

Pediatrics

Faculty



John Flynn, MD



Alexandre Arkader, MD



Keith Baldwin, MD, MPH, MSPT



Patrick Cahill, MD



Robert Campbell, MD



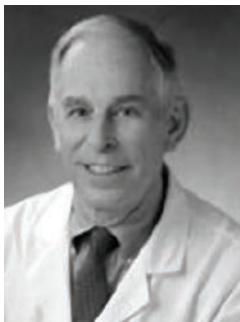
Robert Carrigan, MD



Richard Davidson, MD



Theodore Ganley, MD



Malcolm Ecker, MD



David Horn, MD



John Lawrence, MD



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The Children's Hospital of Philadelphia Division Update



Divya Talwar, PhD, MPH and John (Jack) Flynn, MD

Introduction

The Division of Orthopaedic Surgery at the Children's Hospital of Philadelphia (CHOP) enjoyed another year of significant growth, accomplishment, and innovation. Upholding our mission to provide the most comprehensive care to patients, we have continued to expand our clinical, research, and teaching programs. In 2016, *US News and World Report* ranked the Division of Orthopaedic Surgery 2nd in the nation in pediatric orthopaedic surgery.

In 2016, CHOP Orthopaedics hired one non-operative surgeon, renovated the Nicholson Visiting Professorship, appointed a new manager of Clinical Research, awarded Chair's research grants to four winners totaling \$40,000, received the prestigious CHOP Frontier grant of \$4.5M, 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), renovated the Fellowship recruitment and interviewing process, and continued our partnership with CHOP Office of Clinical Quality Improvement on two major projects (Sports and Spine) to improve the efficiency, safety and value of orthopaedic surgery.

Clinical Program

Our orthopaedic faculty continues to expand and is currently comprised of thirty total providers, including nineteen specially-trained pediatric orthopaedic surgeons (sixteen operative and five non-operative), six pediatricians with sports medicine training, and three transition-to-adult care faculty. CHOP Orthopaedics is pleased to announce the addition of a new provider: Dr. Vincent Deeney. Dr. Vincent Deeney (Figure 1). Dr. Deeney joins our team as a non-operative orthopaedic surgeon focusing on spine. In 2016, the department also saw significant growth in the mid-level provider staff. There are currently 24 nurse practitioners and physician assistants, and six athletic trainers who evaluate, diagnose, and treat a full range of musculoskeletal disorders.



Figure 1. Dr. Vincent Deeney

Education Program

CHOP Orthopaedics currently funds four one-year clinical fellowships and one one-year research fellowship. The 2016-2017 clinical fellows are Daniel Miller, MD; Todd Blumberg, MD; Andrew Gambone, MD; and Susan Nelson, MD (Figure 2). This year's research fellow is Mahmoud El-Magd, MD from

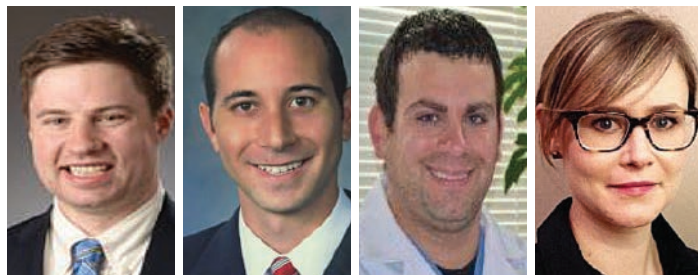


Figure 2. (From left to right) Dr. Daniel Miller, Dr. Todd Blumberg, Dr. Andrew Gambone, Dr. Susan Nelson.

Egypt (Figure 3). While at CHOP Dr. El-Magd has focused his research efforts on trauma and lower limb deformities.



Figure 3. Dr. Mahmoud El-Magd

We held our inaugural Drummond Rising Star Visiting Professorship in October 2016. The nominees are rising stars in pediatric orthopaedics that completed their fellowship here at the Children's Hospital of Philadelphia, Department of Orthopaedics. The 2016 Drummond Rising Star Visiting Professor was Michelle S Caird, MD (Figure 4), who is an Associate Professor of Orthopaedic Surgery at the University of Michigan in the Division of Pediatric Orthopaedics and serves as Program Director for the Orthopaedic Surgery Residency. Dr. Caird is one of ten 2015 American Academy of Orthopaedic Surgery Leadership Fellows.

The Division also continues to host visiting scholars to provide them with an opportunity to observe clinical care of pediatric patients in a high volume, academic setting. Over the past year, the Division hosted Dr. Kunbo Park, Assistant Professor of Pediatric Orthopaedic Surgery at Inje University Haeundae Paik Hospital in Busan South Korea.



Figure 4. Michelle S. Caird

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 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, one Department of Defense (DOD) grant and one Veterans Administration (VA) grant.

Our clinical division remains a major national and international center of diagnosis, care and surgical treatment for children affected by MHE. Our scientists are closely collaborating with our clinicians and clinicians-scientists, in particular Dr. Alexandre Arkader, to further examine the genetics of MHE, identify second hits needed to cause tumor formation, and eventually obtain insights into genotype-phenotype correlations that could be used for diagnostic and prognostic purposes. Our faculty member, Dr. Eiki Koyama, joined forces with Dr. Hyun-Duck Nah in the CHOP Division of Plastic and Reconstructive Surgery to study the development and growth of the temporomandibular joint (TMJ) and to identify possible therapeutic means to treat TMJ osteoarthritis, a debilitating condition particularly common in women.

Our basic research work on FOP has led to a current phase 2 double-blind clinical trial sponsored by the Canadian-based pharmaceutical company Clementia. The clinical trial was launched in July 2014 in close collaboration with our colleagues at the Penn FOP Research Center—Drs. Fred Kaplan, Bob Pignolo and Eileen Shore. The results of the phase 2 trial were disclosed for the first time in October 2016 and are exceedingly promising. The drug was well tolerated by the patients and there was a considerable decrease in their HO and improved skeletal function. This work is a major milestone achievement for our basic research division and shows that years of basic research can and do translate into possible new treatments for severe pediatric skeletal disorders.

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

In 2016 CHOP awarded three-year funding support of 4.5 million dollars in the Frontier Program funding to the Division's Center for Thoracic Insufficiency Syndrome (CTIS) to encourage innovation in translational research.

The CTIS Basic Science Research Lab, established with funding from the Frontier Program, is developing a rabbit model of thoracic insufficiency syndrome. Dr. Casey Olson, a bioengineer, leads this lab. It is expected that this model will improve understanding of the biomechanics and the pathobiology of thoracic insufficiency syndrome to help generate new medical and surgical treatments that can be pioneered at CHOP.

The CTIS Advanced Imaging Research Program has now been active for 5 years with collaboration from the University of Pennsylvania Department of Radiology Medical Image Processing Group (MIPG), led by Dr. Jay Udupa, and Dr. Sriram Balasubramanian in the Department of Bioengineering at Drexel University. The CHOP/MIPG collaboration has focused on dynamic lung MRI (dMRI) image analysis of thoracic insufficiency patients to understand the biomechanics of TIS

and quantify the degree of dysfunction of the rib cage and diaphragm as a new metric to define thoracic performance. Refinement of the software for the quantification technique along with analysis of dMRIs of CTIS patients are now being supported by a NIH R21 grant. Future work will focus on creating a large database of normative data and standard subjects through an R01 grant-funded initiative. The Drexel University Bioengineering/CTIS relationship is also a long-standing collaboration which centers on detailed software analysis of CT scans and EOS® biplanar radiographs of TIS patients. Recent funding will strengthen this collaboration with many new research efforts.

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). This past year, in conjunction with colleagues in genetics and basic science at CHOP, preliminary results from a study of genetic predispositions for MHE were published in *Bone*. To further investigate genetic characterizations of the EXT1/EXT2 mutations harbored by each exostosis and identify second hit(s) across exostoses from the same patient, Dr. Arkader was awarded a competitive faculty award from Division of Orthopaedics. This pilot project represents the first biomedical research focused on MHE.

Orthopaedic Engineering

Dr. Saba Pasha, Director of Orthopedic Engineering, continues her research on application of 3D imaging and computer simulation in surgical planning, use of predictive models in surgical decision-making, and exploring gait and motion analysis for a more personalized treatment. In 2016, Xochitl Mellor joined our team as research technician. Dr. Pasha's work utilizes advanced imaging and motion analysis to collect data on a range of conditions and patient populations. These tools will help us to visualize and determine the best treatment options for patients.

Clinical Research

The Division of Orthopaedic Surgery is currently conducting 158 IRB-approved clinical research projects. This includes 70 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), The Fox Pediatric Spinal Deformity Study (Fox PSDS), PLUTO (Pediatric ACL: Understanding Treatment Operations, and International Hip Dysplasia Institute (IHDI). In 2016, the Division published over 114 articles in major orthopaedic journals, including JBJS, JAMA Pediatrics, JPO, and CORR. Members across our division presented 123 presentations at



Figure 5. (From left to right) Christopher DeFrancesco, Taylor Jackson, and Brendan Striano.

international and national conferences last year alone. Our attending surgeons presented 47 invited presentations.

The Division 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 June, Christopher DeFrancesco (Perelman School of Medicine at the University of Pennsylvania), Taylor Jackson (University of Texas Southwestern Medical Center) and Brendan Striano (Rutgers Robert Wood Johnson Medical School), were awarded with the fellowship (Figure 5).

Recognition and Achievements

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

Alexandre Arkader, MD co-directed the 5th Combined SLOATI/POSNA/EPOS/ meeting, Sao Paulo Brazil Oct 2017. He also served as an International Faculty at the Salzburg Medical Seminar in Pediatric Orthopedics in Salzburg, Austria. Dr. Arkader continues to serve as a reviewer for *Current Orthopaedic Practice*, *Journal of Bone and Joint Surgery*, *Clinical Orthopaedics and Related Research* and *Journal of Pediatric Orthopaedics*. He was invited as a visiting professor at Saint Peter's University Hospital, NJ.

Keith Baldwin, MD, MSPT, MPH is the current Director of Clinical Research and Associate Director of Orthopaedic Trauma in the Division of Orthopedic Surgery. This past year he earned the Jacqueline Perry Award Paper from the Orthopaedic Rehabilitation Organization. Dr. Baldwin was elected as the president of the Orthopaedic Rehabilitation Association and also served as course director for the 2016 Orthopaedic Rehabilitation Association Annual Meeting. Dr. Baldwin 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*.

Patrick Cahill, MD was selected to serve as the program chair at Penn's Rare Disease course on SMA and the SMA course at IPOS. In addition, he served as the director of an ICL course on complications in pediatric spine deformity. Dr. Cahill also serves 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.

Robert Campbell, MD continues to expand and develop the Center for Thoracic Insufficiency at CHOP and was awarded the prestigious CHOP Frontier Grant. Dr. Campbell and Dr. Udupa (Perelman School of Medicine) continued their work on the NIH R21 Grant. He continues to serve as a member of the Early Onset Scoliosis Task Force, FDA Grants for National Non-Profit Pediatric Device Consortia, and FDA Office of Orphan Product Development

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 is the current chair of the AAOS Pediatric Evaluation Committee and is a member of the Board of Directors for Philadelphia Orthopaedic Society. He 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 Orthopaedic Surgery, continues to serve his 10-year term as a Director of the American Board of Orthopaedic Surgery and his 4-year term as AAOS Chair of Continuing Medical Education. He also co-chairs the sold-out Spine Surgery Safety Summit. Dr. Flynn is co-editors of two textbooks: *Rockwood and Wilkins' Fractures in Children* and *Operative Techniques in Orthopaedic Surgery—Pediatrics*. 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 a visiting professor at Columbia University, Harvard University and Northwestern University.

Theodore Ganley, MD is the Sports Medicine Director at CHOP, supporting the continued growth of clinical, research, and outreach initiatives. Dr. Ganley has continued in several leadership roles, 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 vice president for the Philadelphia Orthopaedic Society.

John Todd Lawrence, MD, PhD, was awarded the National Science Foundation grant through collaborative research with

the PI at Drexel University, Dr. Leo Han, to conduct 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. 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) 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 continues to serve as co-PI on a POSNA Directed Research Grant. Dr. Shah also received the Peter F. Armstrong, MD Shriners Hospitals for Children Award, Best Quality, Safety, Value Paper for his research presentation at

POSNA, "Determining the Prevalence and Costs of Unnecessary Referrals in Adolescent Idiopathic Scoliosis." In October 2016, Dr. Shah served 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. 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 Canada. For his international work, the Scoliosis Research Society's (SRS) awarded Dr. Spiegel the prestigious Walter P. Blount Humanitarian Award and John E. Lonstein, MD and Harry L. Shufflebarger, MD Lifetime Achievement Award.

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.