activity to prevent bone resorption, are widely used to control osteoporosis. In total joint replacement, the same protection against bone resorption has the potential to slow loosening and extend the life of the joint replacement. Since the

establishment of the Center for Orthopaedic Research in 2003, there have been 3 other OREF resident research awards (Steve Storer, MD, and Dr. Lee in 2003; Jonathan H. Lee, MD, and Melvin Rosenwasser, MD, in 2004; Greg M. Osgood, MD, and Dr. Blaine in 2004). According to Drs. Lee and Blaine, one of the most important missions of the Center for Orthopaedic Research is to provide orthopaedic residents and young scientists with ample research and educational opportunities.

OREF was created in 1955 as a joint effort by the American Orthopaedic Association, the American Academy of Orthopaedic Surgeons, and the Orthopaedic Research Society. Its mission is to fund important research to advance the treatment of orthopaedic diseases. By entrusting 3 of its major grants in 2006 to a single institution, OREF has acknowledged the important research initiatives being carried out at Columbia.

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Sanjeev J. Suratwala, MD, recently completed his residency in the Department of Orthopaedics at NewYork-Presbyterian Hospital/Columbia University Medical Center.

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Fall 2006

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**Important news from
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forefront of research and
practice in the diagnosis,
treatment and rehabilita-
tion of musculoskeletal
conditions in adults
and children.**

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