

# Orthopaedics

## Division Details

### RESEARCH AND TRAINING DETAILS

Faculty	14
Joint Appointment Faculty	1
Research Fellows and Post Docs	2
Research Graduate Students	6
Total Annual Grant Award Dollars	\$116,149
Total Annual Industry Award Dollars	\$54,283
Total Publications	39

### CLINICAL ACTIVITIES AND TRAINING

Clinical Fellows	3
Inpatient Encounters	1,037
Outpatient Encounters	47,406



Row 1: J Sorger, S Chandran

Row 2: V Jain, S Parikh, P Sturm, R Cornwall, P Whitlock

Row 3: E Wall, A Crawford, J McCarthy, J Tamai, C Mehlman, K Little, J Denning, D Bylski-Austrow

## Research Highlights

### Dr. McCarthy, MD, MHCM, serves as POSNA President

This year, [Dr. McCarthy](#) is serving as the president of the Pediatric Orthopaedic Society of North America ([POSNA](#)). POSNA is a not-for-profit professional organization of over 1200 surgeons, physicians, and allied health members passionately dedicated to advancing musculoskeletal care for children and adolescents through education, research, quality, safety and value initiatives, advocacy, and global outreach to children in underserved areas.

Additionally, Dr. McCarthy is the former chair of POSNA's Quality, Safety and Value Initiative ([QSVI](#)) and successfully launched the group's first performance measures. As president, Dr. McCarthy will continue focusing on the QSVI measures, as well as, work to initiate micro grants for members and implement the first ever combined POSNA and [EPOS](#) (European Paediatric Orthopaedic Society) annual research symposium.

### Justifying Patellar Instability Treatment by Early Results

[Dr. Shital Parikh](#) received a combined \$55,000 award from the [Pediatric Orthopaedic Society of North America](#), and the [Arthroscopy Association of North America](#), to create a study group aimed at analyzing the management and treatment results of patellar instability frequently seen in adolescents and young adults. Patellar instability can be a cause of significant morbidity and arthritis and management is currently controversial. JUPITER (Justifying Patellar Instability Treatment by Early Results) will be a multi-center, multi-armed, prospective cohort study to compare the safety and efficacy of (1) non-operative treatment, (2) isolated MPFL reconstruction, and (3) combined or 'other' surgical procedures for management of patellar instability. Recruitment will take place over one year at eight

sports centers. Researchers will assess post-treatment outcomes at six, 12 and 24 months, including assessment of function, activity level, health-related quality of life and complications.

## **The Orthopaedic Biomechanics Lab**

The Orthopaedic Biomechanics lab recently published two papers. The first described results from biomechanical feasibility testing of a novel material for spinal 'growing rods.' The second reported research in an in vivo model of knee joint injury of the bone-cartilage interface in growing joints. The purpose was to develop a preclinical model to determine causes and compare treatments.

Recent presentations include two at the Orthopaedic Research Society ([ORS](#)), and two at the International Research Society for Spinal Deformities ([IRSSD](#)). For the latter, an analysis of the effectiveness of magnetically-lengthened growing rods received an award nomination for measuring rod length increases using ultrasound.

Ongoing research includes exploring a novel material for bioresorbable intramedullary nails for fracture fixation in applications with relatively low load requirements and analyzing and testing aspects of growing rods explanted from early onset scoliosis patients. In addition, researchers have finalized the second generation implant for the clinical trial of spine growth modulation for adolescent idiopathic scoliosis.

## **The Cornwall Lab in the Neuromuscular Development Group**

The [Cornwall lab](#) focuses on investigating the pathophysiology of contracture formation following neonatal brachial plexus injury (NBPI). Using a surgical mouse model which recapitulates contracture formation in humans, we discovered that impaired postnatal skeletal muscle growth is the cause of contractures. We are using this model to elucidate the mechanisms by which neonatal denervation impairs muscle growth in order to develop novel medical strategies to prevent and treat neuromuscular contractures.

Our current work addresses two aspects of neuromuscular contractures. First, we seek to determine the fundamental aspects of muscle growth disturbed in neonatally denervated muscle, including myonuclear accretion and protein synthesis. We have identified, and characterized, deficiencies in the behavior of satellite cells-resident muscle stem cells thought to be critical for skeletal muscle growth through fusion with growing myofibers. In collaboration with the [Millay lab](#), we are using transgenic mice to both track, and manipulate, the ability of satellite cells to fuse to growing muscle fibers in normal and denervated muscle. Our findings to date challenge existing assumptions about the importance of satellite cell fusion to neonatal muscle growth, and highlight novel mechanisms by which stem cells may regulate protein synthesis, and muscle growth.

Second, we seek to determine the precise neuromuscular circuitry required for normal muscle growth, as well as the specific circuitry perturbations required to impair muscle growth. We have identified that muscle growth can proceed without motor innervation, provided the preservation of afferent and/or sympathetic innervation. This finding highlights roles for afferent and sympathetic circuitry in muscle growth and development, which we are studying with surgical and chemical models to manipulate these circuits. Again, there is little known about the role of sympathetic innervation in normal muscle function, our hope is that our model will shed light on both contracture formation, and normal neuromuscular physiology.

## **The Osteochondral Tissue Engineering Lab**

The osteochondral tissue engineering lab is a new lab within the Division of Pediatric Orthopaedics. The lab is working towards the improving care of large osteochondral (OC) injuries ( $\geq 2.5$ cm) by overcoming current barriers inherent to micro-fracture, autologous chondrocyte implantation and autologous osteochondral transfer. Our current project can be broadly divided into two major areas of study.

The first study assesses the chondroinductive ability of synthetic, biocompatible microspheres containing decellularized osteochondral matrix. We have successfully decellularized the osteochondral matrix and characterized the residual DNA, protein, growth factors and chemokines present after the decellularization process. Cell viability and chondrogenic/osteogenic differentiation of mesenchymal stem cells from bone marrow on plates coated with dOCM was observed in the laboratory with immunocytochemistry, biochemical analysis and rtPCR. Our present involvement is in incorporating the dOCM within the microspheres for 3D tissue culture.

The second study aims to combine the microspheres into a biphasic 3-d printed scaffold with dimensions equal to 2.5 cm in diameter and assess the ability of the biphasic scaffold to produce osteochondral differentiation and tissue formation in the presence of seeded

mesenchymal precursor cells.

We are collaborating with Dr. James Lin from the [University of Cincinnati](#). We are currently applying for various grants, and look forward to several publications and presentations at major tissue engineering conferences this academic year.

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## Significant Publications

Eismann EA, Laor T, [Cornwall R](#). **Three-Dimensional Magnetic Resonance Imaging of Glenohumeral Dysplasia in Neonatal Brachial Plexus Palsy**. *J Bone Joint Surg Am*. 2016 Jan 20;98(2):142-51.

Existing quantitative measurements of glenohumeral dysplasia in children with unresolved neonatal brachial plexus palsy (NBPP) have been mostly limited to the axial plane. This study described the three-dimensional (3D) pathoanatomy of glenohumeral dysplasia using 3D magnetic resonance imaging (MRI) reformations. Results showed clinical staff should not consider a simple "dislocation" with posterior humeral head displacement in NBPP, and glenohumeral dysplasia is not limited to the axial plane. Abnormal glenoid declination may have potential implications for the evaluation and treatment of shoulder weakness and contractures.

Schneider DK, Grawe B, Magnussen RA, Ceasar A, [Parikh SN](#), [Wall EJ](#), Colosimo AJ, Kaeding DD, Myer GD. **Outcomes After Isolated Medial Patellofemoral Ligament Reconstruction for the Treatment of Recurrent Lateral Patellar Dislocations: A Systematic Review and Meta-Analysis**. *Am J Sports Med*. 2016 Feb 12. Epub ahead of print.

Recent treatment trends for patients with recurrent patellar dislocations who fail initial non-operative management reflect a decrease in the use of long-term non-operative treatment, and an increase in surgical intervention (generally medial patellofemoral ligament (MPFL) reconstruction). This study evaluated outcomes, particularly return to sports and its relationship to postoperative instability, of isolated MPFL reconstruction for the treatment of recurrent patellar dislocations. Results indicated a high percentage of young patients return to sports after isolated MPFL reconstruction for chronic patellar instability, with short-term results demonstrating a low incidence of recurrent instability, postoperative apprehension, and reoperations.

Büchler L, Schwab JM, [Whitlock PW](#), Beck M, Tannast M. **Intraoperative Evaluation of Acetabular Morphology in Hip Arthroscopy Comparing Standard Radiography Versus Fluoroscopy: A Cadaver Study**. *Arthroscopy*. 2016 Jun;32(6):1030-7.

This study compared quantitative measurements of acetabular morphology obtained using intraoperative fluoroscopy, to standardized anteroposterior (AP) pelvis radiographs. Results showed that values for the LCE angle and AI determined by hip-centered fluoroscopy did not differ from those obtained by standardized AP plain film radiography. However, fluoroscopy leads to a more anteverted projection of the acetabulum with significantly decreased total anterior coverage, significantly increased total posterior coverage, and underestimated signs of retroversion compared with standardized AP pelvis radiography.

Schaffzin JK, Mangeot C, Sucharew H, Beck AF, [Sturm PF](#). **Factors Affecting Adherence to a Preoperative Surgical Site Infection Prevention Protocol**. *Infect Control Hosp Epidemiol*. 2016 Jun;37(6):728-30.

Surgical site infection (SSI) prevention protocols include preoperative patient and family actions, however, factors that contribute positively or negatively to task execution are unknown. Assuming that nonadherence contributes to higher SSI rates, identifying and addressing such factors is a priority. This study identified factors significant for an increased risk of protocol nonadherence. These factors included the patient having any previous spinal surgery, fewer months since protocol initiation, and poverty. To identify models of care that facilitates adherence to SSI prevention protocols among all patients will require further study.

Agabegi SS, Kazemi N, [Sturm PF](#), [Mehlman CT](#). **Natural History of Adolescent Idiopathic Scoliosis in Skeletally Mature Patients: A Critical Review**. *J Am Acad Orthop Surg*. 2015 Dec;23(12):714-23.

This study assessed the natural progression of adolescent idiopathic scoliosis in skeletally mature patients, as well as, accepted beliefs on anticipated curve progression and treatment indications. Most authors agree to consider surgical treatment in skeletally mature patients with curves > 50° because of the risk of progression into adulthood. This perceived risk of progression is largely

based on the lowa studies, however, the level of evidence for this is relatively weak, and the existing literature is equivocal in supporting the practice of performing surgery on these patients.

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## Division Publications

1. Agabegi SS, Kazemi N, Sturm PF, Mehlman CT. **Natural History of Adolescent Idiopathic Scoliosis in Skeletally Mature Patients: A Critical Review.** *J Am Acad Orthop Surg.* 2015; 23:714-23.
2. Bjorklund K, Eismann EA, Cornwall R. **Medical Trainee Continuity of Care Following Emergency Department Consultations in a Pediatric Hospital.** *J Grad Med Educ.* 2016; 8:33-8.
3. Buchler L, Schwab JM, Whitlock PW, Beck M, Tannast M. **Intraoperative Evaluation of Acetabular Morphology in Hip Arthroscopy Comparing Standard Radiography Versus Fluoroscopy: A Cadaver Study.** *Arthroscopy.* 2016; 32:1030-7.
4. Bylski-Austrow D, Wall E, Jain V, Reynolds J, Crawford A, Thompson G. **Growth Modulation Techniques: Titanium Clip-Screw Implant System (Hemibridge).** In: B Akbarnia, M Yazici, G Thompson, eds. *The Growing Spine Management of Spinal Disorders in Young Children.* New York: Springer; 2015:769-81.
5. Cornwall R. **Closed, Percutaneous, and Open Reduction of Radial Head and Neck Fractures.** In: F J, ed. *Operative Techniques in Orthopaedic Surgery.* Philadelphia PA: Lippincott Wilkins & Williams; 2015:1304-07.
6. Cornwall R. **Glenohumeral Joint Secondary Procedures for Obstetrical Brachial Plexus Birth Palsy.** In: J Abzug, S Kozin, D Zlotolow, eds. *The Pediatric Upper Extremity: Volume 2.* New York: Springer; 2015:633-51.
7. Cornwall R, Waters P. **Pediatric Brachial Plexus Palsy.** In: S Wolfe, W Pederson, R Hotchkiss, S Kozin, M Cohen, eds. *Green's Operative Hand Surgery.* Philadelphia PA: Elsevier; 2016:1391-424.
8. d H, A, McCarthy J, Klimaski D, Stringer K. **Proximal Femoral Growth Modification: Effect of Screw, Plate, and Drill on Asymmetric Growth of the Hip.** *J Pediatr Orthop.* 2016.
9. Dede O, Demirkiran G, Bekmez S, Sturm PF, Yazici M. **Utilizing the "Stable-to-Be Vertebra" Saves Motion Segments in Growing Rods Treatment for Early-Onset Scoliosis.** *J Pediatr Orthop.* 2016; 36:336-42.
10. Denning J. **Orthopedics.** In: M MacDonald, M Seshia, eds. *Avery's Neonatology Pathophysiology and Management of the Newborn Sixth Edition.* Philadelphia PA: Wolters-Kluwer; 2015:265-91.
11. Denning JR. **Tarsal Coalition in Children.** *Pediatr Ann.* 2016; 45:e139-43.
12. Eismann EA, Laor T, Cornwall R. **Three-Dimensional Magnetic Resonance Imaging of Glenohumeral Dysplasia in Neonatal Brachial Plexus Palsy.** *J Bone Joint Surg Am.* 2016; 98:142-51.
13. Eismann EA, Parikh SN, Jain VV. **Rereduction for Redisplacement of Both-Bone Forearm Shaft Fractures in Children.** *J Pediatr Orthop.* 2016; 36:405-9.
14. El-Hawary R, Sturm P, Cahill P, Samdani A, Vitale M, Gabos P, Bodin N, d'Amato C, Harris C, Al K, A. **What Is the Risk of Developing Proximal Junctional Kyphosis During Growth Friendly Treatments for Early-Onset Scoliosis?** *J Pediatr Orthop.* 2015.
15. Emery KH, Zingula SN, Anton CG, Salisbury SR, Tamai J. **Pediatric Elbow Fractures: A New Angle on an Old Topic.** *Pediatr Radiol.* 2016; 46:61-6.
16. Fader LM, Laor T, Eismann EA, Cornwall R, Little KJ. **Eccentric Capitellar Ossification Limits the Utility of the Radiocapitellar Line in Young Children.** *J Pediatr Orthop.* 2016; 36:161-6.

17. Hopkins TM, Heilman AM, Liggett JA, LaSance K, Little KJ, Hom DB, Minter DM, Marra KG, Pixley SK. **Combining Micro-Computed Tomography with Histology to Analyze Biomedical Implants for Peripheral Nerve Repair.** *J Neurosci Methods.* 2015; 255:122-30.
18. Jain V, Lykissas M, Crawford A. **Neurofibromatosis.** In: B Akbarnia, M Yazici, G Thompson, eds. *The Growing Spine Management of Spinal Disorders in Young Children.* New York: Springer; 2015.
19. Jain V, Zawodny S, McCarthy J. **Etiology of Lower Limb Deformity.** In: S Sabharwal, ed. *Pediatric Lower Limb Deformities Principles and Techniques of Management.* Basil: Springer; 2015:3-13.
20. Jaquith BP, Parikh SN. **Predictors of Recurrent Patellar Instability in Children and Adolescents after First-Time Dislocation.** *J Pediatr Orthop.* 2015.
21. Kreul SM, Sorger JI, Rajamanickam VP, Heiner JP. **Updated Outcomes of Prophylactic Femoral Fixation.** *Orthopedics.* 2016; 39:e346-52.
22. Little K. **Multi-Ligament Laxity.** In: J Abzug, S Kozin, D Zlotolow, eds. *The Pediatric Upper Extremity: Volume 2.* New York: Springer; 2015:1811-21.
23. Little K, Cornwall R. **Congenital Anomalies of the Hand-Principles of Management.** *Orthop Clin North Am.* 2016; 47:153.
24. Little K, Cornwall R. **Closed Reduction and Casting of Forearm Fractures.** In: D Skaggs, ed. *Master Techniques in Orthopaedic Surgery: Pediatrics, Second Edition.* Philadelphia PA: Lippincott Williams & Wilkins; 2015:59-66.
25. Little K, To P, Draeger R. **Galeazzi and Essex Lopresti Injuries.** In: J Abzug, S Kozin, D Zlotolow, eds. *The Pediatric Upper Extremity; Volume 2.* New York: Springer; 2015:1107-20.
26. Lykissas M, Sharma V, Jain V, Crawford A. **Assessment of Rib Hump Deformity Correction in Adolescent Idiopathic Scoliosis with or without Costoplasty Using the Double Rib Contour Sign.** *J Spinal Disord Tech.* 2016; 28:134-39.
27. McCarthy JJ, Alessandrini EA, Schoettker PJ. **Posna Quality, Safety, Value Initiative 3 Years Old and Growing Strong. Posna Precourse 2014.** *J Pediatr Orthop.* 2015; 35:S5-8.
28. Mehlman C. **Neonatal Brachial Plexus Palsy.** In: J Abzug, S Kozin, D Zlotolow, eds. *The Pediatric Upper Extremity; Volume 2.* New York: Springer; 2015:589-605.
29. Mehlman CT, Ain MC. **Evaluation of the Child with Short Stature.** *Orthop Clin North Am.* 2015; 46:523-31.
30. Nikolaou S, Hu L, Cornwall R. **Afferent Innervation, Muscle Spindles, and Contractures Following Neonatal Brachial Plexus Injury in a Mouse Model.** *J Hand Surg Am.* 2015; 40:2007-16.
31. Parikh S. **Patellar Instability Preface.** *Orthop Clin North Am.* 2016; 47:XXII-XXII.
32. Parikh S. **Skeletal Dysplasia and Congenital Malformation Preface.** *Orthop Clin North Am.* 2015; 46:XIX-XX.
33. Parikh S, Lykissas M. **Classification of Lateral Patellar Instability in Children and Adolescents.** *Orthop Clin North Am.* 2016; 47:145.
34. Parikh SN, Lykissas MG, Roshdy M, Mineo RC, Wall EJ. **Pin Tract Infection of Operatively Treated Supracondylar Fractures in Children: Long-Term Functional Outcomes and Anatomical Study.** *J Child Orthop.* 2015; 9:295-302.
35. Samora W, Beran M, Parikh S. **Intercondylar Roof Inclination Angle: Is It a Risk Factor for Acl Tears or Tibial Spine Fractures?** *J Pediatr Orthop.* 2015; 36:e71-4.
36. Schaffzin JK, Mangeot C, Sucharew H, Beck AF, Sturm PF. **Factors Affecting Adherence to a Preoperative Surgical Site Infection Prevention Protocol.** *Infect Control Hosp Epidemiol.* 2016; 37:728-30.

37. Schneider DK, Grawe B, Magnussen RA, Ceasar A, Parikh SN, Wall EJ, Colosimo AJ, Kaeding CC, Myer GD. **Outcomes after Isolated Medial Patellofemoral Ligament Reconstruction for the Treatment of Recurrent Lateral Patellar Dislocations: A Systematic Review and Meta-Analysis.** *Am J Sports Med.* 2016.
38. Zbojniewicz A, Stringer K, Laor T, Wall E. **Juvenile Osteochondritis Dissecans: Correlation between Histopathology and Mri.** *Am J Roentgenol.* 2015; 205:W114-W23.
39. Zbojniewicz AM, Meyers AB, Wall EJ. **Post-Operative Imaging of Anterior Cruciate Ligament Reconstruction Techniques across the Spectrum of Skeletal Maturity.** *Skeletal Radiol.* 2016; 45:517-30.

## Grants, Contracts, and Industry Agreements

### Annual Grant Award Dollars

Investigator	Title	Sponsor	ID	Dates	Amount
Roger Cornwall, MD	The Role of Muscle Satellite Cells in Contracture Format	Orthopaedic Research and Education Fdn	OREF 2013	7/1/2013 - 6/30/2016	\$75,000
Charles T Mehlman DO-MPH	BrAIST 2+ Year follow up	Ira and Libbie Pink Foundation (University of Iowa)		7/1/2012 - 6/30/2017	\$1,650
Peter Sturm, MD	VEPTR Implantation to Treat Children with Early Scoliosis without Rib Abnormalities: A Prospective Multicenter Study	Children's Spine Foundation	CWSD-VEPR	7/1/2011 - 6/30/2016	\$17,499
Eric J Wall, MD	Omega Fellowship Grant for 2015-2016	OMeGA Medical Grants Association	gfpa3147GF	8/1/2015 - 7/31/2016	\$22,000
<b>Total Annual Grant Award Dollars</b>					<b>\$116,149</b>

### Annual Industry Award Dollars

Investigator	Industry Sponsor	Amount
Peter Sturm, MD	Ethicon Edo-Surgery, Inc.	\$54,283
<b>Total Annual Industry Award Dollars</b>		<b>\$54,283</b>