



Children's Hospital of Philadelphia Update



John Flynn, MD and Divya Talwar, PhD, MPH

Pediatric Faculty



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Jason Anari, MD



Alexandre Arkader, MD



Keith Baldwin, MD, MPH, MSPT



Patrick Cahill, MD



Robert Carrigan, MD



Benjamin Chang, MD, FACS



Richard Davidson, MD



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Theodore Ganley, MD



B. David Horn, MD



J. Todd Lawrence, MD, PhD



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Christopher Renjilian, MD



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David Spiegel, MD



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Lawrence Wells, MD



Jennifer Winell, MD

Introduction

The Division of Orthopaedic Surgery at the Children's Hospital of Philadelphia (CHOP) had another successful and productive year of significant growth, accomplishment, and innovation. Upholding our mission and vision to provide the most comprehensive care to our patients, we have continued to expand our clinical, research, and teaching programs. In 2018, US News and World Report ranked the Division of Orthopaedics 2nd in the nation in pediatric orthopaedics.

In 2018, CHOP Orthopaedics continued the Nicholson Visiting Professorship, hosted major conference meetings and Food and Drug Administration (FDA) reviewers, started a FDA investigational drug trial and maintained a device trial, expanded our research coordinator team, obtained significant extramural funding from major funding agencies such as National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), National Science Foundation (NSF), and hired Quality Safety and Value initiatives advisor to improve the efficiency and value initiatives in orthopaedics.

Clinical Program

Our orthopaedics faculty continues to expand and is currently comprised of twenty-seven total providers, which consists of seventeen specially trained pediatric orthopaedic surgeons (twelve operative and five non-operative), five sports medicine-trained pediatricians, two active plastic surgeons, and three transition-to-adult care faculty. Our division welcomed a new faculty member, Dr. Jason Anari, MD (Figure 1) and Dr. Chris Renjilian, MD (Figure 2). Dr. Anari joins our program as new Attending Orthopaedic Surgeon and specializes in the treatment of spine and chest wall disorders in children. Dr. Renjilian is an Attending Physician and will on focus on sports injuries.

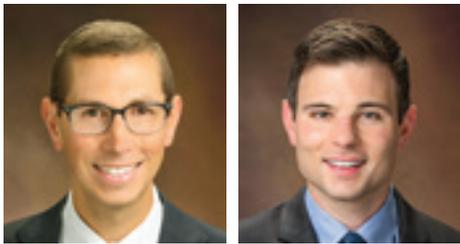


Figure 1. Jason Anari, MD **Figure 2.** Chris Renjilian, MD

Education Program

CHOP Orthopaedics currently funds four one-year clinical fellowships and one one-year research fellowship. The 2018-2019 clinical fellows are Ishaan Swarup, MD (Figure 3); Brendan Williams, MD (Figure 4); Michael Hughes, MD (Figure 5); and Christopher Makarewicz, MD (Figure 6). This year's research fellow is Dr. Daniel Weltsch, MD from Israel (Figure 7). While at CHOP Dr. Weltsch has focused his research efforts on between basic science projects related to cartilage regeneration and clinical research focused on pediatric trauma, neuromuscular conditions, and sports injuries.



Figure 3. Ishaan Swarup, MD **Figure 4.** Brendan Williams, MD **Figure 5.** Michael Hughes, MD



Figure 6. Christopher Makarewicz, MD **Figure 7.** Daniel Weltsch, MD

To celebrate the graduation of the 2017-2018 clinical fellows, the Division hosted the Nicholson Visiting Professor Program and Fellows Graduation & Reunion in June 2018. This year's Visiting Professor was Dr. James McCarthy, who is a professor for the Department of Orthopaedics Surgery at the University of Cincinnati as well as the director of Pediatric Orthopaedic Surgery and the Alvin L. Crawford chair in pediatric orthopaedics at Cincinnati Children's Hospital Medical Center. The program consisted of a mix of short lectures and discussions, a cocktail reception, and research and end-of-the-year remarks from the four fellows.

We continued to hold our Drummond Rising Star Visiting Professorship in October 2018. Current CHOP staff nominate visiting professors. The 2018 Drummond Rising Star Visiting Professor was Benton Heyworth, MD (Figure 8). Dr. Ben Heyworth, Assistant Professor in Orthopaedic Surgery at Harvard Medical School, visited us from Boston Children Harvard. He specializes in pediatric orthopaedic surgery, pediatric orthopaedic trauma, and arthroscopy/sports medicine injuries in the pediatric, adolescent and young adult populations. The Division also continued to host visiting scholars to provide them with an opportunity to observe clinical care of pediatric patients in a high volume, academic setting.



Figure 8. Benton Heyworth, MD

Research Program

Basic Science and Translational Research

This past year, our basic and translational medicine researchers led by Maurizio Pacifici, Ph.D. have made

impressive progress and generated novel, exciting, and far-reaching insights on key aspects of skeletal biology and growth and pediatric musculoskeletal pathologies. Our pediatric musculoskeletal research lab became much stronger with the recruitment of Dr. Fanxin Long (Figure 9) and Dr. Veronique Lefebvre (Figure 10). Our faculty members and their associates, including postdoctoral fellows, visiting scientists and research technicians, continued to tackle and fulfill the goals of several current NIH R01 grants and one Department of Defense (DOD) grant. These biomedical research projects aim to advance current understanding of basic cellular, biochemical and genetic mechanisms that regulate the behavior and function of skeletal forming cells. These basic and key insights and observations are used to predict what may subtend and lead to pediatric pathologies including Multiple Hereditary Exostoses (MHE), Fibrodysplasia Ossificans Progressiva (FOP) and Temporomandibular Joint dysfunction.



Figure 9. Fanxin Long



Figure 10. Veronique Lefebvre

Center for Thoracic Insufficiency Syndrome (CTIS) Frontier Translational Research Program

Through funding from the Frontier Program, the Division's Center for Thoracic Insufficiency Syndrome (CTIS) continued developing innovative projects in translational research. The CTIS program strives to develop novel imaging techniques, construct new metrics for clinical outcomes, and establish reliable evidence to support innovative surgical strategies and devices through its research. These efforts are made possible by the collaboration of a multidisciplinary team of specialists from clinical research, image processing, informatics, and basic sciences/biomechanics. Currently, the CTIS Basic Science Lab is developing an animal model of TIS that will provide a platform for testing novel devices. The animal surgeries and biomechanics testing will be performed at Penn Vet's New Bolton Center. In addition, the CTIS team recently engineered surgical instruments with a tensionometer to quantify the force generated by attending surgeons during VEPTR lengthening procedures.

CHOP lost a true giant in the field of orthopaedic surgery with the passing of Robert Campbell, MD, on July 29, 2018. The Campbell Center for Thoracic Insufficiency Syndrome will carry on Dr. Campbell's legacy and continue to grow, strengthened by the Frontier Program funding.

Genetic Research

CHOP Orthopaedics continues to work in collaboration with the Center for Applied Genomics (CAG), led by Dr. Hakon Hakonarson and Dr. Struan Grant, to compile a registry of DNA and RNA samples. These samples are obtained from patients

and families with a variety of orthopaedic conditions including adolescent idiopathic scoliosis (AIS), osteochondritis dissecans (OCD) of the knee, and multiple hereditary exostoses (MHE). The team is investigating further genetic characterizations of the EXT1/EXT2 mutations harbored by each exostosis and identify second hit(s) across exostoses from the same patient. This pilot project represents the first biomedical research focused on MHE and will provide novel and broadly relevant information. The goal is to translate the findings to prognostic tools based on the severity of the disease and to identify therapeutic means to counter the effects of EXT1/EXT2 plus "second hit" mutations.

Orthopaedic Engineering

Dr. Saba Pasha, Director of Orthopedic Engineering, continues her research on the application of 3D imaging and computer simulation in surgical planning, use of predictive models in surgical decision-making, and the exploration of gait and motion analysis for a more personalized treatment. For her research, Dr. Pasha was awarded grants by POSNA and SRS.

With new emerging technology, such as the EOS x-ray imaging system, comprehensive information about a patient's condition is now readily available. Dr. Pasha's work utilizes advanced imaging and motion analysis to collect data on a range of conditions and patient populations.

Clinical Research

The Division of Orthopaedic Surgery is currently conducting 198 IRB-approved clinical research projects. This includes 80 prospective and observational studies. CHOP Ortho faculty are also members of a number of multicenter study groups, including the Harms Study Group (HSG), Research in Osteochondritis Dissecans of the Knee (ROCK), SCFE Longitudinal International Prospective Registry (SLIP), The Fox Pediatric Spinal Deformity Study (Fox PSDS), Pediatric ACL: Understanding Treatment Operations (PLUTO), Medial Epicondyle Outcomes Multicenter (MEMO) study and International Hip Dysplasia Institute (IHDI). Investigators within the division have been awarded funding from both internal and external sources to conduct these studies. In 2017, the Division published over 160 articles in major orthopaedic journals, including JBJS, JAMA Pediatrics, Annals of Internal Medicine, JPO, and CORR. Members across our division presented 148 presentations at international and national conferences last year alone.

The Division successfully continues to award the annual Benjamin Fox Fellowship Award for medical students who are interested in conducting a year of clinical research within orthopaedics. In July, Scott Lavalva (Perelman School of Medicine at the University of Pennsylvania), Blake Meza (Perelman School of Medicine at the University of Pennsylvania) and Ronit Shah (University of Toledo), were awarded with the fellowship (Figure 11-13).

Recognition and Achievements

Our faculty have assumed several leadership roles within the pediatric orthopaedic community over the past year.

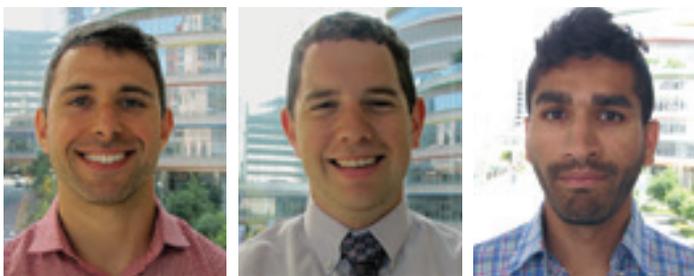


Figure 11. Scott Lavalva **Figure 12.** Blake Meza **Figure 13.** Ronit Shah

Alexandre Arkader, MD was the international faculty “XXXVIII Congreso Annual Sociedad Argentina de Ortopedia y Traumatología Infantil”. Dr. Arkader continues to serve as a reviewer for Journal of American Academy of Orthopaedic Surgeons, Journal of Bone and Joint Surgery Essential Surgical Techniques, BMC Musculoskeletal Disorders and Journal of Children’s Orthopaedics.

Keith Baldwin, MD, MSPT, MPH is the Associate Director of Orthopaedic Trauma in the Division of Orthopedic Surgery. Dr. Baldwin continued his term as president of the Orthopaedic Rehabilitation Association. He currently serves as a reviewer for a number of journals including the BMC Medical Education, BMC Musculoskeletal Disorders, Journal of Bone and Joint Surgery—American, and the American Academy of Pediatrics. He also serves as associate editor for Journal of Orthopedic Trauma and an editorial board member of the American Journal of Orthopedics, Current Orthopaedic Practice and World Journal of Orthopedics. Dr. Baldwin is an active member of CORTICES study group.

Patrick Cahill, MD continued his term as chair of the SRS research grants committee and is a member of POSNA’s Quality, Safety, Value Initiative Committee. He continues to serve as an Associate Editor for Spine Deformity Journal and as a reviewer for the Journal of Bone and Joint Surgery

American and the Thrasher Research Fund. Dr. Cahill is an active member in the Harms Study Group, Children’s Spine Study Group, and Fox Pediatric Spine Deformity study group, which are multi-center groups prospectively researching care improvements for complex pediatric spine deformities. He is now the Director for Center for Thoracic Insufficiency Syndrome.

Robert Carrigan, MD continues to serve on the AAOS CAQH Test Validation Committee, AAOS Appropriate Use Committee, and POSNA Resident Newsletter Committee. He also serves as a reviewer for Journal of Hand Surgery and Clinical Orthopaedics and Related Research.

Richard Davidson, MD has continued to serve as an associate editor for Foot & Ankle, International. He also serves as a reviewer for Clinical Orthopedics and Related Research and Advances in Orthopaedic Society.

B. David Horn, MD continues to serve as a reviewer for journals, such as Clinical Orthopaedics and Related Research (CORR), Pediatric Emergency Medicine, and Pediatrics.

Jack Flynn, MD, Chief of the Division of Orthopaedics, continues to serve his 10-year term as a Director of the American Board of Orthopaedic Surgery. Dr. Flynn is co-editor of Lovell

and Winter’s Pediatric Orthopaedics, Rockwood’s Fractures in Children, Operative Techniques in Pediatric Orthopaedics. He is President of the Children’s Spine Study Group and is active in the Harms Study Group, a multicenter collaboration of researchers studying care improvements for pediatric spine deformity surgery. In the past year, Dr. Flynn also was invited as the visiting professor at Nemours/duPont Hospital for Children, Seattle Children’s Hospital, Johns Hopkins, University of Miami, University of Utah, St. Luke’s Medical Center, and Riley Children’s Hospital.

Theodore Ganley, MD is the Sports Medicine Director at CHOP, continued growth of clinical, research initiatives. Dr. Ganley has continued in several leadership roles with national organizations, such as the chairman for the POSNA Evidence Based Practice Committee, second vice president of the Pediatric Research in Sports Medicine (PRISM) group, co-founder and executive board member for the Research in Osteochondritis Dissecans of the Knee (ROCK) group, executive committee member for the American Academy of Pediatrics, advisory board member for the International Pediatric Orthopaedic Symposium, and program chair for the Philadelphia Orthopaedic Society. Along with his leadership roles, he continues to be actively involved in biomechanical studies utilizing cadaver specimens in collaboration with the Biedermann Lab for Orthopaedic Research and Human Motion Lab. Additionally, he is the site leader for the FDA clinical trial for studying the efficacy and safety of autologous cultured chondrocytes on porcine collagen membrane (MACI).

John Todd Lawrence, MD, PhD continued his collaborative work with Dr. Leo Han at Drexel University. Funded by the National Science Foundation, the project focused on conducting in vitro studies for a novel cartilage repair strategy. He also served as an international faculty member at the Salzburg Medical Seminar in Pediatric Orthopedics in Salzburg, Austria. Dr. Lawrence is an active member of sports medicine multicenter research groups such as PLUTO and he leads a 12-site study group called MEMO. He continues to serve as a reviewer for the American Journal of Sports Medicine (AJSM) and Journal of Shoulder and Elbow Surgery (JSES).

Wudbhav Sankar, MD is the Director of the Young Adult Hip Preservation Program at CHOP. Dr. Sankar currently serves as the chair of the POSNA Fellowship committee and co-director of the International Hip Dysplasia Institute. He remains active in several study groups including Academic Network of Conservational Hip Outcomes Research (ANCHOR), SCFE Longitudinal International Prospective Registry (SLIP) and International Perthes Study Group. Dr. Sankar is currently a reviewer for the Journal of Bone and Joint Surgery, Journal of Pediatric Orthopaedics, and an Editorial Board Reviewer of Techniques in Orthopaedics.

Apurva Shah, MD, MBA started his tenure as the current Director of Clinical Research. He continued to serve as co-PI on the POSNA Directed Research Grant entitled, “Improving value delivery in pediatric distal radius fracture care.” The grant aims to assess practice pattern variation and compare treatment costs across institutions and low- and high-volume centers. Dr. Shah also received a new grant as co-PI from Orthopaedic Trauma

Association titled, "Opioid utilization after rotational ankle fractures". He continued to serve as team leader and traveled to Sigua Tepeque, Honduras for a pediatric hand surgery medical mission.

David Spiegel, MD continued his work with the Children's Hospital of Philadelphia Global Health Pilot Grant. He currently is the chair for International Scholars Program at the American Academy of Orthopaedic Surgeons (AAOS). In collaboration with Dr. Bibek Banskota in Nepal, Dr. Spiegel is conducting the

longest follow-up in the world's literature of patients treated by the Ponseti method in a low-middle income country. Dr. Spiegel continued to be an active academic internationally, giving lectures in Iraq, Nepal and Pakistan.

Lawrence Wells, MD is the Associate Director of the Sports Medicine Performance Center at CHOP and Director of Quality, Safety, Value, and Patient Experience in the Division of Orthopaedic Surgery. Dr. Wells currently serves as the President of Board of Directors for the Philadelphia Orthopaedic Society