**Georgia Tech and Shriners Hospitals for Children Collaborate on Research Data Resources**

The collaboration between experts at Georgia Institute of Technology and Shriners Hospitals for Children® that was launched last year is expanding to encompass the fields of precision medicine and big data analysis and interpretation in 2021.

The new initiative will create pilot research projects and tools that align with the needs and aims of Shriners Hospitals’ network of clinicians to enable state-of-the-art clinical research and facilitate clinical practice. The seed grants will support Georgia Tech faculty and research associates working directly with Shriners Hospitals for Children physicians and surgeons. The overall goal remains to improve the lives of children treated at Shriners Hospitals.

“This particular round of research is all about going further with information and data, and making it accessible for research and patient care,” said Leanne West, chief engineer of pediatric technologies at GIT. “With the unique data from Shriners Hospitals and GIT’s expertise in data analytics, we’re going to be able to provide more specific information for diagnosis and treatment of future Shriners Hospitals for Children patients.”

The initial seed grant opportunity supported by Shriners Hospitals inspired investigator partners to conceptualize seven innovative clinical research projects. “These seven projects represent the breadth of care provided at Shriners Hospitals, and they are very focused on the specific research needs for each of the patient populations,” said Coleman Hilton, research informatics manager at Shriners Hospitals for Children, who is responsible for addressing resource needs from the teams.

The teams, awarded two-year seed grants by Shriners Hospitals of either $50,000 or $150,000, are led by principal investigators from each institution. May Dongmei Wang, a professor in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University, is the Georgia Tech principal investigator for three of the seven projects this year.

Wang’s lab has been busy working with Shriners Hospitals, “to establish a new Fast Healthcare Interoperability Resources (FHIR) prototype as the backend server” for research projects, she said. “We want to enable interoperable clinical data management across all Shriners Hospitals locations.”

FHIR is the standard for joining disparate systems together in the exchange of electronic health records. It was developed by HL7 International, the non-profit organization that develops standards and solutions to empower global health data interoperability.

In this initial 2021 round of seed projects, Wang said, “We’ll assist four Shriners Hospitals locations to develop three FHIR applications to showcase the acceleration of the clinical informatics pipeline from idea, to data, to insights, using FHIR.”

This innovative initiative has the potential to improve the lives of children around the world for years to come.

“This program will allow us to capture, access, share, and analyze data, including diagnostics, radiographic images, and genomics in a way that is not currently available in existing Shriners Hospitals for Children patient registries and research databases,” said Marc Lalande, vice president of Shriners Hospitals for Children research programs. “The infrastructure that will be developed will not only enhance our clinical research capabilities, but also advance our clinical practices.”

The seven projects funded for 2021 are as follows:

***3D Graphical Scale for Assessing Hip Functional Range of Motion***

**Principal Investigators:** Megan Denham, senior research associate, Georgia Tech Research Institute; Harold van Bosse, M.D., orthopaedic surgeon, Shriners Hospitals for Children — Philadelphia

**Project Synopsis:** Hip pathology in babies and children can affect long-term development and lead to malformations and deformations and other conditions. While surgery can correct pediatric hip conditions and optimize functionality and range of motion, there currently are no outcome measurements that can adequately analyze hip function across the spectrum of conditions; no way to compare results of different treatment modalities; and none that follow results over time and growth.

Utilizing a computer model to graph range of motion, the team will develop a pediatric hip score system, allowing for more precise evaluation of various treatments of hip contractures in children across the spectrum of neuromuscular conditions (such as cerebral palsy and muscular dystrophies). They intend to develop a mobile application that can quantify function with a single figure, to assist clinicians with making more practical evaluations, leading to more valid comparisons of treatment options.

***Craniofacial Microsomia (CFM) Informatics Infrastructure***

**Principal Investigators:** May Dongmei Wang, professor, Wallace H. Coulter Department of Biomedical Engineering (Georgia Tech and Emory University); Chad Purnell, M.D., board-certified craniofacial and plastic surgeon, Shriners Hospitals for Children — Chicago

**Project Synopsis:** CFM is a clinical conundrum – it is the second most common craniofacial anomaly, but its pathogenesis is not clearly understood. The research team’s long-term goal is to develop an AI model of how genes and environmental factors conspire in CFM. This seed grant will establish the first step in the process, creating a secure framework for sharing phenotypic, clinical, radiologic, and genetic data between Shriners Hospitals for Children — Chicago and Georgia Tech.

Specific aims for the seed project include creating a set of minimum common data elements for CFM research data, and developing a system to allow secure, high-volume data sharing between institutions, which will leverage the Wang lab’s expertise in developing parallel FHIR infrastructure, enabling flexible integration of data sets within the Shriners Hospitals for Children system.

***GL-SMART (Greenville-Lexington Shriner Multisite AI-enabled Rehabilitation Technology)***

**Principal Investigators:** May Dongmei Wang, professor, Wallace H. Coulter Department of Biomedical Engineering; J. Michael Wattenbarger, M.D., chief of staff, Shriners Hospitals for Children — Greenville; Henry J. Iwinski, M.D., chief of staff, Shriners Hospitals for Children — Lexington

**Project Synopsis:**This is a multi-site collaboration between Shriners Hospitals for Children in Greenville (SC) and Lexington (KY), the Wallace H. Coulter Department of Biomedical Engineering (BME) at Georgia Tech and Emory University, and Georgia Tech’s School of Electrical and Computer Engineering (ECE). Together, they intend to develop an advanced technology platform to improve scoliosis patient care at multiple Shriners Hospital sites.

The two Shriners Hospital sites involved in the study have accumulated extensive data from more than 1,000 patients over the past decade – insight that can help clinicians make better care decisions. Wang’s lab will develop a FHIR application to enable clinicians at both Shriners Hospitals sites to share and access clinical data seamlessly. Wang also is developing a multimodal AI algorithm to streamline the process of predicting clinical outcomes in scoliosis patients.

***HR-pQCT Informatics Infrastructure***

**Principal Investigators:** May Dongmei Wang, professor, Wallace H. Coulter Department of Biomedical Engineering; Gary S. Gottesman, M.D., Center for Metabolic Bone Disease, Shriners Hospitals for Children — St. Louis

**Project Synopsis:** For patients with musculoskeletal disorders, bone mineral density scans are critical in the evaluation, surveillance, and treatment. High resolution peripheral computed tomography (HR-pQCT) is a revolutionary advancement as a new 3-D skeletal imaging tool with the ability to differentiate internal structures from cortical bone, and inform the pathophysiology of bone diseases, providing insights into bone biology, and better treatments.

Using all of that illuminating information is hampered by the inability to query the data based on significant research parameters, which is crucial to gaining deeper insight into bone disorders. So the researchers plan to build an integrative, relational database to house the data, design a FHIR interface, then populate the database with patient data, and explore options for automating the extraction, transformation, and loading of new HR-pQCT data as it is generated.

***Machine Learning to Predict Fentanyl Efficacy and Adverse Effects to Advance Precision Medicine***

**Principal Investigators:** Jeffrey Skolnick, School of Biological Sciences, Georgia Tech; Kristin Grimsrud, Assistant Clinical Professor, University of California-Davis

**Project Synopsis:** Personalized pain management continues to be a challenging issue for patients and clinicians. Although advances in pharmacogenetics aid in decoding genetic variants, no one really knows how a given patient will respond to a particular drug until it is administered.

To address this problem, deidentified data from two ongoing Shriners Hospitals for Children studies will be used as input for machine learning (ML) algorithms to predict if a patient will experience a decrease in pain or adverse events following fentanyl administration. Skolnick’s lab will then use an ML tool it developed, MEDICASCY, for disease indication, mode of action, small molecule drug efficacy, and side effect predictions. MEDICASCY predictions will then be combined with an enzyme inference algorithm, anonymized clinical data, and information on fentanyl blood concentrations to generate specific predictions for fentanyl efficacy and adverse effects.

***Platform Architecture and Machine Learning for Arthrogryposis***

**Principal Investigators:** Tony Pan, Research Scientist, institute for Data Engineering and Science (IDEaS) at Georgia Tech; Noémi Dahan-Oliel, Ph.D., OT, clinical research coordinator, Shriners Hospitals for Children — Canada

**Project Synopsis:**Three Shriners Hospitals for Children locations – Chicago, Greenville, and Montreal – are involved in this project with Georgia Tech to address important knowledge gaps in understanding arthrogryposis multiplex congenita (AMC), a rare (1 in 3,000 live births) chronic musculoskeletal disease. Shriners Hospitals will identify the underlying causes, risk factors, and distribution of AMC, documenting interventions and outcomes, and determining genetic and/or environmental factors.

Pan and his team at Georgia Tech essentially are going to help make the data more accessible, developing a computational framework for machine learning to ultimately enable precision medicine. The researchers will design and implement a system to meet the needs for this project by deploying high-performance computing and cloud friendly cyber infrastructure to enable ad-hoc, on-demand, and reproducible data analysis with low deployment cost.

***Sports Medicine Registry***

**Principal Investigators:** Minoru Shinohara, Associate Professor, School of Biological Sciences, Georgia Tech; Corinna Franklin, M.D., orthopaedic surgeon and director of sports medicine, Shriners Hospitals for Children — Philadelphia

**Project Synopsis:** Six Shriners Hospitals for Children locations (Northern California, Erie, Chicago, Portland, Philadelphia, Montreal), as part of the Shriners Sports Medicine Consortium, are working with researcher Minoru Shinohara, who directs the Human Neuromuscular Physiology Lab at Georgia Tech. Their goal is to develop a comprehensive registry that will help clinical researchers answer many large-scale questions in pediatric sports medicine.

Shinohara, and his Georgia Tech and Shriners Hospitals for Children colleagues, will identify the core data elements to use from Shriners Hospitals’ motion analysis centers, surgical procedures, and rehab/clinical information. Ultimately, they intend to create a sports medicine registry that will be easily accessible to researchers within the consortium, giving Shriners clinicians an opportunity to have a greater impact in the treatment of pediatric sports injuries.

**About Shriners Hospitals for Children**

Shriners Hospitals for Children is changing lives every day through innovative pediatric specialty care, world-class research and outstanding medical education. Our health care system provides care for children with orthopaedic conditions, burns, spinal cord injuries, and cleft lip and palate. All care and services are provided regardless of the families’ ability to pay. Since opening its first location in 1922, the health care system has treated more than 1.4 million children. To learn more, please visit shrinershospitalsforchildren.org.