Orthopaedics

Division Photo

First Row: A.Nikolaou, A. Crawford, E. Wall, D. Bylski-Austrow, C. Dahia, J. Sorger.

Second Row: S. Agabegi, V. Jain, S. Parikh, J. Tamai, C. Mehlman, R. Cornwall

Division Data Summary

Research and Training Details	
Number of Faculty	9
Number of Research Fellows	2
Number of Research Students	5
Number of Support Personnel	33
Direct Annual Grant Support	$25,418
Peer Reviewed Publications	16

Clinical Activities and Training	
Number of Clinical Staff	5
Number of Clinical Fellows	4
Number of Clinical Students	13
Number of Other Students	10
Inpatient Encounters	517
Outpatient Encounters	33449

Significant Publications

Laor, T. and A.H. Crawford, Idiopathic chondrolysis of the hip in children: early MRI findings. AJR Am J Roentgenol, 2009. 192(2): p. 526-31.

Idiopathic chondrolysis of the hip is a rare but potentially devastating injury in children. It can result in loss of articular cartilage and rapid and progressive degenerative arthritis. Early diagnosis and treatment greatly improve the outcome, however, the rarity of the disorder precludes early diagnosis. This study identifies previously unreported consistent abnormal signal intensity centered in the acetabulum and femoral head in children with clinical findings of chondrolysis. In a child in whom the diagnostic is considered but is uncertain, confirmation by this modality might potentially result in early diagnosis and treatment.

Klein, G., C.T. Mehlman, and M. McCarty, Nonoperative treatment of spondylolysis and grade I spondylolisthesis in children and young adults: a meta-analysis of observational studies. J Pediatr Orthop, 2009. 29(2): p. 146-56.

The incidence of spondylolysis is at least 6% by the end of childhood and painful lesions are not infrequent. A meta-

analysis of 15 observational studies (and 665 patients) suggests that more than 83% of cases treated non-operatively will have a successful clinical outcome after 1 year. The high clinical success rate of nonoperative treatment of spondylolysis with or without low grade spondylolisthesis is remarkable.

Wall, E.J., et al., The healing potential of stable juvenile osteochondritis dissecans knee lesions. J Bone Joint Surg Am, 2008. 90(12): p. 2655-64.

One of the largest studies on the healing potential of Juvenile Osteochondritis Dissecans. Developed a nomogram that identifies those JOCD lesions that have a high likelihood of healing with nonoperative treatment versus surgical treatment.

Division Highlights

Donita Bylski-Austrow, PhD, Eric J. Wall, MD and Shital Parikh, MD

Juvenile Osteochondritis Dissecans: Model of etiology: Growth plate injuries are often caused by the over-loading of young joints during athletic and other activities. A rabbit model of knee joint overuse has been developed in order to define injury mechanisms and quantitative overload criteria. The model will allow us to test potential improvements in treatments for these common and difficult pediatric skeletal injuries.

Donita Bylski-Austrow, PhD

Spine deformity: Model of early treatment: It has long been believed that the progression of spine deformities such as juvenile and adolescent idiopathic scoliosis may be mechanically slowed or even stopped. This would eliminate the need for children to later undergo a large and difficult surgery. The Division of Pediatric Orthopaedic Surgery was the first to invent an implant and minimally invasive procedures that were shown to alter spine growth. We have recently defined the mechanism at the tissue and cell levels by which our implant works — by inducing structural gradients in the vertebral growth plates. We are currently defining the biomechanical conditions that the implant imposes on the intervertebral disc immediately post-operatively. This will help explain how the implant functions, define the likelihood of any side effects on the disc, and guide possible changes to the design of the implant before beginning any investigation in patients.

Roger Cornwall, MD

Novel mouse model of neonatal brachial plexus injury. The pathophysiology of secondary musculoskeletal deformities following neonatal brachial plexus injury is poorly understood. We have created a surgical model of brachial plexus injury in neonatal mice that allows us to examine the effects of neonatal nerve injury on post-natal growth and development of muscles and joints. The model allows investigation of novel therapies for secondary musculoskeletal complications of nerve injury, including stem cell therapies and pharmacological preservation of muscle function. The research is being performed under the guidance of Roger Cornwall MD in collaboration with Christopher Wylie, PhD of Developmental Biology.

Alvin H. Crawford, MD

Harms Study Group. The Spine Center at CCHMC is one of eight international centers currently participating in the HARMS Study Group, a multi-center clinical study for the treatment of spinal disorders designed to pursue the longitudinal outcome of patients operated for scoliosis. The study group is named for Dr. Juergen Harms, and supported by DePuy Spine.

Alvin H. Crawford, MD

Growing Spine Study Group (GSSG): The Spine Center at CCHMC is also a member of the Growing Spine Study Group (GSSG) dedicated to the treatment of progressive early onset spinal deformities. The treatment of progressive scoliosis in very young children has been a difficult problem to address. Both non-operative such as bracing and casting and operative care such as Growing Rod and Vertical Expandable Prosthetic Titanium Rib (VEPTR) carry high rate of complications in this young population with progressive curves. Furthermore definitive fusion of the entire deformity at an early age can also lead to growth-related problems including short trunk, thorax and crank-shaft phenomenon as well as respiratory problems. Indications for different types of treatments are unclear. Recent studies from Children's and others have shown good early results for patients being treated with Dual Growing Rods in children with Early Onset Scoliosis (EOS). In addition, other more treatments addressing early onset spinal deformity related diseases have promising results as well, but need to be reviewed for long term outcomes. The significance of this multi-center study is to obtain a large number of patient data to compare all treatments for children with this severe, challenging problem. It is important to know how different surgical techniques compare to each other as well as to non-operative care and/or observation to better understand the problem and determine the best way to treat these children with the least amount of surgery necessary. This multi-center study will evaluate the long-term clinical and radiographic outcomes of EOS and other Early Onset Spinal and Chest Wall Deformities in a large population of patients.

Alvin H. Crawford, MD & Hongbo Liu, MD

Comparison of Two Different Techniques in Surgical Treatment of SCFE: To compare the results and complications of two different surgical technique treatments for SCFE in patients who have had at least two years of

follow-up. The old technique, epiphysiodesis or open bone peg epiphysiodesis, was abandoned by our institute about 10 years ago and replaced by pinning in situ or screwing in situ, so we want to compare old cases from 1986 thru 1996, with new cases from 1996 thru 2006.

Chitra Dahia, PhD

Cell signaling in mouse intervertebral disc: Drs. Dahia and Wylie's group has proposed the temporal and spatial schema of major cell signaling pathways in the different components of intervertebral disc; that is the nucleus pulposus, fibrous annulus fibrosis and endplate of mouse. This information will be very useful for designing further studies to understand the molecular mechanism of disc degeneration.

Chitra Dahia, PhD

Role of Nucleus Pulposos on the Maintenance of Mouse Intervertebral disc: Using the mouse model system the molecular mechanism behind the role of nucleus pulposus cells in the maintenance of intervertebral disc is being evaluated.

Charles T. Mehlman, DO, MPH

Bracing in Adolescent Idiopathic Scoliosis Trial (BrAIST). The purpose of this study is to established the effectiveness of thoracolumbar orthoses (TLSOs) in the treatment of Adolescent Idiopathic Scoliosis (AIS), using a multi-center, prospective, randomized, controlled design.

Shital Parikh, MD

Tibial Spine Fractures. In collaboration with Walter Samora, MD. This is a retrospective chart review that hopes to identify at-risk populations for tibial spine fractures. Goals of the study are to evaluate demographic data and identify risk factors associated with tibial spine avulsion fractures using radiographs and MRI, and to compare the tibial spnie group to age/race matched patients with ACL tears and another group with normal radiographs of the knee.

Shital Parikh, MD

Pin Tract Infections. This study is a retrospective chart review of patients who had a supercondylar humerus fracture. This study will report on pin tract infection rates, and also patient outcomes following infection. If a trend can be identified, we hope to be able to prevent some infections from occurring.

Division Collaboration

Collaboration with Orthopaedic Surgery; Developmental Biology

Collaborating Faculty: Roger Cornwall, MD; Christopher Wylie, PhD

Creation of Mouse Model of Neonatal Brachial Plexus Injury: It's effects on postnatal muscle stem cell function and muscle growth.

Collaboration with Orthopaedics; Human Genetics

Collaborating Faculty: Alvin Crawford, MD; Elizabeth Schorry

Spinal abnormalities in Neurofibromatosis Type1: This NIH study is based out of the university of Utah to evaluate the onset of dysplastic scoliosis in patients with Neurofibromatosis.

Collaboration with Orthopaedics; Human Genetics

Collaborating Faculty: Alvin Crawford, MD; Elizabeth Schorry, MD

NF1 Bone Abnormalities Consortium: The Skeleton is frequently affected in individuals with neurofibromatosis tpye 1 (NF1), and some of these bone manifestations can result in significant morbidity. The natural history and pathogenesis of NF1 skeletal abnormalities are poorly understood, and currently therapeutic options for these manifestations are consequently limited. The Children's Tumor Foundation convened an International NF 1 Bone Abnormalities Consortium to address future directions for clinical trials in skeletal abnormalities associated wtih NF1. This project evaluates skeletal manifestations and available preclinical mouse models will help advance toward optimal clinical management of NF 1 skeletal abnormalities, and major difficulties encountered for the design of clinical trials focused on the prevention and treatment of NF 1 skeletal abnormalities.

Collaboration with Orthopaedics; Neurosurgery

Collaborating Faculty: Alvin Crawford, MD; Francesco T. Mangano, DO; Kerry Crone, MD

Instrumented Screw Fixation of C1 and C2 in Pediatric Patients: a retrospective review: Posterior instrumented fusions of C1 and C2 are common in the adult patient population but limited within pediatrics due to the dynamic growth of the cervical spine. The purpose of this review is to report safe and effective instrumentation of C1 and C2 at young ages, increasing treatment options for congenital and traumatic conditions in the upper cervical spine in the pediatric population.

Collaboration with Orthopaedics; Anesthesia; Physical Medicine and Rehabilitation; Neurosurgery; Pulmonary Medicine

Collaborating Faculty: Alvin Crawford, MD; John McAuliffe, MD and Alex Szabova, MD; Douglas Kinnett, MD; Francesco Mangano, MD; Gary McPhail, MD

The Spine Center: A multi-disciplinary clinical program for the treatment of pediatric spinal disorders.

Collaboration with Orthopaedics; Human Genetics

Collaborating Faculty: Dr. Twee Do; Dr. Bradley Tinkle

Skeletal Dysplasia Clinic: A multi-disciplinary clinic with Orthopaedics and Human Genetics for the treatment of patients with skeletal dysplasia.

Collaboration with Orthopaedic Surgery; Developmental Biology

Collaborating Faculty: Chitra Dahia, PhD; Christopher Wylie, PhD

Spinal Deformity Related Projects: Local biochemical regulationof physeal growth in mouse model, identification of the molecular signal for the termination of vertebral growth, role of nucleus pulposus cells in the maintenance of vertebral growth plate.

Collaboration with Orthopaedic Surgery; Developmental Biology

Collaborating Faculty: Chitra Dahia, PhD; Christopher Wylie, PhD

Intervertebral Disc Projects*:* Role of nucleus pulposus cells in the regulation of annulus fibrosis and endplate cells during growth and aging in a mouse model, effect of removal of nucleus pulposus cells on the annulus fibrosis and endplate cells in the intervertebral disc, use of transgenic mouse model system to study the role of specific signaling molecule secreted by the nucleus pulposus cells, use of agonists and antagonists in restoration of intervertebral disc.

Collaboration with Orthopaedic Surgery; Physical Medicine and Rehab

Collaborating Faculty: William Lippert, MPH; Linda Michaud, MD

Social Functioning in Youth with Neonatal Brachial Plexus Palsy: This study is designed to assess the perceived social functioning in youth with neonatal related brachial plexus palsy (NBPP). Parents and youth with NBPP will be asked to complete a number of questionnaires that measure self-esteem, coping skills and social functioning. Information obtained from this research study will hopefully yield general knowledge regarding psychosocial functioning in youth with NBPP. This knowledge will be used to develop initiatives aimed at addressing possible social functioning concerns in this patient population.

Collaboration with Orthopaedics; Physical Medicine and Rehab; Plastic Surgery

Collaborating Faculty: Charles Mehlman, DO, MPH; Linda Michaud, MD; Kevin Yakuboff, MD

Brachial Pleuxs Birth Palsy (BPBP): Multi-center prospective research study to determine the optimal age for microvasuclar repair of infants with BPBP and persistent uppper extremity weakness; compare the functional outcome of patients undergoing early microscopic repair versus late reconstructive surgery verus late reconstructive surgery alone; and determine the natural history of neurologic recovery in patients with BPBP.

The Use of Botulinum Toxin Type A In The Management of 40 Children with Neonatal Brachial Plexus Palsy. This is a retrospective review of 40 patients with neonatal brachial plexus palsy that underwent treatment for muscle imbalance in the shoulder or elbow with Botulinim Toxin type A. This is descriptive report of the results of treatment of NBPP patients.

Collaboration with Orthopaedics; Physical Medicine and Rehab

Collaborating Faculty: Charles Mehlman, DO, MPH; Roger Cornwall, MD; Linda Michaud, MD

Arthroscopic release and latissimus dorsi transfer or release alone in children with neonatal brachial plexus palsy. The purpose of this study is to retrospectively report on the outcomes of a case series of 80 children with brachial plexus palsy that have undergone an arthroscopic release and latissimus dorsi transfer or only an arthroscopic release at CCHMC for improvement of external rotation and abduction.

Collaboration with Orthopaedics; Physican Medicine and Rehab

Collaborating Faculty: Charles Mehlman, DO, MPH; Linda Michaud, MD; Glendaliz Bosques, MD; Shari Wade, MD

The Predictive Value of Electrodiagnostic Findings in Birth Brachial Plexus Palsy. It is our goal in this study to determine whether if electrodiagnostic analysis findings have predictive value in the assessment of birth brachial plexopathy. Because EMG has been used routinely as part of the pre-surgical evaluation at Cincinnati Childrens Hospital Medical Center, we are in the unique position to examine the predictive value that electromyographical findings may have in order to assist physicians with the optimal evaluation and management of this condition.

Collaboration with Orthopaedics; Radiology

Collaborating Faculty: Shital Parikh, MD and Eric Wall, MD; Tal Laor, MD

Orthopaedic Sports Medicine and Radiology Conference: Monthly conference to review radiographic images of sports medicine patients.

Collaboration with Orthopaedics; Sports Medicine Biodynamic Center; Radiology

Collaborating Faculty: Eric Wall, MD and Shital Parikh, MD; Jon Divine, MD, Michael Shaffer, MD and Corey Ellis, MD; Tal Laor, MD

JOCD Center: Multi-disciplinary, multi-center clinical and research program for the treatment of pediatric patients with Juvenile Osteochondritis Dissecans (JOCD).

Faculty Members

Eric Wall, MD, Associate Professor ; *Director, Pediatric Orthopaedic Surgery; Director, Orthopaedic Sports Medicine; Director, Orthopaedic Research*
Research Interests: Scoliosis and Sports Medicine

Donita Bylski-Austrow, PhD, Research Associate Professor ; *Director of Biomechanics Research*
Research Interests: Spine Biomechanics

Roger Cornwall, MD, Assistant Professor ; *Co-Director, The Hand and Upper Extremity Center*
Research Interests: Hand and Upper Extremity

Alvin Crawford, MD, Professor ; *Director, Spine Center and Fellowship Program*
Research Interests: Scoliosis and Neurofibromatosis

Twee Do, MD, FAAP, Assistant Professor ; *Director, Neuromuscular Services*
Research Interests: Neuromuscular

Viral Jain, MD, Assistant Professor
Research Interests: Scoliosis

Charles Mehlman, DO, MPH, Associate Professor ; *Director, Musculoskeletal Outcomes Research, Pediatric Orthopaedic Resident Education, Brachial Plexus and Co-Director of the Limb Reconstruction Center*
Research Interests: Spine Bracing and Evidence-Based Medicine

Shital Parikh, MD, Assistant Professor
Research Interests: Sports Medicine

Junichi Tamai, MD, Assistant Professor ; *Director, Physician Assistant Program*
Research Interests: Process Improvement

Clinical Staff Members

- **Lance Bolin, PA-C**
- **Michael Hood, PA-C**
- **Hillary McClung, PA-C**
- **Mary Pam Pfiester, PA-C**
- **Adriana Reinersman, PA-C**

Trainees

- **Dave Agelillo, DO,** PGY5, Peninsula Hospital Center, Far Rockaway, New York
- **Brandon Boyce, MD,** PGY3, West Virginia University, Morgantown, WV
- **Steven Brantley, MD,** PGY4, University of Cincinnati, Cincinnati, Ohio
- **Michael Callan, DO,** PGY4, Henry Ford Malcomb Hospital/Bi-County, Warren, Michigan
- **Lori Catanzaro, MD,** PGY4, Bethesda North Family Practice, Cincinnati, OH
- **Barry Davis, MD,** PGY3, West Virginia University, Morgantown, WV
- **Benjamin Debelak, DO,** PGY3, Ingham Regional Medical Center, Lansing, Michigan
- **Rasesh Desai, MD,** Fellow, VS Hospital NHL, MMC, India
- **Emily Dixon, MD,** PGY4, Bethesda North Family Practice, Cincinnati, OH
- **Bradley Dunkin, MD,** PGY2, University of Cincinnati, Cincinnati, Ohio
- **Dave Eisenhauer, DO,** PGY4, Oklahoma University Medical Center, Oklahoma City, OK
- **Nabil Farakh, DO,** PGY4, Peninsula Hospital Center, Far Rockaway, New York
- **Vivien Fongue, DO,** Intern, Grandview Hospital, Dayton, Ohio
- **Nathan Gause, MD,** PGY4, University of Cincinnati, Cincinnati, Ohio
- **Ryan Gocke, MD,** PGY5, West Virginia University, Morgantown, WV
- **Mikhail Itingen, DO,** PGY3, Peninsula Hospital Center, Far Rockaway, New York
- **Oner Khera, MD,** PGY4, University of Cincinnati, Cincinnati, Ohio
- **Sarah Kindt, MD,** PGY4, Bethesda North Family Practice, Cincinnati, OH
- **Richard Lin, MD,** Intern, Grandview Hospital, Dayton, Ohio
- **Hongbo Liu, MD,** Fellow, Peking Union Medical College Hospital, Beijing, China
- **Adam Metzler, MD,** PGY2, University of Cincinnati, Cincinnati, Ohio
- **Nikki Nemeth, MD,** PGY2, University of Cincinnati, Cincinnati, Ohio
- **Dzi-View Nguyen, MD,** Intern, Grandview Hospital, Dayton, Ohio
- **Bobby Oommen, MD,** Fellow, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, India

- **Saila Patel, DO,** PGY3, Peninsula Hospital Center, Far Rockaway, New York
- **Vytatus Ringus, MD,** PGY5, West Virginia University, Morgantown, WV
- **Vivek Sharma, MD,** Fellow, GS Medical College and KEM Hospital Program, University of Mumbai, Mumbai, India
- **Christopher Sherry, DO,** PGY4, Ingham Regional Medical Center, Lansing, Michigan
- **Rafal Stachowicz, MD,** PGY2, University of Cincinnati, Cincinnati, Ohio
- **Kyle Switzer, DO,** PGY3, Ingham Regional Medical Center, Lansing, Michigan
- **Matthew Tweet, MD,** PGY4, University of Cincinnati, Cincinnati, Ohio
- **Dan Warner, MD,** PGY3, West Virginia University, Morgantown, WV

Significant Accomplishments

Hand and Upper Extremity Center

Developed multi-disciplinary hand center codirected by Roger Cornwall, MD, Orthopaedics, Kevin Yakobuff, MD, Plastic Surgery and Mohab Foad, MD, University Orthopaedics. The Center is a joint venture of the divisions of Orthopaedic Surgery, Plastic Surgery, Physical and Occupational Therapy and Rehabilitative Medicine. The Hand and Upper Extremity Center is a world-class, multi-specialty program that offers both surgical and non-surgical treatment of conditions involving the hand and upper arm, including fractures as well as tendon, nerve and vascular injuries.

Juvenile Osteochondritis Dissecans Center

The Divisions of Pediatric Orthopaedic Surgery and Sports Medicine have established the world's first Juvenile Osteochondritis Dissecans (JOCD) Center. This condition can destroy the joint surface in high-performing young athletes who subject their bodies to repetitive stress. Patients who require surgical intervention are treated with minimally invasive arthroscopic bone grafting and fixation techniques that were pioneered at Cincinnati Children's.

U.S. News and World Report - Ranked Orthopaedics #6

For the first time Cincinnati Children's Orthopaedics ranked in the top 10 Orthopaedic departments in the nation.

Division Publications

1. Wall EJ, Fine KS. "Orthopedics." *Blueprints pediatrics.* Baltimore: Lippincott, Wiliams and Wilkins; 2009: 287-296.
2. Sponseller PD, Betz R, Newton PO, Lenke LG, Lowe T, Crawford A, Sucato D, Lonner B, Marks M, Bastrom T. Differences in curve behavior after fusion in adolescent idiopathic scoliosis patients with open triradiate cartilages. *Spine.* 2009; 34: 827-31.
3. Laor T, Crawford AH. Idiopathic chondrolysis of the hip in children: early MRI findings. *AJR Am J Roentgenol.* 2009; 192: 526-31.
4. Myer GD, Ford KR, Divine JG, Wall EJ, Kahanov L, Hewett TE. Longitudinal assessment of noncontact anterior cruciate ligament injury risk factors during maturation in a female athlete: a case report. *J Athl Train.* 2009; 44: 101-9.
5. Klein G, Mehlman CT, McCarty M. Nonoperative treatment of spondylolysis and grade I spondylolisthesis in children and young adults: a meta-analysis of observational studies. *J Pediatr Orthop.* 2009; 29: 146-56.
6. Bylski-Austrow DI, Wall EJ, Glos DL, Ballard ET, Montgomery A, Crawford AH. Spinal hemiepiphysiodesis decreases the size of vertebral growth plate hypertrophic zone and cells. *J Bone Joint Surg Am.* 2009; 91: 584-93.
7. Dahia CL, Mahoney EJ, Durrani AA, Wylie C. Intercellular signaling pathways active during intervertebral disc growth, differentiation, and aging. *Spine.* 2009; 34: 456-62.
8. Dahia CL, Mahoney EJ, Durrani AA, Wylie C. Postnatal growth, differentiation, and aging of the mouse intervertebral disc. *Spine.* 2009; 34: 447-55.
9. Cornwall R. "Pediatric hand fractures." *Fractures of the upper extremity: a master skills publication..* Rosemont, IL: American Society for Surgery of the Hand; 2008: 89-119.
10. Wall EJ, Vourazeris J, Myer GD, Emery KH, Divine JG, Nick TG, Hewett TE. The healing potential of stable juvenile osteochondritis dissecans knee lesions. *J Bone Joint Surg Am.* 2008; 90: 2655-64.
11. Schmitt C, Mehlman CT, Meiss AL. Hyphenated history: Erb-Duchenne brachial plexus palsy. *Am J Orthop.* 2008; 37: 356-8.
12. Okike K, Kocher MS, Mehlman CT, Heckman JD, Bhandari M. Nonscientific factors associated with acceptance for publication in The Journal of Bone and Joint Surgery (American Volume). *J Bone Joint Surg Am.* 2008; 90: 2432-7.
13. Sharma V, Crawford AH, Evans J, Collins MH. Sequential Ewing's sarcoma and osteosarcoma. *J Pediatr Orthop B.* 2008; 17: 333-7.
14. Dahia CL, Petrusz P, Hall SH, Rao AJ. Effect of deprivation of endogenous follicle stimulating hormone on rat epididymis: a histological evaluation. *Reprod Biomed Online.* 2008; 17: 331-7.
15. Lippert WC, Wall EJ. Optimal intramuscular needle-penetration depth. *Pediatrics.* 2008; 122: e556-63.

16. Ramachandran M, Skaggs DL, Crawford HA, Eastwood DM, Lalonde FD, Vitale MG, Do TT, Kay RM. Delaying treatment of supracondylar fractures in children: has the pendulum swung too far?. *J Bone Joint Surg Br.* 2008; 90: 1228-33.

Grants, Contracts, and Industry Agreements

Grant and Contract Awards		Annual Direct / Project Period Direct
LIU, H		
US Trends and Regional Variations in Lumbar Spine Surgery Scoliosis Research Society	01/01/09 - 12/31/09	$10,000 / $10,000
MEHLMAN, C		
Bracing in Adolescent Idiopathic Scoliosis National Institutes of Health (University of Iowa) R01 AR 052113	09/01/06 - 08/31/11	$12,519 / $45,242
Bracing in Adolescent Idiopathic Scoliosis(Per Patient) National Institutes of Health (University of Iowa) R01 AR 052113	09/01/06 - 08/31/11	$2,899 / $8,697
	Current Year Direct	**$25,418**
	Total	**$25,418**