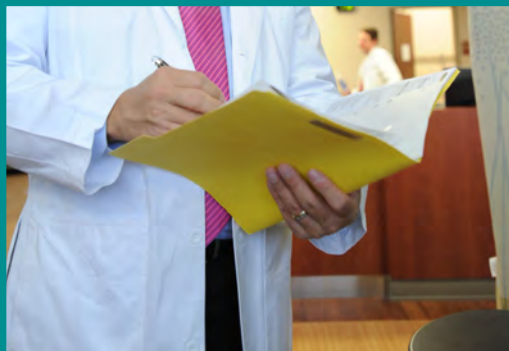


# RESEARCH HIGHLIGHTS 2014



Carolinas HealthCare System





## A LETTER FROM DR. GIBBS

2014 was a year marked by change. At Carolinas HealthCare System, we navigated changes to the healthcare landscape, including lower reimbursements for some services; changes to System priorities; and changes to the organizational structure regarding academics and research. Despite many changes and challenges, we continued to refine the strategy and focus of research investment on investigation and discovery that ultimately improves the care of our patients. Our work has a tangible and durable impact on patients who choose Carolinas HealthCare System every day, as well as others across the globe through collaboration and the dissemination of knowledge.

The content within this publication highlights the increasing strides in excellence that our researchers make in translational, clinical and outcomes research. With a keen eye on value and cost, we put the patient first, always.

Our commitment to improving patient outcomes was powerfully evident when more than 200 Carolinas HealthCare System clinician researchers, nurses, scientists, staff and administrators gathered in November to illuminate our growing efforts in the field patient-centered outcomes research. Internal and external experts shared knowledge, ideas and tactics that will better equip us to achieve national stature in this arena.

I hope you find the information in the pages that follow informative and compelling. Carolinas HealthCare System is poised for continued success in research and I am proud to be part of One Team that is so committed to improving the outcomes and well-being of patients.

Sincerely,

**Michael A. Gibbs, MD, FACEP**  
Chairman of Emergency Medicine  
Carolinas Medical Center  
Vice President of Research  
Carolinas HealthCare System



## TABLE OF CONTENTS

BEHAVIORAL HEALTH	4
LEVINE CANCER INSTITUTE	5
Solid Tumor Oncology and Investigational Therapeutics .....	5
Hematology Oncology and Blood Disorders .....	7
Cancer Pharmacology .....	7
NEUROSCIENCES	9
Department of Neurology at Carolinas Medical Center .....	9
NorthEast Neurology at Carolinas Medical Center-NorthEast .....	10
SANGER HEART & VASCULAR INSTITUTE	11
Clinical Research Program: Adult Cardiology, Pediatric Cardiology, Adult and Pediatric Cardiothoracic Surgery, and Vascular Surgery and Medicine .....	11
Bridges Molecular Cardiac Surgery Research Laboratory .....	12
PEDIATRICS	14
Sanger Heart & Vascular Institute Pediatric Research Program .....	14
Division of Critical Care .....	14
Division of Pediatric Gastroenterology, Hepatology and Nutrition .....	14
Division of Pediatric Infectious Disease and Immunology .....	15
Division of Neonatology .....	16
Division of Pediatric Nephrology .....	16
Division of Pediatric Rheumatology .....	16
Pediatric Muscular Dystrophy Research within the Division of Clinical Genetics .....	16
McColl-Lockwood Laboratory for Muscular Dystrophy Research .....	17
FAMILY MEDICINE	18
RADIOLOGY AT CAROLINAS MEDICAL CENTER-NORTHEAST	20
ORAL MEDICINE	20
EMERGENCY MEDICINE	23
PHYSICAL MEDICINE AND REHABILITATION	24
ORTHOPAEDICS	26
Orthopaedic Clinical Research .....	26
Carolinas Trauma Network Research Center of Excellence .....	26
Orthopaedic Research Engineering Laboratory .....	26
Orthopaedic Research Biology Laboratory and Osteoarthritis .....	28
INTERNAL MEDICINE	29
Department of Internal Medicine .....	29
Division of Hepatology .....	30
Liver Pathobiology Laboratory .....	30

Rheumatology at Carolinas Medical Center-NorthEast .....	32
Integrative Medicine at Carolinas Medical Center-NorthEast .....	32
<b>GENERAL SURGERY</b> .....	<b>33</b>
Surgical Oncology .....	33
Hepato-Pancreato-Biliary Surgery .....	33
Trauma Surgery .....	35
Transplant Surgery .....	35
Gastrointestinal and Minimally Invasive Surgery .....	35
<b>OBSTETRICS AND GYNECOLOGY</b> .....	<b>37</b>
Cord Blood Research at Carolinas Medical Center-NorthEast .....	37
Division of Reproductive Endocrinology .....	37
Division of Maternal Fetal Medicine and Charlotte Fetal Care Center .....	38
Division of Gynecologic Oncology .....	38
Division of Urogynecology/Female Pelvic Medicine and Reconstructive Surgery .....	38
<b>NURSING</b> .....	<b>39</b>
<b>CAROLINAS SIMULATION CENTER</b> .....	<b>39</b>
<b>DICKSON ADVANCED ANALYTICS</b> .....	<b>41</b>
<b>CAROLINAS HEALTHCARE SYSTEM BIOSPECIMEN REPOSITORY</b> .....	<b>43</b>
<b>CORE LABORATORIES</b> .....	<b>44</b>
Immune Monitoring Core Laboratory .....	44
Mass Spectrometry Core Facility .....	45
Molecular Biology Core Facility .....	46
Research Histology and Confocal Core Laboratory .....	46
<b>CAROLINAS HEALTHCARE SYSTEM SUMMER RESEARCH SCHOLARS</b> .....	<b>47</b>
<b>NORTHERN REGION RESEARCH CENTER AT CAROLINAS MEDICAL CENTER-NORTHEAST</b>	
NorthEast Neurology .....	10
Radiology .....	20
Rheumatology .....	32
Integrative Medicine .....	32
Cord Blood .....	37
<b>INTELLECTUAL PROPERTY</b> .....	<b>51</b>
<b>EXTERNAL FUNDING FOR RESEARCH</b> .....	<b>53</b>
<b>PUBLICATIONS</b> .....	<b>62</b>



## BEHAVIORAL HEALTH

According to the World Health Organization, dementia, a cognitive neurodegenerative disorder, affects more than 44 million individuals worldwide. Almost 70 percent of these cases are a result of pathophysiological processes associated with Alzheimer's disease (AD). There are 5.3 million Americans with AD in the United States alone. Every 67 seconds, someone in the US is diagnosed with AD. Total payments for healthcare, long-term care and hospice for individuals with AD and other dementias are projected to increase from \$200 billion in 2012 to \$1.1 trillion in 2050. In the US, the mortality rate from AD is higher than that of breast cancer and prostate cancer (the two most commonly diagnosed types of cancer) combined. However, the level of research spending on AD is one twelfth of that spent on cancer research.

The development of new and effective therapeutics for AD has proven to be very difficult. In the most recently conducted analysis of clinical studies conducted from 2002 to 2012 from ClinicalTrials.gov, researchers from the Cleveland Clinic Lou Ruvo Center for Brain Health found that out of 244 new molecular entities and compounds tested, only one agent (memantine) received a regulatory approval as a symptomatic cognitive enhancer (in 2004). Therefore, the failure rate was 99.6 percent.

A vast majority of new drugs in development were targeting a neuronal loss in the hippocampus and temporal cortex of the brain associated with the pathological hallmarks of AD (amyloid- $\beta$  ( $A\beta$ ) plaques and neurofibrillary tangles). However, there are several other features implicated in the pathophysiology of AD, such as neurotransmitters, neurotrophin deficiency, oxidative stress and mitochondrial dysfunction that could be valid therapeutic targets.

In 2014, the multidisciplinary team of neurologists, radiologists, and primary care physicians and investigators under the leadership of Oleg V. Tcheremissine, MD, of the Department of Psychiatry and Behavioral Sciences continued to grow and advance its portfolio of international multicenter clinical trials for the treatment of AD. In addition, work continued on the phase III trial of Solanezumab (Eli Lilly and Company's LY2062430); a humanized monoclonal IgG1 antibody directed against the A $\beta$  peptide and designed to specifically bond soluble species of A $\beta$ . Additionally, the Behavioral Health Research Center was selected to participate in the phase III clinical trial examining the efficacy and safety of a novel compound – EPV-6124 – a selective agonist of the  $\alpha$ -7 nicotinic acetylcholine receptor. The results from earlier trials have indicated that this compound is safe, well-tolerated and promising with respect to its cognitive benefits. Many other clinical programs from the next generation of therapeutic targets are currently under consideration.

Looking forward to 2015, Carolinas HealthCare System is uniquely positioned to establish robust clinical services for the patients with AD by leveraging data from the large patient population and utilizing a multidisciplinary approach to the treatment of complex, non-linear disorders.

## LEVINE CANCER INSTITUTE

Clinical and translational research in oncology at the Levine Cancer Institute has expanded rapidly in 2014. New translational research laboratories have opened, clinical research tools have been developed and Levine Cancer Institute investigators have begun the development of their research programs and investigator-initiated clinical trials. The goal is to implement studies and tools that will bring cutting-edge personalized molecular medicine to our patients, improve the care of our cancer patients and enhance cancer care globally. To accomplish this goal, Levine Cancer Institute works with many Carolinas HealthCare System departments (e.g., Surgical Oncology, Radiation Oncology, Orthopaedics, Pathology) utilizing a multidisciplinary approach to both patient care and research. The multidisciplinary teams have presented their work at national conferences, such as the American Society of Clinical Oncology (ASCO) and American Society of Hematology (ASH) annual meetings, and published important findings in peer-reviewed scientific publications.

### Solid Tumor Oncology and Investigational Therapeutics

The Levine Cancer Institute Department of Solid Tumors and Investigational Therapeutics developed and initiated original, "homegrown" research studies this year. Three investigator-initiated clinical trials were opened by the end of 2014 with more than a dozen additional studies being developed.

Investigator-initiated clinical trials opened during 2014:

- A study led by J. Stuart Salmon, MD, opened during summer 2014 at 12 Levine Cancer Institute sites in North and South Carolina to evaluate the efficacy of the drug regorafenib targeting multiple kinase receptors thought to be involved in cancer growth in patients with advanced, previously-treated pancreatic cancer.
- A clinical trial led by Kathryn Mileham, MD, opened for patients with advanced, squamous non-small cell lung cancer to investigate the use of combination nab-paclitaxel and carboplatin to improve tumor response rates.
- A translational research study led by Earle Burgess, MD, opened to assess biomarker expression in muscle-invasive bladder cancer patients in tissue and circulating tumor cells which may lead to a non-invasive method to assess whether treatment is effective.



These studies include tissue and blood sample collection in collaboration with the Carolinas HealthCare System Biospecimen Repository (BSR) to seek better understanding of how the drugs work and potential markers that correlate with response or resistance to treatments. Additional investigator-initiated studies for patients with glioblastoma (PI: Ashley Sumrall, MD) and breast cancer (PI: Lejla Hadzikadic-Gusic, MD) are planned to open in early 2015.

In addition to studies being developed by Levine Cancer Institute, they are helping to lead development of early-phase drugs through widespread participation in national and international clinical research studies, offering important options for patients as demonstrated by high accrual numbers for trials with drugs targeting cancer growth or boosting the patient's immune system to fight cancer (immunotherapy). Examples include trials that specifically inhibit the T790M mutation in EGFR (AstraZeneca's AZD9291; PI: Daniel Haggstrom, MD), cyclin-dependent kinase (CDK; Eli Lilly and Company's LY2835219; PI: Edward Kim, MD), and MET receptor (Eli Lilly and Company's LY2875358; PI: Kathryn Mileham, MD), and the programmed cell death 1 receptor (PD-1) on activated T-cells (Bristol-Meyers Squibb's nivolumab; PI: Asim Amin, MD, PhD). Dr. Amin presented several studies related to treatment of metastatic renal cell carcinoma patients with immunotherapy at the 2014 ASCO Annual Meeting.

Using technology to enhance patient care is vital for a healthcare system that spans two states. To assist in better management of patients' side effects from treatment, a team at Levine Cancer Institute developed a mobile application that patients can use anytime to record and transmit information to their clinical care team (led by Derek Raghavan, MD, PhD). Another tool, EAPathways, was developed for physician use to enable consistent, high-quality, personalized care and easy access to clinical trials for all Levine Cancer Institute patients (led by Edward Kim, MD).





## Hematology Oncology and Blood Disorders

The Levine Cancer Institute Department of Hematology Oncology and Blood Disorders also developed a number of investigator-initiated studies and led studies in new treatments for multiple hematologic malignancies. Levine Cancer Institute was also asked to join the Multiple Myeloma Research Consortium to leverage knowledge from world-class researchers from more than 90 institutions to study patients' genetics and responses to treatment (led by Saad Usmani, MD).

The department opened a new adult bone marrow transplant center at Levine Cancer Institute. Bone marrow transplant is a curative treatment for blood cancers such as leukemia; however, several pre- and post-transplant drugs must be administered to either prepare the patient for transplant or reduce the risk of complications following a transplant. Studies led by this team and in collaboration with the Levine Cancer Institute Department of Cancer Pharmacology have already begun to assess additional prophylactic measures that may reduce the chance of infection or graft versus host disease (GVHD) complications.

The Hematologic Oncology Translational (HOT) Laboratory opened in early 2014 and is the first laboratory at Carolinas HealthCare System for dedicated research to better understand the pathogenesis of hematologic malignancies. This laboratory team is comprised of senior scientists (Lawrence Druhan, PhD, and Sarah Baxter, PhD), technicians and trainees (currently: a Levine Scholar from UNCC; an ASH Minority Medical Student fellow; a Davidson Scholar, and an international medical student) and is led by Belinda Avalos, MD, and Jonathan Gerber, MD.

The laboratory is developing novel prognostic tools and identifying more effective treatment approaches for patients affected by myeloid malignancies. It is also one of only a few laboratories in the world with expertise in isolating relatively rare leukemia stem cells (LSCs). LSCs are resistant to many therapies and have been found to be highly predictive of eventual disease relapse in patients who achieved complete remission. Building on these findings and the assay they previously developed to detect and distinguish LSCs from normal hematopoietic stem cells, they are further characterizing the LSCs at the cellular and molecular level (e.g., transcriptome, proteome and metabolome) to improve detection and identification of novel therapeutic targets to prevent relapse. To support this goal, they established a repository of samples from patients with hematologic malignancies and healthy patients for comparison, through collaboration with CMC Orthopaedic Surgery.

The HOT Laboratory is expanding its research in abnormalities of cell survival, proliferation and differentiation – several hallmarks of hematologic malignancies. Previously, members of the laboratory elucidated important roles for leucine rich alpha-2 glycoprotein (LRG) in myeloid cell survival and differentiation. Subsequently, it was reported that LRG has a role in promoting angiogenesis and may be a marker for a variety of cancers and inflammatory conditions. Further studies in the HOT Laboratory on interactions and signal transduction of LRG, suggest a novel mechanism of hematopoiesis modulation, involving extracellular release of LRG from neutrophils into the tumor microenvironment. Work was presented at the ASH 2014 Annual Meeting in San Francisco in December 2014.

## Cancer Pharmacology

Complexities in the structure and workings of the genes in tumors significantly impact the way new cancer treatments are established. The goal of the Levine Cancer Institute Pharmacology Department, led by Ram Ganapathi, PhD, is to support research for developing new treatments for cancer through

translational research – moving ideas from the laboratory to the clinic. Their ongoing translational research program is focused on hematological malignancies and ovarian cancer.

In collaboration with the Levine Cancer Institute Hematologic Oncology Translational Laboratory, they are developing laboratory models for hematologic malignancies using cancer cells from patients resistant to treatment (for example, growing myeloma cells in test tubes) or by genetic manipulation of cells to mimic drug-resistant disease. These model systems are used in the laboratory to test new combinations of drugs that can ultimately be tested clinically. Their focus has been on evaluating genetic differences in relapsed multiple myeloma (MM) and acute myeloid leukemia (AML) that may influence whether the drug combinations are effective at killing these cancer cells, whether they contribute to the success of bone marrow transplants, and also how toxic they are for patients. Drug response is highly variable as both toxicity and efficacy of these drugs may be partially influenced by the DNA within the patient's genes. We have begun studies to identify genetic differences that are responsible for how long the anticancer drug stays in the body and the resulting toxicity in patients receiving pre- and post-bone marrow transplant therapy. The goal is to develop strategies to reduce side effects and improve patient outcomes.

In ovarian cancer, the team is studying the biology of the genesis of serous epithelial ovarian cancer using comprehensive genomic analysis. The team is also identifying a subset of genes that can distinguish tumors that respond well to therapy and those that potentially lead to early relapse or recurrence of disease.

Thus, our bidirectional "Bench to Bedside" and "Bedside to Bench" strategy in cancer pharmacology translational research in hematological malignancies and ovarian cancer takes laboratory findings related to reducing toxicity and improving response rapidly into the clinic to personalize treatment, based on the molecular makeup of the tumor once the laboratory research demonstrates the potential for better clinical outcomes.



### Department of Neurology at Carolinas Medical Center

Carolinas Medical Center-Neurology (CMC-Neurology) is proud to report on several diverse research highlights from 2014.

Benjamin Brooks, MD, collaborated with MediciNova Inc. to develop a protocol for an amyotrophic lateral sclerosis (ALS) study using the MediciNova compound MN-166, also known as ibudilast. Ibudilast is currently being studied in progressive forms of multiple sclerosis (MS) but had not been previously studied in the ALS population. The primary objective of the study is to evaluate the safety and tolerability of MN-166 60mg/day versus placebo in conjunction with riluzole over 6 months. "We are excited to initiate this study of ibudilast which targets a disease with limited treatment options," Dr. Brooks said. "Ibudilast has demonstrated attenuating effects on activated glial cells which are considered to play a key role in disease progression in ALS patients." In addition to Dr. Brooks' involvement in the protocol development, the research staff collaborated with StudyTRAX to develop the electronic data capture (EDC) system for the study.

As the only center in the world to conduct this trial, CMC-Neurology's Carolinas Neuromuscular/ALS-MDA Center has done a remarkable job enrolling more than one-third of the required 60 patients within two months of starting recruitment.

In 2014, one of the initiatives of the Neuroscience Institute was to establish a multidisciplinary research committee that includes neurologists and senior administrators from both CMC-Neurology and NorthEast Neurology, a psychiatrist from CMC-Behavioral Health, and members of CMC-Neurology's research team. The primary objectives of this committee are to foster and expand research for the Neuroscience Institute, and to establish research standards and processes for adult neurology system-wide. The research committee will help identify best practices in clinical research that will empower the research team to manage and coordinate trials more effectively and efficiently. The committee elected Donna Graves, MD, as a leader to work with the senior administration and the research team to accomplish these objectives.

Dr. Graves joined CMC-Neurology's Multiple Sclerosis Center as one of the MS neurologists in July 2014. Prior to this, Dr. Graves was a neurologist at the University of Texas Southwestern Medical Center in Dallas, Texas. She brings many years of clinical experience managing patients living with MS and other central nervous system demyelinating diseases as well as experience as an investigator for MS clinical trials. CMC-Neurology manages 11 ongoing MS clinical trials.

Elena Bravver, MD, is the principal investigator on CMC-Neurology's first clinical trial on the topic of myasthenia gravis. "A randomized, double-blind, placebo-controlled, multicenter study to evaluate the safety and efficacy of Eculizumab in subjects with refractory generalized myasthenia gravis," said Dr. Bravver. Approval from the institutional review board was received in 2014 and the study is sponsored by Alexion Pharmaceuticals.

Mohammed Sanjak, PhD, PT, MBA, mentored Summer Research Scholar Glenn Boyles on a research project entitled, "Sit to Stand (STS) Rating Scale: Construct Validity of a Novel Measure of Lower Extremity (LE) Function in ALS Patients." A poster summarizing this research was presented at the 13th



NEALS (Northeast Amyotrophic Lateral Sclerosis Consortium) Annual Meeting in Clearwater, FL in October 2014. Boyles is a graduate student in the Department of Health Policy and Management at the University of North Carolina at Chapel Hill.

The Amyotrophic Lateral Sclerosis Functional Rating Scale - Revised (ALS FRS-R), a widely used measure of functional status in ALS patients was deployed in the electronic medical record in August 2014. The ALS FRS-R was developed by Dr. Brooks. Direct online data entry has resulted in more complete data collection compared to using paper forms.

Also in 2014, CMC-Neurology worked with the Carolinas HealthCare Foundation to set up an ALS Ice Bucket Challenge to bring awareness to research on ALS.

Collaborations continued through 2014 and included: CMC-Behavioral Health on two Alzheimer's disease clinical trials; Physical Medicine and Rehabilitation on RENEW (Research and Education in Neuro-Wellness) to promote exercise in patients living with Parkinson's Disease; the Department of Emergency Medicine on the First Time Seizure (FITS) project to develop a standardized approach to care for patients presenting to the emergency department with a seizure for the first time; and the Department of Pediatrics on neuromuscular clinical trials, some of which were sponsored by Cooperative International Neuromuscular Research Group (CINRG).

### NorthEast Neurology at Carolinas Medical Center-NorthEast

Robert Mitchell, MD, from NorthEast Neurology at Carolinas Medical Center – NorthEast, is the principal investigator of the TOMMORROW study, an international phase III trial to evaluate a genetic biomarker to predict the risk of development of mild cognitive impairment (MCI) due to Alzheimer's disease (AD) and the ability of pioglitazone to delay MCI due to AD in the high risk biomarker group. By the end of 2014, over 120 subjects have been screened at the Northern Region Research Center, qualifying it as one of the more active sites internationally.

Because of the novelty of this trial's design and its potential impact, Dr. Mitchell and his team created a registry of individuals in at-risk age groups in Cabarrus County and its surrounding areas to facilitate enrollment. This database may also serve as the foundation for more comprehensive registries in research in the neurosciences. This effort fostered a unique collaboration with various physician groups, future research in the neurosciences. This effort fostered a unique collaboration with various physician groups, community organizations and the MURDOCK Study group of the Duke University



Medical Center. On a broader scope, this interdisciplinary research initiative has facilitated the exchange of scientific ideas throughout distinctive care environments within Carolinas HealthCare System and its local community.

## SANGER HEART & VASCULAR INSTITUTE

### Clinical Research Program: Adult Cardiology, Pediatric Cardiology, Adult and Pediatric Cardiothoracic Surgery, and Vascular Surgery and Medicine

Sanger Heart & Vascular Institute's Clinical Research Program continues to grow and advance its larger clinical and academic mission to create and operate a comprehensive system to provide healthcare and related services, including education and research opportunities, for the benefit of the people they serve. The Sanger research team manages more than 50 clinical trials. More than 130 publications, abstracts and international presentations were contributed by all of the departments during 2014. Multi-campus clinical research endeavors evolved to include more than 40 Sanger faculty members on three campuses. External grants exceeded \$1 million in funding in 2014. Research conducted at Sanger continues to facilitate the development of new technology and expertise, and bring advanced therapies to the community. Multidisciplinary collaboration remains a critical ingredient to Sanger's success.

While Sanger celebrated many successes, they also mourn the loss of their Administrative Director Gale Schwarz, RN, who passed away in 2014. Gale was an integral part of the development of the Research Department leading for more than 20 years and a Carolinas HealthCare System Pinnacle Award Winner. She will be greatly missed by so many.

#### Structural Heart Disease

The Sanger Valve Center is a leader in percutaneous valve therapy, contributing to a national database on Transcatheter Aortic Valve Replacement (TAVR) and currently investigating the role of TAVR in the treatment of moderate risk patients in the SURTAVI trial. Sanger continues to be a national leader in percutaneous mitral valve repair now evaluating an investigational device and technology for functional mitral insufficiency in the Clinical Outcomes Assessment of the MitraClip Percutaneous Therapy for Extremely High-Surgical-Risk Patients (COAPT) study.

#### Ischemic Heart Disease

Sanger investigators were major contributors to research in antiplatelet therapy for coronary stenting. The Dual Antiplatelet Therapy (DAPT) study was published in the *New England Journal of Medicine* and several other publications discussed findings from the Assessment of Dual Antiplatelet Therapy with Drug-Eluting Stents (ADAPT DES) study. Sanger continued to study completely bioabsorbable stents in the ABSORB trial. Additionally, Paul T. Campbell, MD, has been active in research with robotically assisted coronary intervention at the Sanger-Concord campus.

#### Vascular Disease

The Sanger Vascular Surgery Department continues to lead in the investigation of new stent graft technology for aortic aneurysm. Frank R. Arko, MD, continued to innovate with the application of stent graft technology for the treatment of complicated aortic dissection. Sanger has also been active in the study of stent technology for the treatment of iliac venous stenosis for chronic venous insufficiency.

## Imaging

Advanced imaging is critical for the advancement of all areas of cardiovascular medicine. Sanger imagers continue to provide industry leading imaging to guide therapy for structural heart, electrophysiology, and vascular surgery investigation using CT angiography, transesophageal echocardiography, and cardiac MRI.

## Heart Failure

The number of patients with advanced heart failure continues to grow and Sanger continues to lead in the investigation of new options for these patients. Sanger is active in the investigation of an innovative implantable device for the treatment of refractory chronic heart failure through the COUNTER HF study. Sanger was also involved in a clinical trial of the SynCardia Totally Artificial Heart and was the first center in North or South Carolina to implant the device.

## Arrhythmia

Atrial Fibrillation (AF) is a growing public health burden and an area of active study for Sanger. Studies include the NIH-sponsored CABANA trial to evaluate AF ablation (supported by the National Heart, Lung, and Blood Institute-National Institutes of Health; U01 HL089786), and through percutaneous left atrial appendage occlusion with the Watchman device for stroke prevention in the CAP2 registry. Sanger also continues to study a new type of catheter used in arrhythmia ablation.

## Pediatric Cardiology and Surgery

Joseph Paolillo, MD, is a top enroller in the Gore Septal Occluder (GSO) study for the percutaneous closure of atrial septal defects. He also implanted the first percutaneous pulmonary valve for failed pulmonary conduit at Sanger as part of an ongoing registry. Benjamin Peeler, MD, FACS, and Thomas Maxey, MD, continue to perform pediatric left ventricular assist implantation and pediatric mitral valve replacements as part of compassionate use registries.

Through participation in some of the most important clinical trials active in the US and through active original research from bench to bedside, Sanger Clinical Research continues to advance the greater Sanger Heart & Vascular Institute and Carolinas HealthCare System mission.

## Bridges Molecular Cardiac Surgery Research Laboratory

2014 was very exciting and productive for the Bridges Molecular Cardiac Surgery Research Laboratory team, which includes Michael Katz, MD, PhD, Anthony Fagnoli, PhD, and Andrew Kendle, BS, under the supervision of Charles Bridges, MD, ScD. Previous work on the potential heart failure therapy sarcoplasmic reticulum  $\text{Ca}^{2+}$  adenosine triphosphatase (SERCA2a) continued with a safety and efficacy study that further supports the delivery of SERCA2a by Dr. Bridges' molecular cardiac surgery with recirculating delivery (MCARD) procedure as an effective strategy (Figure 1). The team concluded that cardiac overexpression of SERCA2a via MCARD is a safe therapeutic intervention that significantly improves left ventricular function,

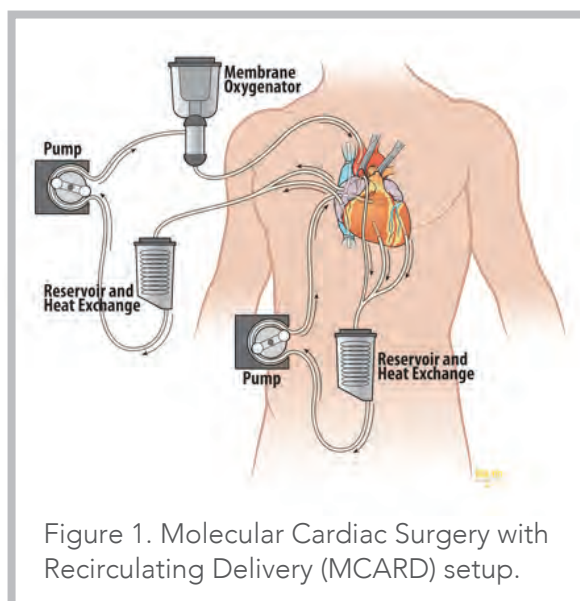


Figure 1. Molecular Cardiac Surgery with Recirculating Delivery (MCARD) setup.



decreases oxidative stress, limits myocyte hypertrophy and arrests adverse remodeling. All of the molecular activities for this study were supported by the Molecular Biology Core Facility under the direction of Nury Steuerwald, PhD, HCLD (ABB). The results of this work were presented at the 94<sup>th</sup> Annual Meeting of the American Association for Thoracic Surgery in Toronto, and a discussion between Dr. Bridges and Todd Rosengart, MD, FACS, a pioneer in gene therapy, was also featured. Although SERCA2a is not a drug, pre-Investigational New Drug (pre-IND) approval was required by and secured from the US Food and Drug Administration (FDA) for the proposal of a MCARD-SERCA2a clinical trial. Pre-IND approval has further progressed to a pharmacology-toxicity study, serving as a prerequisite to FDA approval of the trial.

The team also completed a study of the pathway of fibrosis in heart failure in collaboration with Laura Schrum, PhD, and Elizabeth Brandon-Warner, PhD, from the Liver Pathobiology Laboratory. The data from this study showed that the progression of fibrosis in large myocardial infarction is mediated through increased TGF- $\beta$  and Angiotensin II signaling, which is absent in both small myocardial infarction and large myocardial infarction with MCARD-mediated delivery of SERCA2a. This study identified a novel application of gene therapy in arresting heart failure remodeling and was presented at the annual meeting of the American Heart Association in November 2013 and was submitted for publication in 2014.

The team also completed a study comparing needleless liquid jet injection to the standard injection techniques for gene delivery; results support the advantages of utilizing the needleless technique. This work was presented at the 18<sup>th</sup> annual meeting of the American Heart Failure Society in Las Vegas and for which Dr. Fargnoli received the award for best oral presentation.

Another project was conducted by Michael Alexander, an undergraduate student at the University of South Carolina who has since been accepted into medical school. He was mentored as a 2014 Carolinas HealthCare System Summer Research Scholar. He studied the use of nanoparticle - encapsulated Solu-Medrol as an anti-inflammatory treatment to improve gene delivery. This fascinating project produced very strong results supporting the benefit to gene uptake of the



nanoparticle-encapsulated drug treatment. After the 10-week internship, Alexander presented his work as an oral presentation on July 31 for Research Day for which he received the award for best oral presentation.

Also during 2014, studies were initiated to investigate the use of microRNA treatments, an emerging area of interest affecting gene regulation, for heart failure. Genetic data revealed the roles of various microRNAs in basic pathological processes associated with heart failure: apoptosis, fibrosis, hypertrophy and remodeling. Studies showed promising preliminary results and offer the possibility of regenerating damaged or lost heart tissue, a result unattainable by traditional DNA gene delivery.

Finally, the team was invited to contribute a chapter entitled "Gene Therapy in Cardiovascular Disease" to the textbook "Pathophysiology and Pharmacotherapy of Cardiovascular Disease (Ed. Jagadeesh GG)." This was a testament to the interest in and progress of the field of gene therapy and an exciting opportunity for this team. The textbook will be in print in 2015.

## PEDIATRICS

The Center for Pediatric Research (CPR) at Levine Children's Hospital is committed to providing pediatric patients access to innovative diagnostic methodologies and therapeutic interventions. In 2014, the CPR expanded its reach to collaborate with the Department of Orthopaedics in a therapeutic trial with a new antimicrobial for osteomyelitis. The Pediatric Research Fund, established by Carolinas HealthCare Foundation in 2012, is now available to provide support for investigator-initiated research endeavors conducted by the Department of Pediatrics.

### Sanger Heart & Vascular Institute Pediatric Research Program

Collaborations with Sanger Heart & Vascular Institute in 2013 established a pediatric-specific research program. Since the addition of studies at Sanger Heart & Vascular Institute to the CPR in 2014, six projects in pediatric cardiology and cardiothoracic surgery have opened enrollment. In 2015, the program will add multiple studies focused on outcomes and innovative approaches to caring for pediatric cardiology and cardiothoracic patients as well as investigator-initiated studies and therapeutic treatment trials.

### Division of Critical Care

Traumatic brain injury (TBI) is one of the leading causes of death in children in the United States, and advances in the care of these children have been very slow. Variations in practices and treatments are leading to widespread variations in outcomes. The ADAPT study (Approaches and Decisions for Acute Pediatric TBI) started enrolling pediatric patients with traumatic brain injury in an effort to test the effectiveness of the varied medical therapies. Enrolled subjects receive neurodevelopmental testing one year after injury to assess post-injury recovery and development and evaluate outcomes.

### Division of Pediatric Gastroenterology, Hepatology and Nutrition

During 2014, the Division of Pediatric Gastroenterology entered the fourth year of a five-year research study to evaluate novel agents for the treatment of hepatitis B. Additionally, innovative technology was used to study health literacy of parents of children with inflammatory bowel disease (IBD) including

ulcerative colitis and Crohn's disease. Parents of enrolled patients utilized electronic tools, including a smartphone application, to communicate questions to their child's gastroenterologist, while receiving information about their child's disease, including laboratory results.

The Pediatric IBD Clinic at Levine Children's Specialty Center continued throughout 2014 to receive an excellent response to participation in "Improve Care Now," a quality improvement and research collaborative for pediatric patients with IBD. The collaborative is successful by focusing on three main components: vigilant data entry at each IBD visit or hospitalization, pre-visit planning to make IBD visits efficient yet meaningful, and a monthly review of patient population metrics. Carolinas HealthCare System enrolled more than 250 patients and has noted significant growth and stabilization in all key measures assessed. The population management report allows review of scores in response to clinical remission, nutrition and growth, medication adherence, completion of suggested diagnostic evaluation and recommended office visits, and assessment of growth and nutrition. The pre-visit planning process is diligently utilized for each scheduled visit and the team worked hard to also incorporate patient and family engagement into the process.

Monthly meetings facilitate brainstorming by the group about ways to address inconsistencies with patient care at an individual level as well as new quality improvement goals to address deficiencies at a population level. Work over the past few years established a reliable workflow process that allows consistent care delivery across the ever-growing practice. The clinic's current remission rates are at 80 percent, nearly double the national average. The proportion of patients with favorable nutritional and growth status has remained above 90 percent and patient's compliance with recommended annual visits is nearly 99 percent, one of the highest in the entire collaborative. Another hallmark of the collaborative is engaging patients and families as "parent partners." The project's lead parent, Justin Vandergrift, has been an integral part of the team. He has partnered with the team to create a series of patient and provider videos depicting common health issues and available learning opportunities for families coping with this condition. The videos are stored on a website he developed: EmpoweredByKids.com. He also published a booklet to inspire newly diagnosed IBD patients called "IBD Book of Hope" that details the success stories of patients living with this condition. The response was so positive that both the booklet and website have branched out to include families affected by cystic fibrosis and congenital heart disease, and will hopefully continue to extend to other chronic diseases in the future.

## Division of Pediatric Infectious Disease and Immunology

By the end of 2014, the Division of Pediatric Infectious Disease and Immunology enrolled more than 400 patients into the Centers for Disease Control and Prevention study of the diagnosis of latent tuberculosis infection (LTBI). New projects included: a study involving a device that provides real-time results for herpes simplex virus during active labor to decrease and prevent transmission of the virus from mother to baby during delivery, as well as therapeutic studies in the treatment and evaluation of babies born with congenital cytomegalovirus (CMV) which is a leading cause of hearing loss in newborns.

Also during 2014, a large multicenter study, which included 88 infants and young children who received subcutaneous immunoglobulin therapy, was completed. Immunodeficiency in young children is often treated with immunoglobulin treatment. The study was the largest of its kind in very young children and concluded that therapy was safe and effective. Separately, the group participated in a national registry project to enhance early diagnosis and treatment strategies for children with primary immunodeficiency diseases (PID); enrollment is approaching 100 patients.



The division looks forward to 2015 when a study of a novel therapy for newborn babies with herpes simplex virus will be added and a 10-year study evaluating hearing loss in babies with congenital CMV will be closed.

## Division of Neonatology

Matthew Saxonhouse, MD, led the Division of Neonatology in the new SCAMP study to evaluate the safety of antibiotic therapy in infants with complicated intra-abdominal infections. Also, during 2014, the groundwork was laid for two new projects: a therapeutic treatment of thrombosis due to venous and/or arterial catheter placement in children, and a hemorrhagic risk assessment study in infants with thrombocytopenia.

## Division of Pediatric Nephrology

Throughout 2014, the Division of Pediatric Nephrology participated in a registry of patients with Hemolytic Uremic Syndrome as well as the Clinical Phenotyping and Resource Biobank Core (C-PROBE). C-PROBE is a national collaboration of major institutions aimed at developing an infrastructure to serve as an interface between patients in clinical care settings and biomedical investigators conducting translational research in kidney disease.

The division continued to be involved in several multicenter clinical trials through the Midwest Pediatric Nephrology Consortium, evaluating the therapeutic management of nephrotic syndrome, cardiovascular complications in renal transplant recipients and genetic markers of nephrotic syndrome.

Starting in March 2015, Carolinas HealthCare System pediatric patients with biopsy-proven glomerular disease will have the option to participate in the CureGN (Cure Glomerulonephritis) study. This study, sponsored by the National Institutes of Health National Institute of Diabetes and Digestive and Kidney Diseases (UM1 DK100866), will bring together specimens, results and information from children with glomerular disease across the country.

## Division of Pediatric Rheumatology

The Division of Pediatric Rheumatology launched a study of patients taking Orencia® for the treatment of juvenile idiopathic arthritis (JIA). The division also continued to be involved in a nationwide pediatric rheumatology registry supported by the Childhood Arthritis & Rheumatology Research Alliance (CARRA), and participated in an industry-sponsored trial of a novel anti-TNF biologic response modifier, coordinated by the national Pediatric Rheumatology Collaborative Study Group (PRCSG). Affiliation of the division with CARRA and PRCSG will provide future opportunities to participate in additional studies benefitting children with rheumatic disease.

## Pediatric Muscular Dystrophy Research within the Division of Clinical Genetics

The pediatric muscular dystrophy research group participated in therapeutic trials throughout 2014. One trial in genetics included a study, sponsored by Sarepta Therapeutics, in male children with Duchenne Muscular Dystrophy who are ambulatory. Weekly infusions are evaluated for safety, dosing, efficacy and tolerability. An additional study, sponsored by Lilly USA, LLC, is also enrolling boys with Duchenne Muscular Dystrophy, using tadalafil therapy. In 2015, the CPR will add another Sarepta study and will be a hub site for the clinical evaluations for other participating centers in the US.

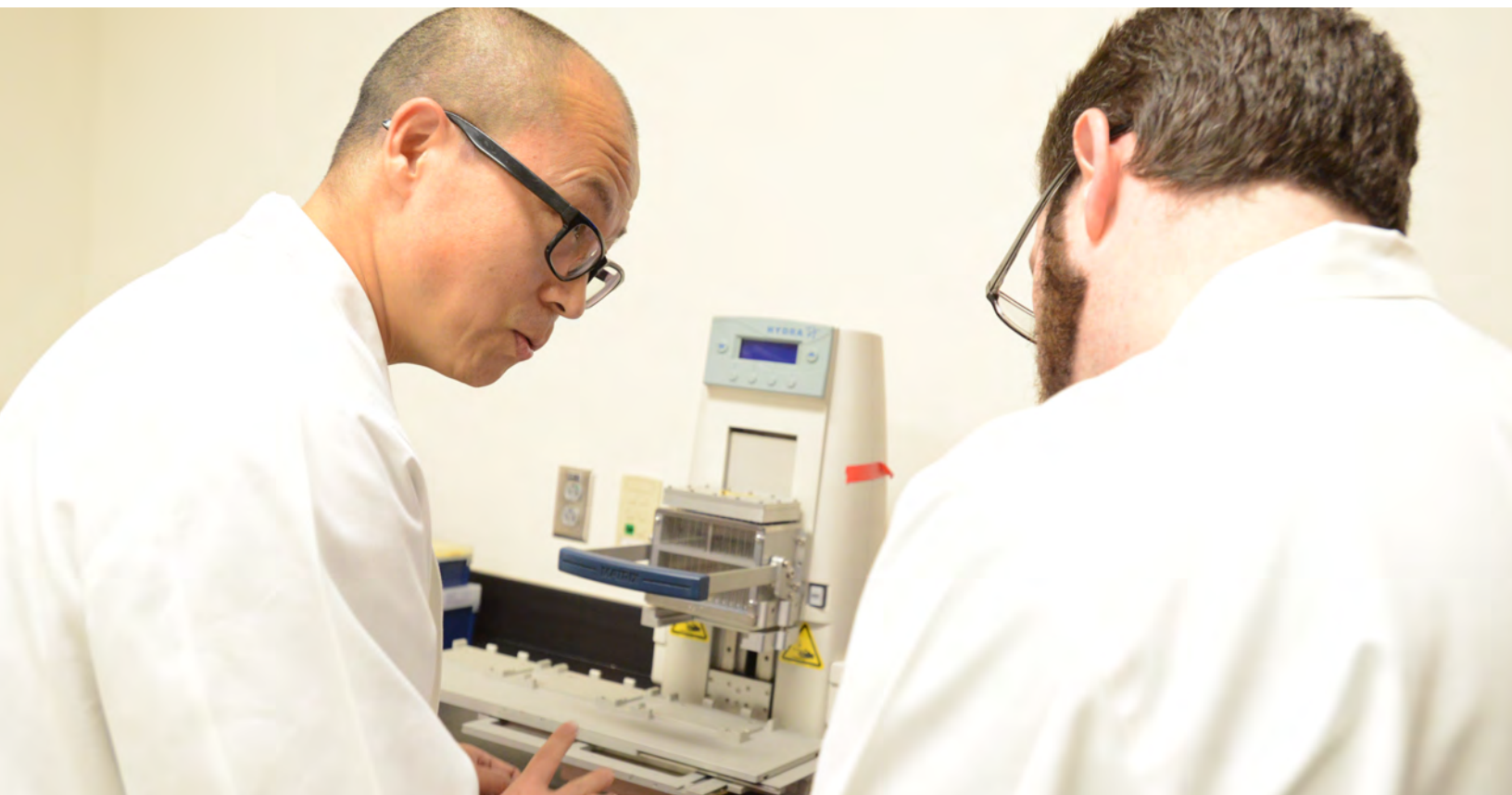
Amy Harper, MD, is part of the Department of Neurology and leads this clinical research program, which includes 16 active clinical research trials in muscular dystrophy and genetic disorders. The Pediatric Muscular Dystrophy Research Laboratory, under Dr. Harper's direction, focused on translational research for muscular dystrophy, with a strong interest in dystroglycanopathies (congenital muscular dystrophy and limb girdle muscular dystrophy), dystrophinopathies (Duchenne and Becker muscular dystrophies) and genetically identifying unknown muscular dystrophies.

The Pediatric Muscular Dystrophy Laboratory continued to serve as Core C: Molecular Diagnostics and Cell Banking Core for the "Center of Research Translation: Systemic Exon-skipping in Muscular Dystrophy," a multicenter project in collaboration with Children's National Medical Center and the University of Pittsburgh that is funded by the National Institutes of Health, National Institute of Arthritis and Musculoskeletal and Skin Diseases (P50 AR060836). The laboratory processes blood and tissue samples from patients with Duchenne and Becker muscular dystrophies evaluated at multiple clinical sites. These samples are used to better understand exon-skipping therapy for the disease.

With funding from the Muscular Dystrophy Association, the laboratory is identifying new genetic etiology of muscular dystrophy. Patients with clinical features of muscular dystrophy are evaluated clinically in addition to undergoing a thorough review of medical history and testing. The patient's muscular dystrophy etiology is identified utilizing specific gene and whole-exome sequencing.

### McColl-Lockwood Laboratory for Muscular Dystrophy Research

During 2014, significant progress was made by the McColl-Lockwood Laboratory for Muscular Dystrophy Research. A focus of the laboratory is on the limb girdle muscular dystrophies (LGMD) 2I which are caused by defects in the FKRP gene. Currently, no effective treatment options are available for patients. During 2014, the laboratory continued to develop experimental therapies for these diseases and, for the first time, a positive therapeutic effect has been clearly demonstrated. The team used an AAV-mediated gene therapy in both severe and mild forms of LGMD2I. Results were published in *Molecular Therapy* and help pave the way for this therapy to move forward into clinical trial.



Additionally, the team utilized animal models to identify drugs capable of alleviating disease severity. This exciting determination points to a new approach for treating the diseases and provides insight and affirmation for further drug optimization in this area.

Additionally, through grant support from the National Institutes of Health, National Institute of Neurological Disorders and Stroke, the laboratory continued to improve the efficacy of a patented exon skipping therapy for Duchenne muscular dystrophy (U01 NS062709). These improvements include optimized treatment regimens and effective new targets using antisense oligonucleotide drugs.

The laboratory operates by grant funds generously donated by the McColl and Lockwood families. The laboratory also actively seeks funding from foundations and federal sources which totaled over a million dollars in 2014 alone. Academically, the laboratory contributed to the literature with 12 peer-reviewed papers in high impact and well-respected international journals.

## FAMILY MEDICINE

During 2014, the Department of Family Medicine research team led several research projects. The Asthma Dissemination Around Patient-centered Treatments in North Carolina (ADAPT-NC) Study is led by Hazel Tapp, PhD, and funded by the Patient-Centered Outcomes Research Institute. It aims to evaluate the dissemination of shared decision-making across primary care practices in North Carolina. During early 2014, 30 practices were recruited through Carolinas HealthCare System and collaborations with Practice-Based Research Networks based in University of North Carolina, Duke University and East Carolina University (see Figure 1). The practices were randomized into three study groups, each with 10 practices. One group received a facilitator-led dissemination of the shared decision making toolkit, another group received a traditional approach to dissemination and the third group served as controls. The facilitator-led implementation incorporates a structured method to bring shared decision making into practices through an approximate 3-month rollout schedule where the facilitator visits the practice regularly and works through a planned approach that is also flexible to match the needs of the

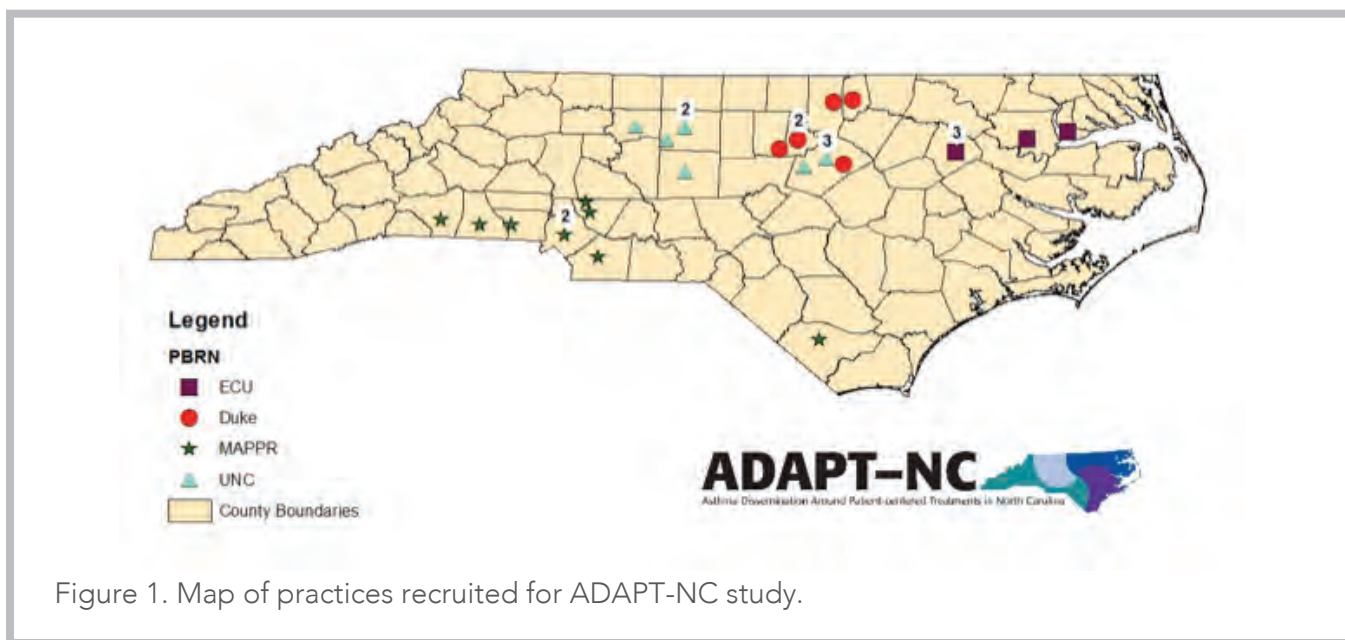


Figure 1. Map of practices recruited for ADAPT-NC study.

practice. The traditional approach to dissemination was a single, one-hour lunchtime presentation of the toolkit. The control group will not receive the toolkit by any method until the data collection for comparison is complete. The implementation rollout is now complete at all sites and more than 650 patient visits between August and December 2014 utilized the shared decision-making toolkit as part of this study. Outcomes will be evaluated based on improvements in disease outcomes and reduction in exacerbations leading to emergency room visits or overuse of rescue medications. Patients and asthma experts are engaged in the project and serve as key project stakeholders in addition to the research team. One patient-stakeholder commented: "I have been able to contribute to the team from the research idea to the implementation phase. I have participated in planning meetings and helped discuss ideas about patients' involvement in their own care. I am grateful for this research opportunity to help improve patient outcomes and look forward to continued involvement in this project."

Family Medicine researchers also continue to collaborate with community partners to improve access to care utilizing a community-based participatory research approach. Michael Dulin, MD, PhD, leads a transdisciplinary team of investigators from Carolinas HealthCare System and University of North Carolina in an NIH-funded study titled, A Transdisciplinary Approach to the Evaluation of Social Determinants of Health (National Institute on Minority Health and Health Disparities; R01 MD006127). This study is designed to identify social determinants and create an intervention that improves community health by enhancing utilization of preventative and primary care services. Team member Claire Schuch's recent publication, *Por Nuestros Ojos: Understanding Social Determinants of Health through the Eyes of Youth*, which highlights work from this grant, was named by Robert Wood Johnson Foundation as 2014's most influential published research on identifying and eliminating health disparities.

The Department of Family Medicine also remained focused on conducting outcomes research through 2014, which aligns innovations in care delivery redesign with research methodologies in order to help inform system strategy. Andrew McWilliams, MD, MPH, and John Emerson, MD, continued to lead a pilot study in this area titled *Comparative Effectiveness of Virtually Delivered Multidisciplinary Intensive Primary Care Services*. Specifically, this study examines various analytical approaches to the risk-stratification of patients and then compares the effects of population health interventions. One such population health intervention was developed by Family Medicine Researchers and is called





Carolinas Partners for Health. Carolinas Partners for Health is a 3-month long intensive primary care intervention designed to leverage health information technology, virtual care, and multidisciplinary care coordination to better serve a high-risk, safety-net population. In 2014, the research team presented at numerous local and national venues the early lessons learned and patient perspectives on deploying health IT in vulnerable populations. This project serves as an excellent example of how patient-oriented outcomes research at Carolinas HealthCare System can simultaneously inform System strategies and improve care delivery systems for our patients.

## RADIOLOGY AT CAROLINAS MEDICAL CENTER-NORTHEAST

In collaboration with Charlotte Radiology, one of the largest radiology groups in the nation, new research initiatives began at Carolinas Medical Center-NorthEast. These projects bridge the common vision of both the Carolinas HealthCare System and Charlotte Radiology: to provide quality-driven, innovative and transformational healthcare to their patients.

Doug Sheafor, MD, along with collaborators from the University of Michigan and the Northern Region Research Center at CMC-NorthEast, is leading an interdisciplinary investigator-initiated research study in contrast-induced nephropathy (CIN). CIN is a complication of intravenous iodinated contrast material administration for radiologic procedures that can cause a sudden deterioration in renal function. While there are numerous prophylaxis techniques to reduce the risk of CIN, none have been substantiated or validated over time. Dr. Sheafor's study is a phase III multicenter randomized controlled trial evaluating short (1+2 hour) versus long (1+6 hour) normal saline volume expansion regimens for post-CT acute kidney injury risk reduction following CT. The primary objective of this study is to determine whether a shorter IV fluid regimen is non-inferior to a longer but equivalent regimen. The implications of this study may have direct and immediate relevance to patients and hospital systems by increasing diagnostic throughput, decreasing hospitalization lengths of stay and reducing overall healthcare costs.

Michael Meuse, MD, and Peter Simon, MD, are collaborators in the LIBERTY 360 Study, a prospective, observational, post-market, multicenter clinical study to evaluate endovascular device interventions in treating distal outflow peripheral arterial disease (PAD) with critical limb ischemia and/or intermittent claudication. By evaluating standard of care data collection, this study aims to create a universal classification schema to describe the distribution and plaque burden for disease in distal outflow PAD. The development of this schema, as well as a plaque burden score, may provide additional guidance for future interventions and allow physicians to predict clinical outcomes.

Further clinical trials of newer endovascular devices are also being initiated by Drs. Meuse and Simon, which will offer patients state-of-the-art advances in treating critical limb ischemia and claudication.

## ORAL MEDICINE

During 2014, the Department of Oral Medicine at Carolinas Medical Center was awarded a \$3.7 million grant from the National Institute of Dental and Craniofacial Research (NIDCR) (R01 DE023375), one of the National Institutes of Health (NIH). Professor Peter Lockhart, DDS, is the study's principal investigator and he leads this research team to study the role of poor oral hygiene and periodontal

disease in patients that develop infective endocarditis – an infection of the heart valves. Infective endocarditis (IE) has been associated globally with 1.58 million years of healthy life lost due to death and non-fatal illness or impairment. It is estimated that 30 to 45 percent of community-acquired cases of IE (CA-IE) originate from oral bacteria, particularly those found around the teeth, and it is likely that the mortality rate for these cases is 10 to 20 percent.

Certain heart valve abnormalities are the only established risk factors for CA-IE due to oral bacteria. Although there are guidelines for prevention for about 10 percent of people at risk for IE, there are no formal recommendations for prevention for the remaining 90 percent, or 5 million people in the US, who are at risk for IE. Most of the available scientific evidence suggests that there is an association between poor oral hygiene or periodontal disease and IE, but there is no direct evidence. This NIDCR/NIH study will provide direct evidence to support or refute oral hygiene or periodontal disease as risk factors for CA-IE. As noted in a supporting letter from a cardiologist member of the American Heart Association Committee on Endocarditis "Clearly, if an association between IE and oral hygiene, periodontal disease or oral bacteria is found, it will have a major impact on clinical practice, and it will provide supporting evidence that improving oral hygiene and preventing periodontal disease may decrease the risk of this devastating disease."

The five-year grant involves dentists and cardiologists at three patient enrollment sites: Hospital of the University of Pennsylvania, University of Michigan, and Carolinas Medical Center. Researchers at Brigham and Women's Hospital, University of Minnesota, The Forsyth Institute in Boston, and Sheffield University in England are also involved. Dr. Lockhart serves with Geoffrey Rose, MD, chief of Cardiology, Sanger Heart & Vascular Institute, and Michael Brennan, DDS, MHS, professor and chair, Department of Oral Medicine, who are site principal investigators for CMC. Farah Mougeot, PhD, director, Oral Medicine Research Laboratory at CMC, will conduct bedside to bench studies of the bacteria cultured from these patients.

In addition to transforming our understanding of risk factors for endocarditis, this study has the potential to reduce the incidence of CA-IE and its associated morbidity, mortality and cost. It would provide important information for future clinical guidelines for the prevention of endocarditis and be an important contribution to the public health in the US and throughout the world for all people at risk for infective endocarditis.

Dr. Brennan leads another multicenter NIH-funded grant that is in the second year of enrollment. The \$8.15 million grant was awarded from the NIDCR/NIH (U01 DE022919) to study dental and oral medicine outcomes of patients who have received high-dose radiation therapy to the head and neck region (OraRad). The results of this five-year, multicenter study will lead to a better understanding of the oral and dental sequelae experienced by head and neck cancer patients, which in turn will guide decision-making and standard of care protocols for the dental management of patients in the pre- and post-radiation period. Dr. Brennan is also a principal investigator of a multicenter study (OraStem) that will assess the burden of illness of oral complications in adult patients undergoing hematopoietic stem cell transplantation (HSCT). He also serves as the faculty advisor of a similar study (Peds OraStem) in children undergoing HSCT. These two prospective HSCT studies have partial funding through Sweden and Singapore, respectively.

Jean-Luc Mougeot, PhD, recently joined the department and will lead and focus on the translational genomics aspects of the studies previously described by using molecular approaches and computational biology tools. Under his mentorship, Summer Research Scholar Marshall Lawler, from University of Illinois College of Medicine, used computational biology tools to perform pathways analyses, build

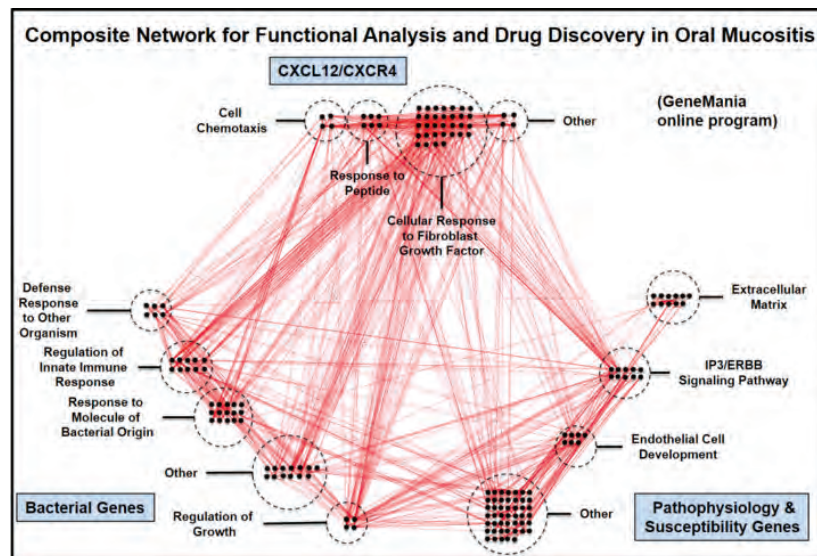


Figure 1

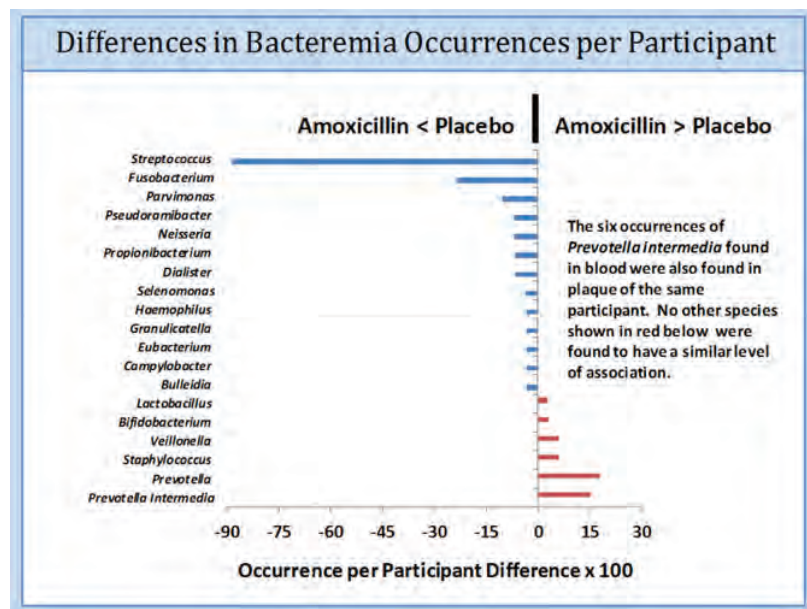


Figure 2

molecular networks, and identify drug candidates for new use in oral mucositis caused by (conditioning) radiation therapy or chemotherapy in cancer patients or patients undergoing hematopoietic stem cell transplant (Figure 1).

The Oral Medicine Research Laboratory had a productive second year of operation under the directorship of Farah Mougeot, PhD. The Oral Medicine research team participated in the 43rd annual meeting of American Association of Dental Research held at the Charlotte Convention Center in March 2014. The research results on associations between bacteremia from oral bacterial species and distant site infections such as infective endocarditis and prosthetic joint infections were presented at the podium. The team additionally conducted metagenomic analysis of microbiome of dental plaques from the bacteremic subjects treated or not treated with antibiotic prophylaxis (amoxicillin) prior to dental procedures and data were presented at the International Association of Dental Research in June 2014 in Cape Town, South Africa (Figure 2).

Another highlight for the Oral Medicine Research Laboratory in 2014 was hosting one of the first international exchange students, Telmy Gonzalez of the Mariano Galvez University of Guatemala. The exchange program is collaborative among the Carolinas HealthCare System's Division of Research and International Medical Outreach Office as well as the University of North Carolina School of Medicine. Gonzalez has a special interest in studying properties of novel dental materials and, during her visit, she gained knowledge of the role of the mouth's microbial community in infective endocarditis which helped prepare her for dental practice in her country.

## EMERGENCY MEDICINE

The research activities within the Department of Emergency Medicine include diverse interests and methodologies, with multidisciplinary studies, patient-centered outcomes studies and qualitative research.

Andrew Asimos, MD, director of emergency stroke care and Andrew Wyman, MD, in collaboration with the Department of Neurology, launched a multiphase research initiative with the ultimate goal of transforming the standard of care and decreasing the overall cost of the evaluation of First Time Seizure (FiTS) patients in a way that is beneficial to both the patients and the healthcare system. A second component of the same project is being led by Sandra Beverly, MD. She was awarded a grant from the Emergency Medicine Research and Education Fund in her intern year to identify important patient-centered outcomes related to first time seizures and associated evaluations. To understand the experience of patients with first time seizures a series of focus groups were conducted with patients and their families.





Another area of research focus for emergency medicine is the appropriate use of imaging in trauma. Eliminating unnecessary testing can lower cost and reduce radiation exposure. Stacy Reynolds, MD, program director of the emergency medicine pediatric fellowship program, is investigating the necessity of pelvic imaging in blunt abdominal trauma in both adults and children, potentially lessening the radiation exposure of standard trauma imaging. Chad Scarboro, MD, is studying the adherence to clinical decision rules for head CT in pediatric trauma. With assistance from the Carolinas Trauma Network and the Carolinas Trauma Network Research Center of Excellence, the second phase of the project has revised and implemented a head injury tool to be utilized System-wide in emergency departments that triggers a clinical decision tool when orders for head CT imaging are placed. Pediatric Emergency Medicine fellow, Abby Mofield, MD, has initiated a qualitative study to understand how shared decision making in the emergency department between patients, families and clinicians can be improved for children who have experienced mild traumatic head injury.

Michael Runyon, MD, research director for emergency medicine, participates as a co-investigator for an NIH (R01 GM103799) grant from the National Institute of General Medical Sciences for the use of a novel therapy L-carnitine to ameliorate the adverse hemodynamic effects of sepsis. Dr. Runyon is also a physician educator with the World Health Organization and taught physicians best practices to combat the recent Ebola outbreak. David Pearson, MD, Code Cool® director, established the Carolinas HealthCare System Code Cool® Collaborative that includes partnerships with critical care, cardiology and pre-hospital medicine, to disseminate and standardize post-cardiac arrest therapeutic hypothermia throughout the Carolinas HealthCare System network. Michael Gibbs, MD, chair of the department and vice president of research for the Carolinas HealthCare System, partnered with the Department of Physical Medicine and Rehabilitation to build a comprehensive registry for concussion. The protocol involves bedside evaluations, long-term follow-up and biobanking to better understand what can be done in the immediate post-injury period to optimize recovery and to characterize moderators of gender differences in outcome after traumatic brain injury. The registry is supported by grants from the Carolinas Trauma Network Research Center of Excellence.

The toxicology group continued to conduct important studies of treatments for snake bites and envenomation. The Ultrasound Division continued numerous studies demonstrating the value, efficiency and improvement in care that the technology can bring to the bedside while providing ongoing education and training to residents, fellows and medical students.

## PHYSICAL MEDICINE AND REHABILITATION

The research interests and activities within the Department of Physical Medicine and Rehabilitation (PM&R) contribute to achieving the vision of Carolinas HealthCare System to be recognized nationally as a leader in the transformation of healthcare delivery and chosen for the quality and value of services provided. Under the direction of Research Director Janet Niemeier, PhD, several new and innovative studies launched in 2014 that aligned well with the System strategic priorities.

Jesse Lieberman, MD, was awarded a prestigious K01 Award (K01 HL120913) from the National Heart, Lung, and Blood Institute-National Institutes of Health to investigate the effect of additional nutrition education for cardiovascular disease prevention in individuals with spinal cord injury (SCI). This study symbolizes the delivery of quality, effective and innovative patient care and a superior patient experience for SCI rehabilitation medicine patients. Dr. Lieberman will examine the effectiveness of a nutrition education program relative to usual care in two SCI cohorts (acute and chronic). Desired



outcomes include: change in nutrition behavior (i.e. increased intake of prudent foods and decreased intake of fat, cholesterol, sugar, and sodium), increase in nutrition knowledge, improvement in dietary quality, less weight gain and smaller increases in waist circumference, and improvement in metabolic cardiovascular disease risk factors.

Mark A. Hirsch, PhD, began leading a cross-field Carolinas Trauma Network Research Center of Excellence collaborative study with investigators from the Department of Orthopaedic Engineering, Trauma Surgery, Levine Children's Hospital and the University of North Carolina at Charlotte. Dr. Hirsch's research uses inertial sensors worn on the body, an innovative technology, to investigate the association between cognition and movement in an understudied population – children with moderate to severe traumatic brain injury (TBI) compared to age and gender matched typically developing children. It is anticipated that this research will provide the foundation to transform the delivery of care for these pediatric TBI patients.

2014 was a productive year for other PM&R research projects as well. Dr. Niemeier leads a project aimed to determine the role of hormones on recovery from TBI. Mark Newman, PhD, continued investigating medication adherence challenges for individuals following TBI.

PM&R Research continued as an active follow-up site for TBI Model Systems through the National Data and Statistical Center which is funded by the US Department of Education, the Office of Special Education and Rehabilitation Services and the National Institute on Disability and Rehabilitation Research (NIDRR). The team has completed more than 450 follow-up contacts for data collection resulting in a 93 percent follow-up rate. Individuals contacted are five, 10 and 15 years post injury. Lori Grafton, MD, is the site medical director and Dr. Niemeier is the project director for the TBI Model Systems Follow-up Site.

TBI Project STAR is an ongoing demonstration project funded through North Carolina Department of Health and Human Services for more than 17 years to identify needs and provide direction to address the gaps of service provision for individuals with traumatic brain injuries once they return to their communities. During 2014 and through TBI Project STAR, curriculum was developed to educate community-based service providers such as substance abuse providers about the unique needs of individuals with TBI who are seeking their services. Also in 2014, a modified 12-step approach to substance abuse program was developed for individuals with TBI.

### Orthopaedic Clinical Research

The Orthopaedic Clinical Research Program had a productive year. In addition to three new externally funded grants, six peer-reviewed publications resulting from original research, and more than 15 posters and podium presentations at regional, national and international scientific meetings, the team continued leadership and participation in the Department of Defense-funded Major Extremity Trauma Research Consortium (METRC; [www.metroc.org](http://www.metroc.org)). The Carolinas Medical Center (CMC) Orthopaedic Clinical Research Team leads enrollment across more than 30 Level I Trauma Centers on the 12 prospective research studies, including the three studies that launched in 2014. The team is now working with METRC collaborators to lead new efforts to include pediatric trauma. Trauma is the most common cause of mortality and morbidity in children; therefore, it is imperative that critical questions about care and outcomes of injured children be answered. Individual institutions do not have adequately sized patient populations to independently answer important questions regarding care of the injured pediatric patient. To aggregate enough data to answer these important patient care questions, Kelly VanderHave, MD, and other faculty from the CMC Department of Orthopaedic Surgery and METRC were awarded a grant from the Orthopaedic Trauma Association to establish a Registry of Orthopaedic Trauma in Children. This registry will utilize the existing METRC infrastructure to establish a platform for research in pediatric orthopaedic trauma to identify research opportunities and power future studies.

### Carolinas Trauma Network Research Center of Excellence

The Carolinas Trauma Network Research Center of Excellence (COE) completed its third year with two major awards for external funding, 13 presentations at regional, national, and international conferences, and two peer-reviewed publications.

The COE received an award from the Centers for Disease Control and Prevention under the new "Research on Integration of Injury Prevention into Health Systems" program. "Prescription Reporting with Immediate Medication Utilization Mapping (PRIMUM)", a two-year award, is one of only two grants awarded nationally. It aims to reduce narcotic abuse, misuse, and diversion in a high-risk population. Rachel Seymour, PhD, and Joseph Hsu, MD, will lead a multidisciplinary team from Orthopaedic Surgery, Emergency Medicine, the Carolinas Trauma Network, and the Carolinas Poison Center along with colleagues from Administration and Information Services to implement this innovative health information systems intervention. The objective of this study is to assess the ability to affect prescribing behavior and reduce morbidity and mortality within a large healthcare system by providing immediate feedback to prescribers on prescription narcotic utilization in potentially high-risk patients. Specifically, we believe the proposed intervention will reduce prescriptions for high dose opioids, co-prescribing of opioids with other controlled substances, and reduce the number of prescriptions from multiple prescribers.

### Orthopaedic Research Engineering Laboratory

Throughout 2014, the Orthopaedic Engineering Research Laboratory continued to be involved in collaborative research and development efforts with departments both within and outside Carolinas HealthCare System. Internal collaborators included the Department of Physical Medicine and

Rehabilitation and the Department of Neurology at Carolinas Medical Center (CMC) and external partners included both the Department of Mechanical Engineering and Engineering Science at the University of North Carolina at Charlotte and OrthoCarolina. Collaborative engineering projects and clinical research protocols focused on the Falls Prevention Technology Development Program through the Carolinas Trauma Network Research Center of Excellence (COE) and on resident research projects supported primarily by the Winkler Orthopaedic Fund.

The Falls Prevention Technology Development Program develops and evaluates performance-based measurement tools (PBMs) that can be used in conjunction with patient-reported outcomes measures (PROMs) for patient assessments and outcomes which can be used in a variety of medical applications beyond the prevention of falls. These PBMs involve the electronic monitoring of patients as they perform various mobility tests. Four ongoing protocols approved by the institutional review board involve collecting and analyzing mobility data on patients with orthopaedic lower extremity trauma, Parkinson's disease, amyotrophic lateral sclerosis, and pediatric mild to moderate traumatic brain injury patients. The last three years of technology development efforts led to the receipt of a \$727,000 grant from the AO Foundation Strategy Fund to develop a "Mobility Toolkit" of performance-based measures for the AO Patient Outcomes Center. The project involves the synergistic efforts of AO and the Department of Orthopaedic Surgery at Carolinas Medical Center, the COE, the University of North Carolina at Charlotte and the Department of Orthopaedic Surgery at Carolinas Medical Center, the COE, the University of North Carolina at Charlotte and the Department of Orthopaedic Surgery at the University of Texas Health Science Center at Houston. Two related abstracts were presented at the World Congress of Biomechanics in July 2014. Also, a provisional software patent application (No. 61/929,560) was submitted in January 2014 related to these efforts.

Patient-focused, resident research projects also continued to be an important part of the laboratory efforts. Study topics included: a comparison of ACL reconstruction techniques by Harvey Montijo, MD, (in conjunction with Scott O'Neal, MD, a fellow at OrthoCarolina and OrthoCarolina sports medicine attending Jim Fleischli, MD); radiation treatment for spinal tumors in the presence of PEEK or titanium spine fusion cages by Benjamin Jackson, MD, Joshua Patt, MD, and collaborators from CMC Radiation Oncology and Dickson Advanced Analytics Group (Dennis Duggan, PhD; Anthony Crimaldi, MD; H. James Norton, PhD; and William Anderson, MS); patella tendon repair by Gabriella Ode, MD, and OrthoCarolina attending Dana Piasecki, MD. All of these projects are conducted under the supervision and support efforts of Richard Peindl, PhD, Nahir Habet, MSc (research engineer), and Stephen Daugherty (machinist/technician). In 2014, resident research projects resulted in three manuscripts accepted for publication with two more submitted, one podium presentation and four poster presentations at local, national and international meetings and two additional abstracts submitted.





## Orthopaedic Research Biology Laboratory and Osteoarthritis

The Orthopaedic Research Biology team is part of the nationally and internationally recognized Department of Orthopaedic Surgery at Carolinas Medical Center, a program of excellence in clinical care, resident education, and translational research. The team is committed to uncovering the causes of diseases of joints and bones, and devising effective strategies for their treatment. The team supported two major research efforts in 2014. They addressed intervertebral disc degeneration and low back pain under the direction of Helen Gruber, PhD, and Edward Hanley, MD, and with support from research staff: Jane Ingram, Gretchen Hoelscher, Synthia Bethea, Tish Bullock, and Michael Cox, along with the help of staff assistant Brenda Davis. The second major research effort was focused on osteoarthritis and was under the direction of Yubo Sun, PhD, David Mauerhan, MD, and Dr. Hanley with support from postdoctoral fellows Andrea Roberts, PhD, and Alex Kiraly, PhD.

Drs. Gruber and Hanley carried out research funded by the North American Spine Society which was investigating whether human annulus cells actively try to repel nerve ingrowth into the disc. Another project investigated expression of pain-related genes and cell products in co-cultures of human disc and nerve cells and was financially supported by the Smith Arthritis Fund. These studies are part of the larger disc degeneration and low back pain research work by Drs. Gruber and Hanley. The lifetime prevalence of disc degeneration and its associated low back pain approximates 80 percent with estimated health care costs exceeding \$100-200 billion per year. Chronic low back pain takes a high socio-economic toll in terms of lost wages, reduced productivity; long term it also takes a high personal toll, and can lead to disability and job loss. Recently published findings from this laboratory included studies of the production and expression of growth and differentiation factor-5, cortistatin, and RANTES by disc cells and their modulation by proinflammatory cytokines, investigations on the catabolic agent matrix metalloproteinase-12 in the disc, and discovery of a novel catechol-O-methyltransferase variation associated with human disc degeneration and pain. Research using an animal model for spontaneous disc degeneration continued, and a 2014 publication documented degeneration in the cervical spine as well as the lumbar spine in the sand rat. Additionally, a book chapter on the utility of the sand rat in disc studies was also published in the text entitled "The Intervertebral Disc." Dr. Gruber continued to collaborate with Das Roy, PhD, at the University of North Carolina at Charlotte on how neutralization of IL-17A reduced breast cancer-associated metastasis in arthritic mice.

Osteoarthritis is characterized by cartilage breakdown and loss in joints in hands, feet, spine, hips and knees and is a common condition affecting more than 25 million people in the US. Research conducted within this laboratory focused on collagen and proteoglycan changes in the meniscus and the biological effects of phosphate on cells in the synovial fluid. Findings were published on phosphocitrate-targeted genes in osteoarthritic menisci and calcium mineral formation and deposition induced by fibroblast-like synoviocytes.

The Orthopaedic Research Medical Resident, Gabriella Ode, MD, was involved in several biology studies during 2014. She worked with the disc degeneration laboratory team on studies of the osteogenic nature of the biomembrane formed in human segmental defects. The work was accepted as a platform presentation in the 2014 Orthopaedic Trauma meeting. Dr. Ode also worked with the osteoarthritis research team and performed semi-menisectomy, femur condyle drilling and tail disc stab surgeries to rats to set up animal models of post-traumatic osteoarthritis, osteochondral defects and disc degeneration.



## INTERNAL MEDICINE

### Department of Internal Medicine

The Department of Internal Medicine had significant and exciting growth in its research division in 2014.

The HIV research team, led by Marc Johnson, MD, continued to serve the community by offering new and novel treatments for patients. Most of the active trials focus on single tablet regimens (combining multiple medications into one pill) to reduce the pill burden and increase compliance. These trials target both treatment-naïve and experienced patients. Dr. Johnson collaborated with University of North Carolina at Chapel Hill on the "Antiretroviral Activity and Tolerability of Once Daily Etravirine in Treatment-naïve Adults with HIV-1 Infection Explores the Effectiveness" study and submitted an abstract for publication.

Researchers from ID Consultants & Infusion Care Specialists were enthusiastically welcomed to the HIV research team this year. The new research team members are led by Christopher Polk, MD, and Lewis McCurdy, MD. The merger of these two independent research groups was a significant and exciting process that involved all aspects and team members working together. Collaboration among the teams affords a greater number of patients access to cutting edge treatment options.

James Horton, MD, continued to collaborate with Duke Clinical Research Institute in conjunction with the National Institutes of Health on a project analyzing the length of time that patients with sepsis receive antibiotic treatment. This important research will help create national standards for antibiotic dosing, which will lend to decreasing the ever growing number of issues with highly resistant organisms. Dr. Horton also continued collaboration with Martin Blaser, MD, at New York University and published their work in the *Journal of Infectious Diseases* on the link between abscesses and the naturally occurring microorganisms that live on the skin.

Internal Medicine also expanded the research program to Carolinas Medical Center-University with Michael Zgoda, MD, leading research focused on chronic obstructive pulmonary disease (COPD). This trial opened enrollment in 2014 and will compare the standard medicinal management of COPD to an endobronchial valve that is implanted into the diseased portion of a patient's lung effectively maximizing the amount of healthy lung tissue exchanging oxygen with the blood. Under Dr. Zgoda's leadership, another trial will start enrolling patients in 2015 to evaluate a single inhaler with three medications to reduce polypharmacy and dosing intervals for patients with COPD.

In 2014, the department welcomed Jianfeng Cheng, MD, to the research team. Her research interests focus on pharmacological management of ulcerative colitis and Crohn's disease (inflammatory bowel diseases). Dr. Cheng is currently enrolling patients into a registry (LEGACY) trial for patients on Humira® to collect long-term safety and side effect data of patients being treated for ulcerative colitis.

Research in the Department of Internal Medicine is supported by research coordinators: Jessica Kearney-Bryan, Ann Boye, Madeline Ferrell, and Lisa Engel (ID Consultants).

## Division of Hepatology

The faculty and staff of the Division of Hepatology are committed to improving the outcomes of patients locally and globally. The research team in the Division of Hepatology is led by Mark Russo, MD, MPH, and is comprised of four clinician researchers, a clinical research director, research nurse and two research analysts. They presented their research at several national and international meetings and published eight peer-reviewed journal articles. In addition to Dr. Russo, Philippe Zamor, MD, Andrew deLemos, MD, and Paul Schmeltzer, MD each led clinical trials during 2014 and the team finished 2014 with a portfolio of 15 open, active trials on the topics of Hepatitis B, chronic hepatitis C, acute hepatic porphyria, liver transplant and drug-induced liver injury.

Dr. Russo's research on drug-induced liver injury made quite an impact on the interested public and experts in 2014. His research was published in *Hepatology* and he was subsequently quoted in *The New York Times* (August 11, 2014) stating that routine tests of liver function are not necessary by the sole indication of taking statin drugs. He was also interviewed by the *New England Journal of Medicine* *Journal Watch* on this research.

Dr. Russo was also elected as part of the inaugural class of Fellows in the American Association for the Study of Liver Diseases (AASLD), which recognizes physicians for their research and clinical contributions in liver disease.

Siddesh Besur, MD, a Hepatology resident, presented his research about inpatients with hepatocellular carcinoma at the 49<sup>th</sup> annual meeting of the European Association for the Study of the Liver (EASL)-The International Liver Congress in London, United Kingdom in April, 2014.

## Liver Pathobiology Laboratory

The Liver Pathobiology Laboratory, directed by Laura Schrum, PhD, conducts translational research in collaboration with hepatologists and surgeons at Carolinas Medical Center. Research focuses on investigating the intricate cellular and molecular mechanisms of hepatic fibrosis and cirrhosis aimed to discover earlier diagnoses and better therapies because of its progressive advancement to hepatocellular carcinoma (HCC). Fibrosis/cirrhosis can arise from many factors including obesity, chronic alcoholism, or hepatitis B or C viral infection.

Obesity is an independent risk factor for the development of liver fibrosis/cirrhosis and eventual hepatocellular carcinoma (HCC), the third leading cause of cancer death worldwide due, in part, to late diagnosis. A consequence of obesity is nonalcoholic fatty liver disease (NAFLD). NAFLD is another focus of the laboratory team as it is currently the leading cause of chronic liver disease affecting approximately 30 percent of the US population, and in susceptible hosts, it can lead to steatohepatitis, cirrhosis and HCC. One of the early key events in the development of obesity-associated HCC is the activation of hepatic stellate cells (HSCs), which increase secretion of extracellular matrix proteins, such as tenascin-C (TnC), associated with inflammation, fibrosis and tumorigenesis. This team's research showed that TnC is significantly elevated in cirrhotic patients with a further increase in cirrhotic patients with HCC, suggesting TnC as an early, non-invasive biomarker for HCC (Figure 1).

HSC activation/transdifferentiation is a pivotal event in initiation and progression of fibrosis/cirrhosis, and the Liver Pathobiology Laboratory is focused on investigating the HSC as a therapeutic target and identifying molecules expressed by HSCs that could serve as non-invasive biomarkers for HCC. The team identified transcriptional repressor, Rev-erb, as a key regulator in this process, and a potential therapeutic target. They demonstrated that activation of Rev-erb, through use of a biologically active agonist, significantly reduced fibrosis in a CCl<sub>4</sub> fibrotic mouse model (Figure 2), suggesting this ligand as a treatment or inhibitor for hepatic fibrosis and related pathologies.

During the development of fibrosis, critical changes in microRNA (miR), small non-coding RNAs, profiles are observed and show great potential for diagnostic and therapeutic strategies in managing liver disease. The team tested miR19b as a therapy for fibrosis in an animal model. They delivered miR19b to activated HSCs using an adeno-associated virus (AAV) construct. These studies demonstrated that re-introduction of miR19b (Col-GFP-miR19b) inhibits development of hepatic fibrosis as seen by immunohistochemistry and may serve as a therapy for liver fibrosis (Figure 3, decreased red staining indicates less fibrosis).

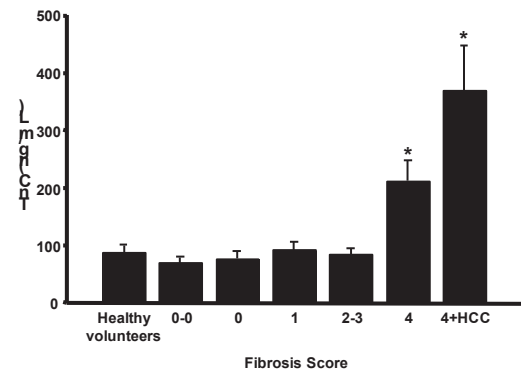


Figure 1. Tenascin-C in human plasma is elevated in hepatic fibrosis and progression to HCC. TnC levels were measured by ELISA in plasma samples from healthy volunteers (BMI<30) and patients with a primary diagnosis of obesity (BMI>30) and a liver fibrosis score of 0 – 4. Patients with a fibrosis score of 0 were further stratified by the presence (0) or absence (0-0) of hepatic steatosis, inflammation or ballooning. Patients with fibrosis scores of 4 (cirrhosis) were further stratified by progression to HCC (n ≥ 4). Data represent mean values from n ≥ 4; \*p<0.05 compared to all groups; error bars indicate SEM.

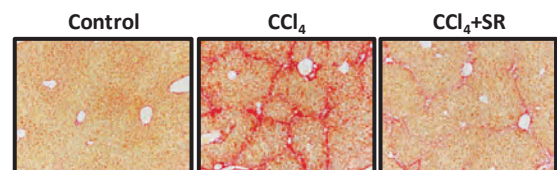


Figure 2. Rev-erb agonist SR9009 ameliorates CCl<sub>4</sub>-induced fibrosis. C57BL/6 mice were injected i.p. with CCl<sub>4</sub> twice/week for five weeks. Three weeks after initiating CCl<sub>4</sub>, agonist (SR9009, SR; 100mg/kg) was administered for two weeks (5x/week). Sirius red staining was performed to detect collagen deposition.

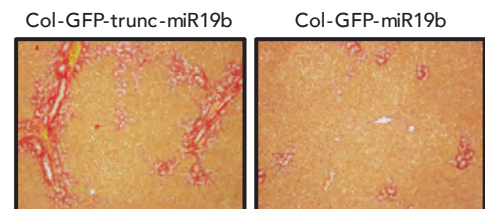


Figure 3. AAV Col-GFP-miR19b inhibited hepatic fibrosis in a BDL model. Sprague-Dawley rats underwent BDL followed by portal vein AAV injections (1x10<sup>12</sup> vector genome/rat; control AAV, Col-GFP-trunc-miR19b; miR19b AAV, Col-GFP-miR19b). After one week BDL, tissue was harvested and collagen deposition assessed by PicroSirius red staining.



Overall, the Liver Pathobiology Laboratory will continue translational and clinical research in close collaboration with clinicians to identify biomarkers and develop novel therapeutic strategies for liver disease. These research endeavors are aimed at providing improved and high quality patient care and superior personalized medicine.

## Rheumatology at Carolinas Medical Center-NorthEast

In 2014, research initiatives in Rheumatology expanded significantly to include basic, translational, and clinical research projects. Led by Gordon Lam, MD, FACR, director of the Northern Region Research Center at Carolinas Medical Center-NorthEast, these initiatives aim to advance knowledge in specific immunotherapeutic disease states, as well as study promising new pharmaceutical and biologic agents in the treatment of systemic inflammatory diseases.

Collaboration with Martin Kohlmeier, MD, of the University of North Carolina Nutrition Research Institute, led to further understanding of individual methotrexate responses in patients with rheumatic diseases. This investigator-initiated project seeks to determine genetic and metabolomic factors related to nutrient metabolism and drug transport, thus enabling rheumatologists to predict an individual patient's response to therapy. Implications from this research may lead to more appropriate choice of therapies, decreased adverse events, and more efficient dose-escalation of the drug, with ultimate benefits of improved efficacy and tolerability rates in patients with autoimmune diseases. Results from this study were presented in an abstract at the annual American Society of Nutrition meeting in Washington, DC.

NorthEast Rheumatology is a national leader in hyperuricemia and gout management. A phase IV study was initiated in 2014 with Dr. Lam as principal investigator to evaluate pegloticase in adult hyperuricemic patients who are refractory to conventional gout therapy. The main objective of this multicenter study is to evaluate the frequency and severity of infusion reactions, anaphylaxis, and immune complex-related events for this novel biologic agent. Evaluation of the long-term efficacy of this drug may significantly alter the current treatment paradigm of patients with refractory chronic gout, which is one of the most painful and debilitating diseases.

NorthEast Rheumatology continues to participate in the RALLY registry, a national database tracking the long-term outcomes and safety of biologic agents used in clinical practice for rheumatoid arthritis. This 5-year, 20,000-patient study was characterized as setting a new standard for outcome studies by the FDA Arthritis Committee.

Further clinical trials of newer biologic agents for the treatment of systemic, inflammatory autoimmune conditions such as rheumatoid arthritis, psoriatic arthritis and ankylosing spondylitis are also being launched, which will offer patients early access to novel therapeutic advances in contemporary rheumatologic science.

## Integrative Medicine at Carolinas Medical Center-NorthEast

Marie Mercier, MSN, is leading an investigator-initiated pilot study at CMC-NorthEast entitled "Effects of abdominal and foot massage on post-operative ileus and pain after abdominal surgery." This study utilizes a comprehensive approach to the care of surgical patients that combines Western medicine and complementary therapies to relieve pain and prevent or resolve post-operative ileus. In 2014, the study started to include laparoscopic patients. Funding for this study was provided by a William T. Morris grant.

2014 was an exciting and dynamic year for the Division of Research within the Department of Surgery at Carolinas Medical Center. Brent Matthews, MD, FACS, was welcomed as the new Department Chair. Dr. Matthews was recruited from Washington University of St. Louis where he was a Professor of Surgery, specializing in minimally invasive surgery of the liver, pancreas and digestive tract. Dr. Matthews brought his experience managing and leading a research laboratory funded by the National Institutes of Health that studied Barrett's esophagus and he is the author of more than 150 peer-reviewed manuscripts. Dr. Matthews' continued commitment to academic surgical research has been evident since his arrival and 2015 promises to bring important transitions as the research goals of each division are aligned with the translational and clinical research endeavors of the department. Throughout the year, the research efforts of the department were recognized at the local and national level with more than 30 peer-reviewed manuscripts and book chapters published, and more than 80 presentations undertaken at local, national and international meetings. The divisions also continued to support the education of surgical residents, fellows and students pursuing undergraduate, masters and doctoral degrees. divisions also continued to support the education of surgical residents, fellows and students pursuing undergraduate, masters and doctoral degrees.

### Surgical Oncology

David Foureau, PhD, and Kendall Carpenter, CCRP, as part of the General Surgery Research Laboratory, work with Richard White, Jr., MD, FACS, Asim Amin, MD, PhD, and Jonathan Salo, MD, FACS, from the Levine Cancer Institute. In 2014, they continued their work studying immunotherapy for melanoma. Immunotherapeutic protocols such as cytokine therapy or immune checkpoint blockade represent the most effective therapeutic approach currently available to treat late stage melanoma, however cancer remission is observed in a minority of patients.

Previous work from this group combined basic and translational research approaches to uncover novel cellular and molecular immune imbalance mechanisms associated with differential responses to immunotherapy. This work aims to identify early biomarkers that can predict patient responsiveness to immunotherapy, as well as develop new immunotherapeutic strategies that will restore immune potency against the cancer cells. These studies are sponsored in part by the Purple Promise Foundation to End Melanoma and were presented at 66<sup>th</sup> Annual Cancer Symposium of the Society of Surgical Oncology.

In addition, this group collaborated with Gloria Elliott, PhD, from the University of North Carolina at Charlotte (UNCC) to develop a targeted drug delivery system (nanoparticles) that can directly deliver immunotherapeutic drugs to immune "effector" cells to improve treatment efficiency and reduce side effects. This work is funded in part by UNCC's Center for Biomedical Engineering and Sciences and was presented at the American Society of Mechanical Engineers.

### Hepato-Pancreato-Biliary Surgery

The clinical Hepato-Pancreato-Biliary (HPB) research efforts are led by David Iannitti, MD, John Martinie, MD, and Ryan Swan, MD, and continued to grow through 2014. As the HPB database system (managed by Allyson Cochran) becomes fully integrated, it is anticipated that the patient outcomes

data will form a core component of the HPB clinical research efforts. Access to this data will not only directly influence how complex disease states are managed in our HPB patient cohort, but also inform translational research efforts aimed to improve future treatment and therapy. Studies include clinical trials to improve surgical outcomes, partnerships with industry to improve surgical equipment and approaches, and collaborations with academic institutes and other partners to develop innovative drug delivery and three-dimensional imaging systems. As the HPB Program continues to develop and grow, so does the recognition for the clinical research and education performed in HPB Surgery at Carolinas Medical Center. During 2014, Carolinas Medical Center hosted the Third Annual HPB Surgery Fellows Course in Minimally Invasive HPB surgery and the Eighth Annual GI-HPB Conference.

Other ongoing research projects aim to understand the underlying pathogenesis of the disease states with which our HPB patients present. For example, Kyle Thompson, PhD, in collaboration with the Divisions of HPB and Bariatric Surgery, led studies on the growing impact of obesity and alcohol in liver disease progression toward cancer. In parallel, research led by Iain McKillop, PhD, Eugene Sokolov, PhD, and Valentina Zuckerman, PhD, seeks to understand the role of lysophosphatidic acid (LPA) signaling in the liver, with a particular emphasis on LPA and hepatocellular carcinoma (HCC). In recent years, LPA, a small lipid-signaling molecule synthesized from cell membranes, has been a molecule of particular interest in cancer biology with several new pharmacological agents entering clinical trial. However, within the liver, the impact of LPA has been less understood, due in large part to the absence of established LPA receptors (LPARs) in the liver. In 2014, Dr. McKillop and colleagues were the first to identify a newly reported LPAR. LPAR6 is not only expressed in the liver but expression levels of LPAR6 are dramatically altered in human HCC. In collaboration with clinical colleagues at Carolinas Medical Center and bio-engineers at UNCC, ongoing research seeks to determine how these pathways regulate tumor cell function, and whether novel therapeutics can be developed and targeted for localized drug delivery using innovative bioceramic nanoscaffold systems.

These cutting edge approaches to bench-to-bedside research will be further aided in 2015 with the arrival of Dionisos (Dennis) Vrochides, MD, PhD, and Cesar Aviles (NP). Aviles, a Nurse Practitioner, was awarded a full scholarship by the University Scholars Program to pursue his Doctor of Nursing Practice degree from Duke University.



## Trauma Surgery

The Trauma Research Laboratory studies the pathophysiology of hemorrhagic shock and reperfusion (HSR) injury, as well as septic shock, but focuses primarily on the role of mitochondrial dysfunction and the progression to multiple organ failure (MOF) and death. They utilize both in vitro and in vivo models of hypoxia and severe hemorrhage-reperfusion injury to pursue these studies.

Reactive oxygen species are predicted to be key modulators of the inflammatory response following HSR and/or sepsis, and while the mitochondria produce them in small quantities during normal function, endogenous antioxidant capacity is swiftly overwhelmed when the electron transport chain starts to break down. Thus, recent studies have focused on the potential therapeutic intervention of mitochondrial-targeted antioxidants. In addition to determining the potential of specific therapeutic interventions, the laboratory focuses on elucidating the redox signaling mechanisms at work to better understand the role of reactive oxygen species in inflammation, the MOF phenomenon and the differences between mitochondrial behaviors in various tissues following injury. These studies are being performed as a collaboration between Susan Evans, MD, and Toan Huynh, MD, who are clinicians in the Department of Trauma, Surgical Critical Care and Acute Care Surgery and Rebecca Powell, PhD, in the Division of Research.

## Transplant Surgery

The Transplant Center at Carolinas Medical Center (CMC) remains one of the busiest in the Carolinas and one of the 50 busiest kidney transplant centers in the US. In the past year, the Division of Abdominal Transplant Surgery continued their clinical research to improve outcomes for their transplant recipients. These efforts to maintain graft survivals above the national averages have led to the Division of Transplant partnering with CMC Quality and Dickson Advanced Analytics Group (DA<sup>2</sup>) to develop a real-time tool to track clinical outcomes and improve clinical care. This tool was shared at the Transplant Management Forum (TMF) and clinical care benefits from this partnership continue to be evidenced. In addition to complex data management and analysis, the kidney transplant program continues to participate in multicenter trials specifically focused on novel immunosuppressive agents. They also partnered in a multicenter trial to explore the use of a new cytomegalovirus (CMV) in transplant patients. Between 60 and 80 percent of the population are thought to be infected with CMV by age 40, but most are unaware because their immune system can adequately suppress the effects of CMV infection. Following organ transplant, patients receive immune suppressant drugs to reduce the chance of organ rejection. This suppression of normal immune responses in transplant recipients can lead to the effects of CMV emerging. Indeed, complications associated with CMV infection are amongst the most common complications and can lead to serious illness in the transplant patient population. It is anticipated that CMV vaccinations will thus significantly reduce the impact of immune system suppression in transplant patients to reduce organ rejection and improve survival.

## Gastrointestinal and Minimally Invasive Surgery

The Division of Gastrointestinal and Minimally Invasive Surgical research is led by B. Todd Heniford, MD, FACS, chief of GI and Minimally Invasive Surgery and director of the Carolinas Hernia Center at Carolinas Medical Center. He is a world-renowned clinical investigator and surgeon, specializing in abdominal wall reconstruction, minimally invasive surgery, and hernia surgery. Dr. Heniford founded the Carolinas Laparoscopic and Advanced Surgery Program (CLASP), which conducts research in surgical techniques, devices, mesh, and patient outcomes through the use of basic science



laboratories, patient databases, and clinical trials. He is the author of more than 350 peer-reviewed publications and is an academic mentor for many successful clinical research fellows.

This year was particularly exciting for the department as Dr. Heniford was awarded the MedStar Georgetown University Surgical Lifetime Achievement Award in Abdominal Wall Reconstruction. Shortly following, his dedication to clinical research was also recognized by the American Hernia Society when he was awarded the Nyhus-Wantz Lifetime Achievement Award for untiring attention to the study and skill of abdominal wall surgery. He was additionally recognized by his peers for his expertise with an Asia-Pacific Surgical Society Honorary Membership.

Dr. Heniford and CLASP continue to innovate to improve the future of surgery with evidence-based mobile apps and programs to reduce postoperative complications and cost by optimizing patients' comorbidities prior to surgery. His recent focus has been on facilitating patient communication in hernia repair with the development of the mobile Carolinas Equation for Determining Associated Risks (CeDAR) app which has been downloaded by thousands of patients and surgeons in more than 50 countries. The division's previous app, Carolinas Equation for Quality of Life (CeQOL), has now been downloaded in more than 90 countries thousands of times. CeDAR is a groundbreaking app that predicts both the risk and financial impact of wound-related complications following hernia repair in a real-time risk model which can be used to facilitate patient discussion.

The Division of Gastrointestinal and Minimally Invasive Surgery's research has resulted in 53 regional, national and international awards over the last 14 years and has led to real changes in the surgical care of patients around the world. In 2014 alone, 12 peer-reviewed publications and two book chapters were generated.

CLASP research continued to win national awards during 2014. Sam W. Ross, MD, MPH, received first place in the North Carolina American College of Surgeons Committee on Trauma Resident Trauma Papers Competition for "Hemodilution: fact or fiction? A prospective, randomized controlled trial to quantify the effect of blood loss and crystalloid resuscitation on hemoglobin." Another mentee of Dr. Heniford, Blair A. Wormer, MD, received the M. Judah Folkman Memorial Award at the American Pediatric Surgical Association's 44<sup>th</sup> annual meeting for Best Podium Presentation for the study entitled "Home Intravenous Versus Oral Antibiotics Following Appendectomy for Perforated Appendicitis, A Randomized Controlled Trial." The group also won the Andrew Kingsnorth Award - European Hernia Society Research Award and received second place awards at the European Association for Endoscopic Surgery and Society of American Gastrointestinal and Endoscopic Surgeons.



### Cord Blood Research at Carolinas Medical Center-NorthEast

Ryan Brown, MD, in collaboration with the Northern Region Research Center at Carolinas Medical Center (CMC)-NorthEast and the Carolinas Cord Blood Bank (CCBB) at Duke University Medical Center, has expanded the Umbilical Cord Blood Banking program within Carolinas HealthCare System. This multicenter initiative involves the public donation of umbilical cord blood that would otherwise be discarded following delivery and makes it available to patients and doctors for transplantation or research. The CCBB also maintains a research database that contains information associated with the collection, processing, storage, testing, and banking of the cord blood.

In 2014, the number of cord blood collections at CMC-NorthEast increased significantly under Dr. Brown's leadership, and this initiative was expanded to CMC-University. Currently, these are the only two hospitals in the greater Charlotte metropolitan region to offer this service at the time of delivery. In recognition of these efforts, the Jeff Gordon Children's Foundation awarded a grant of \$280,000 to further implement this process across Carolinas HealthCare System. Use of these funds has been directed at dedicated programming within the Carolinas HealthCare System electronic medical record, as well as for proprietary marketing efforts. Plans are to expand this collection process to other Carolinas HealthCare System facilities in the future, which will position Carolinas HealthCare System as the largest contributor to this cord blood repository.

### Division of Reproductive Endocrinology

In 2014, the reproductive endocrinology research team presented four abstracts at national or international meetings (three of which were presented by department resident physicians).

Additionally, the division was invited to participate in two industry-sponsored multicenter studies involving ovulation induction in women with hypothalamic amenorrhea and use of an adhesion barrier in women undergoing laparoscopic myomectomy.

Ongoing studies include: the comparison of a slow-release intrauterine insemination with the standard intrauterine insemination; the use of a device to time intrauterine insemination; and the comparison of two different techniques for endometrial activation for women undergoing in vitro fertilization.

The division also participated in a multicenter clinical trial as part of the Reproductive Medicine Network funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development through the National Institutes of Health (U10 HD055925). The multicenter Pregnancy in Polycystic Ovary Syndrome II (PPCOS II) trial was a randomized control trial comparing the cumulative live birth rate of the use of clomiphene versus letrozole over five treatment cycles in 750 infertile women with polycystic ovary syndrome (PCOS) between 18 and 40 years of age. More than six million women in the United States are diagnosed with PCOS. It is the most common hormonal abnormality in reproductive age women and a leading cause of infertility. Historically, women with PCOS have been prescribed clomiphene citrate to help stimulate ovulation. Clomiphene's success rate for live births is only 22 percent. Letrozole is FDA-approved for breast cancer treatment and it suppresses production of estrogen and in turn triggers release of the hormones that drive ovulation. Letrozole was found to have significantly higher ovulatory rates and live births as compared to the group taking clomiphene.

The cumulative live birth rate was 27.5 percent with letrozole compared with only 19.1 percent with clomiphene. The results were published in the *New England Journal of Medicine*.

## Division of Maternal Fetal Medicine and Charlotte Fetal Care Center

Courtney Stephenson, DO, FACOG, Director of the Charlotte Fetal Care Center and Associate Director of Maternal-Fetal Medicine at Carolinas HealthCare System, authored a paper, Microwave Ablation for Twin-Reversed Arterial Perfusion Sequence: A Novel Application of Technology, which was accepted for publication by the *Fetal Diagnosis and Therapy Journal*.

The paper, written along with David Iannitti, MD, chief of Hepato-Pancreato-Biliary (HPB) Surgery at Carolinas Medical Center, details how, together, they were the first in the world to successfully treat a twin reversal arterial perfusion (TRAP) sequence pregnancy by using microwave ablation.

This is a condition in which a healthy fetus is attached vascularly to a mass that has no heart. This mass "steals" blood from the healthy baby and can ultimately cause its demise. Drs. Iannitti and Stephenson combined their expertise to perform this procedure in utero to allow the healthy fetus a chance at survival.

Recently, surgeons from Texas Children's Hospital in Houston asked Dr. Stephenson to teach them how to use the device for one of their patients. After discussing the case, both Dr. Stephenson and the team from Texas decided it would be best to have the patient come to Charlotte so they could do the surgery at the Charlotte Fetal Care Center. The surgery was a success and proved that the System's fetal medicine team is a leader in the field.

## Division of Gynecologic Oncology

David Tait, MD, is Associate Director of Gynecologic Oncology and Director of the Sonya Wyatt Ovarian Cancer Research Laboratory. This laboratory houses the ovarian cancer tissue bank and provides a space for bench research in ovarian and other gynecologic cancers. Dr. Tait's specific laboratory interests are biomarker development and discovery in ovarian cancer. Through collaboration with researchers at the Levine Cancer Institute and the University of North Carolina at Charlotte, Dr. Tait is performing genetic and proteomic analysis of high grade serous ovarian cancer evaluating gene signatures that may be important prognostic and early detection tools. Some of the unique genetic dysregulation in ovarian cancer reported by Dr. Tait and his colleagues has been with the HOX family of genes. Their work with the HOX gene family was presented at several national meetings including the American Association for Cancer Research in 2014. The discovery of down-regulation of the HOXC6 gene in ovarian cancer is of particular interest relative to identification of biomarkers for ovarian cancer screening and understanding the early events in ovarian cancer molecular pathogenesis. Dr. Tait is also active in clinical trials, an active member of the National Cancer Institute-sponsored NRG (formally Gynecologic Oncology Group), and is the institutional principal investigator for an international trial in endometrial carcinoma.

## Division of Urogynecology/Female Pelvic Medicine and Reconstructive Surgery

The Division of Urogynecology actively participated in clinical trials during 2014. Active studies include Postoperative Urinary Retention Following Sacral Colpopexy for the Treatment of Pelvic Organ Prolapse. This is a multicenter trial in conjunction with the University of Louisville Department of

## NURSING

The nursing department at Carolinas Medical Center (CMC) continues to promote best practices using published research evidence to improve patient outcomes and by creating and implementing new ideas for innovative approaches to care. During 2014, twenty-four new nurse-led research protocols were reviewed by the Nursing Scientific Advisory Committee (NSAC); a group of dedicated researchers, primarily nurses, who critically evaluate the scientific rigor of all nursing protocols and provide constructive feedback to nursing staff who are seeking future approval from the institutional review board. Examples of 2014 nursing research include, "Effects of a Care Chair on patient perception of caring and satisfaction with nurse and physician communication" by Michelle Deaton, RN-BC, BSN, CHPN, at CMC. The study design uses a randomly assigned group of patients to receive daily rounding and instructions from a seated practitioner, in an effort to improve authentic presence and interactive communication among nurses, physicians, and patients. Deborah Whitley, RN, MSN, and coworkers at Levine Children's Hospital started developing a valid and reliable measurement tool to meet the need for a more appropriate pediatric evaluation of post anesthesia disposition. Alecia Brown, RN, started exploring the use of healing touch and its effect on anxiety levels for individual undergoing CABG procedures. Deborah Lane-Mathern, RN, BSN, CNOR, and Gayle Casterline, PhD, RN, AHN-BC, surveyed nearly 900 nurses at CMC to describe perceptions of the organizational caring culture. Significant differences were found between direct care and non-direct care nursing staff. Sharon Vincent, DNP, RN, initiated a study looking at palliative care, quality of life and depression in persons with heart failure. Peggy MacKay, RN, MN, at Levine Children's Hospital collected data as part of an international study describing the prevalence of nasogastric tube use in US pediatric hospitals.

The 3rd Annual Carolinas HealthCare System Nursing Research Symposium was held on April 2, 2014 at CMC-NorthEast where nurses shared and learned about research. The title and focus of the symposium was Caring in Action: Innovation in Nursing Practice. Anne Boykin, PhD, MN, BSN, professor emeritus at Florida Atlantic University and world-renowned caring theorist was the keynote speaker. Caring research podium presentations included "Caring for the nurse in the hospital environment" by Elizabeth Clericom, MSN, CGRN, from Bon Secours St. Francis Hospital; "Worldview of Mexican Americans about Diabetes Mellitus" by Jesus Hernandez, PhD, FNP, from Queens University of Charlotte; "Heart failure readmission: A patient perspective" by Whitney Patterson, RN, BSN, MBA, from CMC; "Effects of abdominal and foot massage on postoperative ileus and pain after abdominal surgery: A randomized pilot study" by Cathy Carson, RN, BScN, from CMC- Northeast, and "Applying caring theory leadership to reach the 95th percentile on NCNQI" by Marlienne Goldin, RN, BSN, MPA, at Cone Health. Over 30 research and evidence-based practice posters were accepted for presentation.

## CAROLINAS SIMULATION CENTER

Carolinas Simulation Center (CSC) has continued to grow. During 2014, 5,600 participants experienced more than 20,000 learner contact hours, an increase of 5 percent over 2013. The CSC mission is to promote quality and patient safety, enhance education, and develop research through excellence in simulation-based training and assessment. Notably, the CSC research team led by Dimitrios Stefanidis,



MD, PhD, FACS, FASMB, was awarded two new grants during 2014. First, the Institute for Surgical Excellence awarded a \$30,000 grant to Dr. Stefanidis (site principal investigator) and Manuel Pimentel (lead study coordinator). Grant eligibility is open only to members of the American College of Surgeons Accredited Educational Institutes. With this funding, Carolinas HealthCare System will be part of a multisite validation trial that will include 15 different institutions and hundreds of subjects. The aim of this study is to develop a methodology that allows for the validation of the Fundamentals of Robotic Surgery (FRS) Online and Psychomotor Skills Curriculum using a randomized stratification assignment of subjects to four comparison groups: Control, FRS Physical Dome on da Vinci Trainer, da Vinci Skills Simulator, and Mimic Skills Simulator. A total of six expert robotic surgeons and 24 novice or intermediate experienced robotic surgeons will be recruited to form part of this validation trial spanning a 9-month time period.

Also new in 2014, Mark Bullard, MD, Dawn Swiderski, MSN, and Crystal Bencken, MSN, were awarded a \$75,000 grant by the Children's Miracle Network to provide training for precipitous deliveries and neonatal resuscitation within all Carolinas HealthCare System emergency departments that previously lacked neonatology services. This project aims to improve quality of care, team-based communication and patient outcomes in these high-risk, low-frequency events. By the end of the first quarter 2015, training will be complete at 10 facilities.

The collection of observational study data was completed during 2014 for the ongoing, collaborative research study titled 'Procedural Harm - Can Assessment of Surgical Performance Predict Patient Outcomes.' The study is supported via a \$4.6 million contract from the Centers for Medicare & Medicaid Services (CMS) to the Carolinas HealthCare System Division of Patient Safety & Quality in partnership with CSC. The study team included Dr. Stefanidis (principal investigator), Robert Higgins, MD, FACOG, FACS (co-investigator), Manuel Pimentel (lead study coordinator), and Brittany Anderson-Montoya, PhD (human factors psychologist). The project focused on analyzing the patient outcomes of several surgical procedures (laparoscopic and/or robotic cholecystectomy, hysterectomy, and/or colectomy) performed by general and gynecologic surgeons in order to identify the most common outcomes and complications experienced intra- and post-operatively by patients at Carolinas HealthCare System. Components of the study included the video recording of surgical performance, assessment of the respective surgeon's technical and non-technical performance as well as the deployment of a training intervention targeted at identifying and improving skills via one-on-one feedback and hands-on training. All components aimed to enhance the performance of surgeons contributing to an overall positive effect on patient safety. The observational study data was collected



for 32 participating study surgeons and a total of 166 surgical cases. After the captured data is analyzed, findings will be disseminated in 2015.

Also during 2014, CSC began its second year of the Agency for Healthcare Research and Quality (AHRQ)-funded initiative to develop and validate simulation-based mental skills training curriculum. This team continues to illuminate the power of collaboration as Dr. Stefanidis and Lisa Howley, PhD, assistant vice president of medical education partnered to develop a curriculum for surgical trainees aimed to teach stress-coping mental skills and subsequently enhance performance during challenging operating room procedures. Nicholas Anton, MS, the mental skills trainer for this project, helped implement the curriculum with a diverse group of learners (i.e., experienced surgeons and surgical novices) as part of a pilot study to further develop the curriculum and determine its effectiveness. Participants' times to complete the Fundamentals of Laparoscopic Surgery training were significantly reduced compared to historical controls, and there was a significant improvement in psychological coping skills used by participants from baseline to post-test. This data provides initial indications of the curriculum's effectiveness. The curriculum is being implemented in parallel with a group of surgical novices as part of a randomized control trial to determine its effectiveness in a simulated operating room environment. The research team also includes Manuel Pimentel (simulation study coordinator), Cameron Davis, MS (instructional designer), and Nick Sevdalis, PhD, and Sonal Arora, MD, PhD, from Imperial College of London, UK (consultants on the performance assessment component).

## DICKSON ADVANCED ANALYTICS

The Dickson Advanced Analytics (DA<sup>2</sup>) Research team is responsible for providing biostatistics and data management support to Carolinas HealthCare System investigators in addition to engaging in outcomes research focused on one of the following areas: optimizing the delivery of health services; identifying patient care innovations; understanding and improving population health; integrating evidence-based care and delivery into practice; and leveraging analytics, big data, and health informatics to improve the overall quality of care and efficacy of healthcare delivery. During 2014, there were major enhancements in statistical and database support for Carolinas HealthCare System faculty and residents and expanded activity in investigator-led and collaborative research.

Research data management capabilities underwent a significant transformation in 2014 with the addition of two team members, Holly Petruso and Sheenu Abraham, which increased capacity for faculty and resident support and provided the opportunity to improve the research data infrastructure. The team developed REDCap database functionality to support automated data transfer from the Enterprise Data Warehouse, STAR and IDX systems, providing streamlined access to clinical and operational information for investigators' studies. These changes increased both efficiency and effectiveness of research support. Furthermore, the DA<sup>2</sup> Research and Data Management teams led the initiative to enhance geographic information systems (GIS) capabilities with the installation of a state-of-the-art ArcGIS system which benefits both research projects and operations across Carolinas HealthCare System.

The DA<sup>2</sup> Research biostatistics teams, led by H. James Norton, PhD, continued to provide excellent support for faculty and residents, including resident education and seminars as part of medical education. The team completed 93 projects across 25 different departments and collaborated on 19 publications and 9 posters. Dr. Norton also spearheaded a successful grant proposal. He will scale back his biostatistics support in 2015 to serve as the study's principal investigator leading the retrospective

analysis of metformin monotherapy in patients with diabetes. The DA<sup>2</sup> research team welcomed Charity Moore Patterson, PhD, MSPH, who will lead the biostatistics team. She was previously a Professor of Biostatistics at the University of Pittsburgh.

The DA<sup>2</sup> research team provides support to execute existing funded research and to assist internal investigators in proposal development. These activities included study design consulting data sourcing and management, statistics, GIS analysis, study coordination and manuscript preparation and submission. Collaborations in 2014 included: MediciNova Study (Benjamin Brooks, MD); Virtual Telemedicine Study (Andrew McWilliams, MD, MPH); Diabetes SDM Evaluation (Shay Phillips, PharmD and Yhenneko Taylor, PhD); Sildenafil/Albuterol Clinical Trial (Dr. Brooks); Parkinson's Exercise CER (Mark Hirsh, PhD); Diabetes Prevention Program (Carolinas HealthCare System Medical Group); colorectal cancer screening trial (Dr. McWilliams); relationship between CAUTI and stroke (Nursing); trauma minimal dataset (Rachel Seymour, PhD); Sanger pediatric congenital surgery database and analysis (Paul Colavita, MD); Heart Success Database (Sanjeev Gulati, MD); Beacon (Mark Robinson, MD; Jean Wright, MD, MBA); LEAPT (Jason Byrd); ADAPT-DES (Frank Gohs and Susan Christopher); MDRO and Clean Team support (Catherine Passaretti, MD; Zack Zapack, M Arch); PCORI Asthma SDM (Hazel Tapp, PhD); ADAPT-DES (Michael Rinaldi, MD); Asthma Comparative Effectiveness Research (Michael Dulin, MD, PhD); Social Determinants of Health (Dr. Dulin); and Improve Care NOW (Victor Piñeiro, MD).

In 2014, DA<sup>2</sup> Research submitted five investigator-led grant proposals for external funding, including CARE-2D: Cultural Approaches to Racial/Ethnic Disparities in Diabetes; FIGHT: Fighting Infections with Genomics to prevent Hospital Transmissions; and GAP-PAC: Geospatial evaluation of Air Pollution effects in Patients with Asthma and COPD. One of the five has been successfully funded and another is under review. The CARE-2D proposal was noteworthy for its multidisciplinary collaboration between Medical Education, Nursing, the Office of Diversity and Inclusion, Family Medicine Research and DA<sup>2</sup> Research. This research, led by Yhenneko Taylor, PhD, proposed a five-year study designed to reduce disparities in both diabetes care and outcomes as well as improve the health of patients with diabetes by implementing a cultural competency intervention in a randomized trial of providers treating patients with diabetes. Patient focus groups were conducted to inform the study design and provided patients' perspectives on diabetes care:

"...my two brothers, my sister and my momma, they died with diabetes. Now it's me and my other brother and my sister, we are diabetic; we're on pills and needles."

"[My doctor] puts forth a whole lot of effort to make sure I'm satisfied and before I leave out of there he says is there anything else I can do for you or you want to share with me because when you got a doctor you can relate to you got some shaky doctors here don't get me wrong, but when you develop a relationship with a doctor that's really concerned about you and your condition then you can just, sense in your spirit that you're comfortable doing that."

Other research accomplishments included competitive internal funding awarded to Melanie Spencer, PhD, MBA, to study susceptibility and transmissions in multi-drug resistant (MDRO) infections. This research was conducted in collaboration with the University of North Carolina at Charlotte and The Broad Institute and has already led to proposed changes in management of patients with MDRO infections at Carolinas HealthCare System. DA<sup>2</sup> Research also applied for an Agency for Healthcare Research and Quality (AHRQ) contract as part of a consortium with the American Institute of Research and was approved by AHRQ. This preapproved collaborative will provide the opportunity to work with AHRQ to define research topics of interest and to submit proposals over the 5-year contract period.



## CAROLINAS HEALTHCARE SYSTEM BIOSPECIMEN REPOSITORY

Carolinas HealthCare System has created a Biospecimen Repository (BSR) to collect and process blood, tissue, DNA and other samples from patients across the System, enhancing the capabilities of investigators to conduct clinical and translational research. The BSR is an asset that helps distinguish Carolinas HealthCare System as a nationally recognized clinical service provider that utilizes tissues for molecular prognostication and application to personalized medicine. This "bedside-to-bench" approach will ultimately lead to a more personalized approach to treatment.

The construction of the BSR facility, located at Carolinas Medical Center-Mint Hill was completed during summer 2014 and includes numerous backup and security systems to ensure biospecimen quality continuously. A state-of-the-art information system complete with biospecimen barcoding and scanning was developed to track every step of the collection and storage process. The BSR team worked with leaders and teammates across Carolinas HealthCare System (e.g., Office of Clinical and Translational Research, Laboratory Services, and Information Services) to develop tools for consistency and ease, including: umbrella protocols to use for all disease sites, electronic order forms to ensure proper blood collection for the BSR at the same point in time as routine lab work, and continuing education modules to enable clinic staff to consent patients for biospecimen collection. The collection process is complex and varies for each disease site, sample type, and location of the facility. An important goal for the BSR is to integrate into existing clinical processes seamlessly, minimizing the impact on the clinic staff while ensuring collection of high quality samples.



At the end of 2014, the BSR was already accepting specimens from 14 sites in North and South Carolina with plans to expand collections rapidly in 2015. Sites collected specimens under the BSR umbrella protocols as well as novel Levine Cancer Institute investigator-initiated studies with correlative samples for translational research related to a clinical trial treatment. This collection is a team effort by faculty and staff from the laboratory, clinic, pathology, radiology, surgery, and physicians. The planned specimen collection has not previously been done on this scale in the community-based setting and is in perfect alignment with the Carolinas HealthCare System mission and Levine Cancer Institute's goal to deliver the same high-level of care and research at all Carolinas HealthCare System facilities.

## CORE LABORATORIES

### Immune Monitoring Core Laboratory

The Immune Monitoring Core (IMC) Laboratory's mission is to provide clinical investigators and research scientists a technological platform for the testing of the immune status in the diagnosis and therapy of cancer, immune proliferative or immunodeficiency disorder and autoimmune abnormalities.

During 2014, and under the direction of David Foureau, PhD, the IMC laboratory expanded its customer base to encompass clinical investigators from: the Liver-Biliary-Pancreatic Center, Levine Cancer Institute, Levine Children's Hospital, and the Departments of Physical Medicine and Rehabilitation and Surgery. The year also proved to have an increased focus on retrospective and prospective clinical studies as illustrated by the following examples.

**Mapping out immunological events associated with acute drug-induced liver injury:** Drug-induced liver injury (DILI) describes liver injury caused by drugs or herbal medicines. There are currently no tools available to establish a direct diagnosis of DILI or predict the severity of liver damages resulting from exposure. In support of research led by the Carolinas HealthCare System Liver-Biliary-Pancreatic Center and Herbert L. Bonkovsky, MD, and in collaboration with the Molecular Biology Core Facility (directed by Nury Steuerwald, PhD HCLD (ABB)), a set of soluble immune mediators predictive of liver failure (RANTES, IL-9, IL-17 and GM-CSF) have been identified using a retrospective clinical study design to analyze blood specimens of patients with acute DILI. Another retrospective clinical study analyzing liver biopsies characterized hepatic leukocytes capable of differentiating DILI from other causes of acute hepatitis such as autoimmune or viral hepatitis. This work was supported by the US Drug-Induced Liver Injury Network.

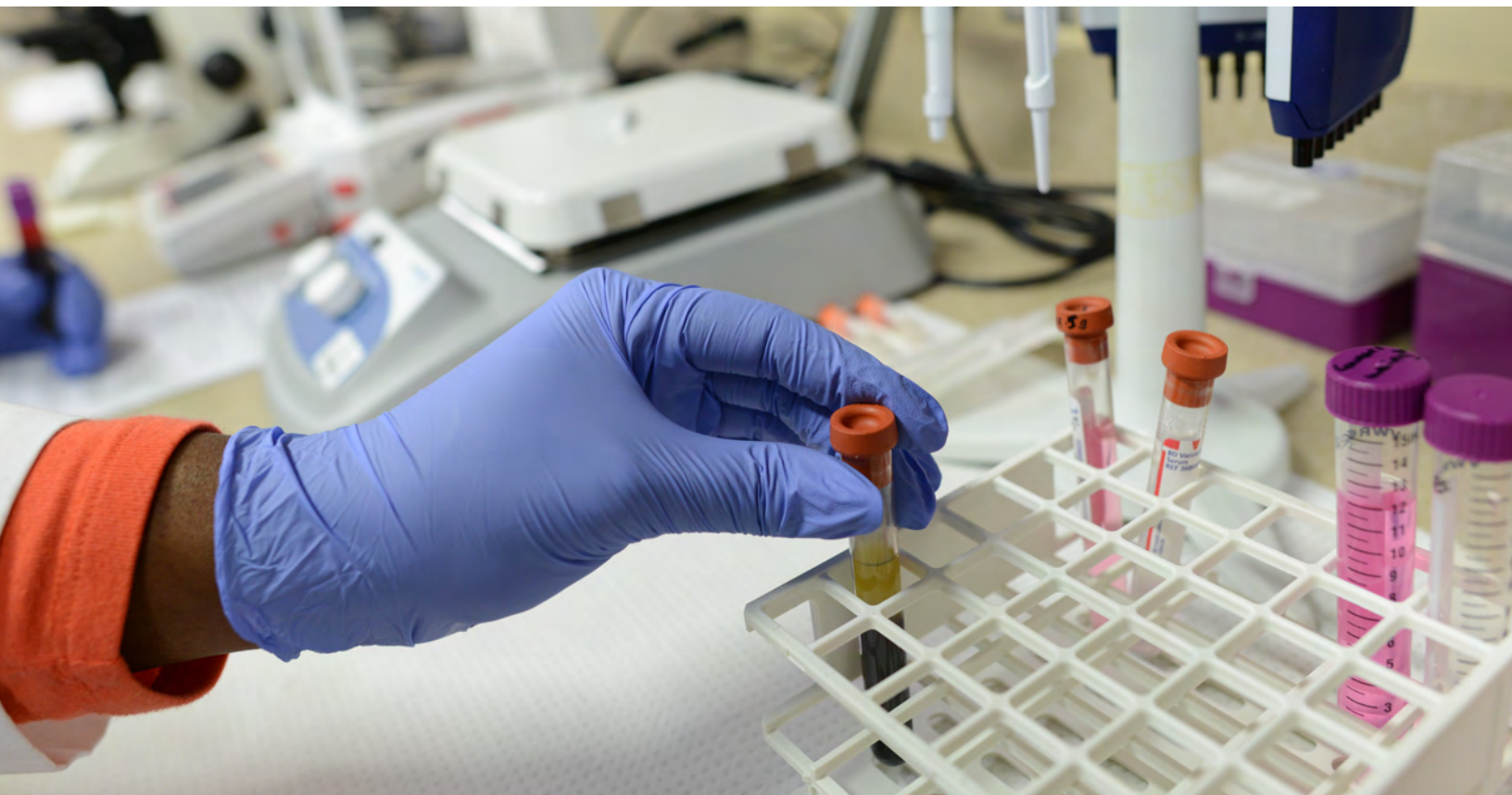
**Investigating surrogate clinical endpoints for Interleukin-2 (IL-2) immunotherapy against melanoma and renal cell carcinoma:** Immunotherapeutic drugs target the immune system to promote tumor clearance. An increasing number of drugs are becoming available to treat late stage melanoma and renal cell carcinoma (RCC) but early, objective biomarkers predicting or indicating (e.g. surrogate endpoint) therapeutic success are lacking. In a large, single-center retrospective study, Dr. Foureau, and flow cytometrist Fei Guo, PhD, performed a comprehensive survey of peripheral blood mononuclear cells with particular emphasis on T-cell immune balance on samples from patients with late stage melanoma or RCC during high dose IL-2 therapy, an immune amplifier. Through this work led by the Carolinas HealthCare System Surgical Oncology Laboratory Group (Richard White, MD; Asim Amin, MD; Terry Sarantou, MD; and Jonathan Salo, MD), a cancer-specific and time-sensitive immune marker has been identified indicating a patient's response to the drug as early as two to four days after treatment initiation.

**Lowering detection threshold of hematological malignancies:** Clinical management of hematological malignancies involves complex sequences of therapeutic interventions. Early detection of a patient's relapse can limit complications and improve outcomes. In an ongoing prospective clinical study, a leukemic stem cell subset indicative of relapse is being isolated and characterized out of peripheral blood samples from patients with myeloid leukemia. In a second prospective clinical study, a minimal residual disease measurement protocol (developed by the Euroflow consortium) is being tested and validated and aims to detect rare transformed cells in the bone marrow of patients with multiple myeloma. These projects support the Myeloid Leukemia and Multiple Myeloma groups at Levine Cancer Institute (Belinda Avalos, MD, Jonathan Gerber, MD, Lawrence Druhan, PhD, Sarah Baxter, PhD, and Saad Usmani, MD).

**Pre-clinical assessment of folate inhibition on pediatric malignancies:** Osteosarcoma and Ewing's sarcoma are the two most common types of bone cancer affecting primarily children and adolescents. With the current multimodal treatment strategy, the 5-year progression-free survival is about 60 to 70 percent. To improve therapeutic approaches and outcomes, studies were designed to test anti-tumor potential of metabolic inhibitors such as anti-folate agents. This work supports the Levine Children's Hospital Developmental Therapeutics Program led by Javier Oesterheld, MD.

## Mass Spectrometry Core Facility

The Mass Spectrometry Core Facility was involved in both local and international collaborative projects throughout 2014 and is under the direction of Sunil Hwang, PhD. Locally, this group helped Carolinas HealthCare System researchers apply techniques of genoproteomics to both muscular dystrophy and pancreatic cancer. Internationally, the team played a role in investigating proteome and metabolome biomarkers in multiple sclerosis and neuromyelitis optica. In addition to two peer-reviewed publications, Dr. Hwang contributed a book chapter "Proteomic differences and linkages between chemoresistance and metastasis of pancreatic cancer using knowledge-based pathway analysis" in the book *Molecular Diagnostics and Treatment of Pancreatic Cancer Systems and Network Biology Approaches* (Ed. Asfar Azmi).



## Molecular Biology Core Facility

The Molecular Biology Core Facility is a full service, CLIA certified genomics laboratory located in the James G. Cannon Research Center at Carolinas Medical Center. Under the direction of Nury Steuerwald, PhD, HCLD (ABB), the facility has been engaged in a variety of projects aimed at investigating the molecular mechanisms underlying diverse disorders as well as identifying molecular markers or uncovering molecular signatures for use in the assessment, management, and classification of human disease. In particular, the facility has been collaborating with the Bridges Molecular Cardiac Surgery Research Laboratory as they explore the use of gene therapy to restore heart function following ischemic heart failure. The facility conducted genetic and cytokine profiling in heart failure models in order to investigate the effect of therapeutic transgene delivery on cardiac function and monitor the ensuing immune response.

Together with scientists at Reprogenetics, world-renowned pioneers in the field of preimplantation genetic testing, the facility developed methods for detecting de novo mutations in human blastocysts by whole exome sequencing. These results were presented at the 2014 Annual meeting of the American Society for Reproductive Medicine. The facility also employed whole exome sequencing to characterize mutations in pediatric patients with muscular dystrophy for Susan Sparks, MD, PhD, in the Department of Clinical Genetics. The facility is assisting Qi Lu, MD, PhD, with mechanistic studies aimed at developing experimental therapies for limb girdle muscular dystrophy. The facility continued to collaborate with the Hematologic Oncology Translational Laboratory led by Belinda Avalos, MD, and Jonathan Gerber, MD, to profile genetic variants and expression patterns in leukemic stem cells. Additionally, due to the team's expertise in Next Generation Sequencing (NGS), the facility was called upon to validate critical applications for major corporations in the area and we have been trusted to sequence precious DNA samples from nearly extinct species for the Smithsonian Institution.

In 2014, the Molecular Biology Core expanded its NGS system portfolio to include an Illumina NextSeq 500 sequencing system, a transformative instrument that will bring many new capabilities to Carolinas HealthCare System including, for the first time, the ability to sequence whole human genomes in-house. Whole-genome sequencing provides a method to identify genetic changes in the genome, including single-nucleotide mutations, deletions, amplifications, and chromosomal translocations, at a single-base resolution. The facility also acquired a QuantStudio® 3D digital PCR system, a highly sensitive instrument able to detect and quantify rare mutation prevalence as low as 0.1 percent.

## Research Histology and Confocal Core Laboratory

The Research Histology and Confocal Core (RHCC) Laboratory was established in 2013 as part of the Imaging Core Facility. In 2014, it became an entity separate from the Electron Microscopy Laboratory and is under the supervision of Tracy Walling BS, HT (ASCP). The RHCC's mission is to provide high quality histology and imaging services to researchers within Carolinas HealthCare System and to outside institutions. The RHCC supports and provides a variety of services including routine paraffin histology, hematoxylin and eosin (H&E) and special staining, immunohistochemistry, immunocytochemistry, and in situ hybridization.

Throughout 2014, the RHCC supported the research of numerous investigators and clinicians within and outside of Carolinas HealthCare System including General Surgery, Liver Pathobiology Laboratory, Bridges Molecular Cardiac Surgery Research Laboratory, McColl-Lockwood Laboratory for Muscular Dystrophy Research, Levine Cancer Institute, David H. Murdock Research Institute, the University of North Carolina at Charlotte and Queens University of Charlotte.



# CAROLINAS HEALTHCARE SYSTEM SUMMER RESEARCH SCHOLARS

2014 marked the sixth year of the Summer Research Scholar Program. Twenty-seven academically competitive applicants were identified and matched with one of Carolinas HealthCare System's research mentors to develop and/or conduct a research project within the 10-week program. The 2014 class comprised 21 undergraduate students and six graduate or medical students (Table 1). During their stay, the scholars were exposed to a wide range of topics relevant to conducting research specifically within a healthcare setting. A scholar described the experience: "This program is a great learning experience and provides a great opportunity to meet people valuable to a future career in medicine or research."

At the conclusion of the program, the scholars presented their research projects to their peers and the community in either oral or poster format. Students said that the program helped refine their future goals. One student said, "I still want to go to Med School, [but I] have a new interest in medical research." Another reflected, "This internship has helped teach me about the research process as a whole and helped me learn about what research is like when in a hospital as opposed to an academic setting." The scholars' accomplishments extend beyond the summer; some students go on to present their research at national meetings or be published in peer-reviewed journals. There have been scholars join Carolinas HealthCare System as teammates and resident physicians.

Table 1. Class of 2014

Name/Represented Institution	Project Title
Michael Alexander, <sup>1-Oral</sup> University of South Carolina	<i>Effect of Cardiac Intramuscular Administration of SoluMedrol Solution and Nanoparticle-Encapsulated SoluMedrol on Acute Inflammatory Response after Myocardial Infarction</i>
Anup Bhattacharya University of Pennsylvania	<i>Effectiveness of a Novel Educational Curriculum for Advanced Clinical Practitioners</i>



Name/Represented Institution	Project Title
Katie Bolling, <sup>3-Poster</sup> University of South Carolina School of Medicine	<i>CT pelvis does not identify additional clinically-important intra-abdominal injuries beyond those seen on CT abdomen alone in children suffering blunt abdominal trauma</i>
Glenn Boyles University of North Carolina at Chapel Hill	<i>Validation of the Sit-to-Stand Rating Scale as an Outcome Measure in ALS Patients</i>
Heidi Cope, <sup>2-Oral</sup> University of North Carolina at Charlotte	<i>Investigating the Role of Tenascin C in Nonalcoholic Fatty Liver Disease</i>
Kate Culbreath Wake Forest University	<i>Infiltrating Leukocytes in Liver Biopsies in Drug-Induced Liver Injury vs. Other Etiologies of Acute Hepatitis</i>
Kaleigh Fetcko Indiana University School of Medicine	<i>MitoQ Effects on Cellular Oxidative Stress and Inflammation in Rat Model of Hemorrhagic Shock and Reperfusion Injury</i>
Christopher Gardener University of North Carolina School of Medicine	<i>A Novel Secondary Task Enables the Quantification of Workload Differences Between Traditional and Single Incision Laparoscopic Surgery</i>
Vrushab Gowda University of North Carolina at Charlotte	<i>Porphyrogenic Effects of Selected Anticonvulsants, Analgesics, and Sulfa Drugs</i>
Katie Gray Medical University of South Carolina	<i>The Effects of Asthma Shared Decision Making on the Management of Diabetes and Hypertension</i>
Pahul Hanjra Virginia Commonwealth University	<i>Dental Plaque Bacterial Profiles, Bacteremia, and Infective Endocarditis (IE)</i>
Jade Harris Johnson C. Smith University	<i>The Transcriptional Regulation of Fatty Acid Binding Protein 4 in Hepatocellular Carcinoma Cell Line</i>
Hayley Hatherly Clemson University	<i>Compliance to SOC for Ankle Contractures Survey</i>
Duy Huynh Queens University of Charlotte	<i>Toll-like Receptor 3 and 9 Stimulation Increases Immunotherapy effectiveness Against Melanoma</i>
Marshall Lawler, <sup>3-Oral</sup> University of Illinois College of Medicine	<i>Cancer Therapy-Induced Oral Mucositis: Interaction with the Oral Microbiome and Computational Drug Discovery</i>
Caitlin Lindbery, <sup>2-Poster</sup> Clemson University	<i>Timing of intrauterine insemination (IUI) after <math>\beta</math>HCG administration</i>
Mitchell Lynn University of North Carolina at Charlotte	<i>Does Preoperative Resting Energy Expenditure Predict Weight Loss After Bariatric Surgery</i>

Name/Represented Institution	Project Title
Natalie Marsh Pfeiffer University	<i>Gender and Hormonal Influence on Traumatic Brain Injury (TBI) Outcomes</i>
Sandy Mathurin Johnson C. Smith UniversityOshauna	<i>Validation of the HOXC6 in Patients with Serous Ovarian Cancer</i>
Oshauna Morgan Johnson C. Smith University	<i>Electromagnetic Navigation Bronchoscopy in the Evaluation of Lung Lesions: the Carolinas Medical Center Experience</i>
Megan Nanney Belmont Abbey College	<i>AAV9-FKRP Gene Therapy to Restore the Glycosylation of <math>\alpha</math>-Dystroglycan in Dystrophic Mice</i>
Presley Parkes Davidson College	<i>Role of the Redox Signaling Pathway in Regulating Drug Sensitivity to Proteasome Inhibitors in Multiple Myeloma at Physiologic versus Atmospheric Oxygen Condition</i>
Bernice Sem Western Carolina University	<i>ONE-SIZE-FITS-ONE: Self-managing diabetes by individualizing nutrition education to improve patients nutrition knowledge</i>
Kenneth Shiao Duke University	<i>Electronic Timed Up and Go (TUG) Test Validation for Falls Prevention Technology Development Project</i>
Nathan Suskovic University of North Carolina at Chapel Hill	<i>Reducing The Triage Time for CMC's Emergency Department (ED) during Plan A</i>
Jeremy Thompson University of North Carolina School of Medicine	<i>Operative vs. Non-operative Treatment of Humerus Fractures in the Polytrauma Patient: A Retrospective Cohort Study</i>
Sarah Whitmire University of North Carolina at Charlotte	<i>The impact of medications on stimulated and unstimulated salivary flow</i>

1-Oral: First Place Oral Presentation  
2-Oral: Second Place Oral Presentation  
3-Oral: Third Place Oral Presentation

1-Poster: First Place Poster Presentation  
2-Poster: Second Place Poster Presentation  
3-Poster: Third Place Poster Presentation



## INTELLECTUAL PROPERTY

### Disclosures

Jeko Madjarov's disclosure CMC14-001 *Bone fixation implants*.

Laura Cragg, Dawn Swiderski and Scott Wilson's disclosure CMC14-002 *Central venous adjunct trainer, system, and associated method*.

Tvzi Nussbaum's disclosure CMC14-003 *App/software to alert physician's mobile phone when dialysis machine detects critical values from patients*.

Yubo Sun and Edward Hanley's disclosure CMC14-004 *Treatment of diseases characterized by the degeneration of musculoskeletal tissues with phosphonocarboxylate compounds*.

Jeko Madjarov's disclosure CMC14-005 *Three-layer graft with extendable ends for supporting anastomoses*.

Casey Scully's disclosure CMC14-006 *Ultrasound coupling solid*.

Qi Lu's disclosure CMC14-007 *Codon optimized human fukutin-related protein (FKRP) gene for treating muscular dystrophy*.

### Provisional Applications Filed

US provisional application no. 61/929,560 filed on January 21, 2014 for Richard Peindl's *Electronic free-space motion monitoring and assessment*.

US provisional application no. 61/935,990 filed on February 5, 2014 for David Price's *Impact reducing protective headgear*.

US provisional application no. 61/942,671 filed on February 21, 2014 for Jeko Madjarov's *Bone fixation implants*.

US provisional application no. 61/972,858 filed on March 31, 2014 for Mingxing Wang and Qi Lu's *Triazine cationic polymers and methods of use thereof*.

US provisional application no. 61/992,611 filed on May 13, 2014 for Jeko Madjarov's *Method and apparatus for ultrasound-guided delivery of vascular devices*.

US provisional application no. 61/992,944 filed on May 14, 2014 for Laura Cragg, Dawn Swiderski and Scott Wilson's *Central venous adjunct trainer, system, and associated method*.

US provisional application no. 62/026,875 filed on July 21, 2014 for Jeko Madjarov's *Intravascular device for hemiarch repair and associated method*.

### Patent Applications Filed, Including Continuation in Part

US non-provisional application no. 14/193,445 was filed February 28, 2014 for Michael Dulin and Ed Connors' *Methods and systems for facilitating use of healthcare and social service resources in a community*.

US continuation application no. 14/478,270 was filed September 5, 2014 for Richard Peindl and Craig Halberstadt's *Bioreactor for cell growth and associated methods*.

US non-provisional application no. 14/484,553 was filed September 9, 2014 for Michael Dulin, Lindsay Kuhn, Beau Mack, Paula Schrum, Ron Barus, Kelly Reeves and Brian Pritchett's *Methods and systems for an electronic asthma action plan*.



US non-provisional application no. 14/472,643 was filed August 29, 2014 for Edward Kim's *Multi-user clinical pathway systems with therapy options and visual notices of clinical trial opportunities*.

## US Patents Issued

US Patent No. 8,759,313 was issued on June 24, 2014 for Laura Schrum's *Treatment of fibrosis using microRNA-19b*.

## Foreign Applications Filed

International patent application no. PCT/US2014/011865 was filed on January 16, 2014 for Charles Bridges and Anthony Fagnoli's *Needleless injection device and methods of administering one or more needleless injections to an organ of interest*.

International patent application no. PCT/US2014/012515 was filed on January 22, 2014 for David A. Pearson, Peter T. Tkacik and Jeffrey A. Kline's *Devices, systems, and methods for monitoring blood pressure*.

International patent application no. PCT/US2014/025948 was filed on March 13, 2014 for Pierce Irby's *Ureteroscope and associated method for the minimally invasive treatment of urinary stones*.

International patent application no. PCT/US2014/028851 was filed on March 15, 2014 for Jeko Madjarov's *Method and apparatus for therapy of mitral valve*.

International patent application no. PCT/US2014/035845 was filed on April 29, 2014 for B. Todd Heniford and Amy Lincourt's *Device, system, and method for insertion of a medical device into a subject*.

International patent application no. PCT/US2014/040193 was filed on May 30, 2014 for Paul Marshburn's *Surgical drape for collecting discharged fluid*.

International patent application no. PCT/US2014/045258 was filed on July 2, 2014 for Jeko Madjarov's *Device, system, and method for supporting and approximating ribs*.

International patent application no. PCT/US2014/051017 was filed on August 14, 2014 for Jeko Madjarov's *Method and system for longitudinal closure of dissected sternums*.

International patent application no. PCT/US2014/051613 was filed on August 19, 2014 for Paul Marshburn's *Device, system, and method for placement of an intrauterine balloon*.

International patent application no. PCT/US2014/070621 was filed on December 14, 2014 for Charles Bridges' *Method and apparatus for therapy of aortic valve*.

## Foreign Patents Issued

Chinese Patent No. ZL201010625236.6 was issued on March 17, 2014 for Qi Lu and Guqi Wang's *Nitrate esters and their use for the treatment of muscle and muscle related diseases*.



## EXTERNAL FUNDING FOR RESEARCH

- Ahmed A.** Targeted Clinical Research to Address Select Viral Infections-Pharmacokinetic, Pharmacodynamic and Resistance Evaluation of Intravenous Ganciclovir in Premature Infants. University of Alabama at Birmingham (UAB), NIH/National Institute of Allergy and Infectious Diseases (NIAID).
- Ahmed A.** Adaptive Sequential Study Evaluating Prevention of Neonatal HSV: Detection of Maternal Shedding at Delivery Followed by Preemptive Antiviral Therapy in Exposed Neonates (CASG-401). University of Alabama at Birmingham (UAB), NIH/National Institute of Allergy and Infectious Diseases (NIAID).
- Ahmed A.** Prospective Comparison of the Tuberculin Skin Test (TST) vs. Interferon Gamma Release Assays (IGRAs) in Diagnosing Latent Tuberculosis Infection (LTBI) and in Predicting Progression from LTBI to Active Tuberculosis Disease. Duke University, HHS/Centers for Disease Control and Prevention (CDC).
- Ahmed A.** The Natural History of CMV-Related Hearing Loss and the Feasibility of CMV Screening as Adjunct to Hearing in the Newborn. University of Alabama at Birmingham (UAB), NIH/National Institute on Deafness and Other Communication Disorders (NIDCD).
- Bartel S.** TBI Project STAR Demonstration Project Research and Development 2013-2014. NC DHHS/ Division of Mental Health, Developmental Disabilities and Substance Abuse Services (NC MHDDSAS).
- Bartel S.** Substance Abuse and Traumatic Brain Injury: A Modified 12-Step Approach. Mecklenburg County Alcoholic Beverage Control Board.
- Bartel S.** BIANC HRSA Project Star. Brain Injury Association of NC (BIANC), HHS/Health Resources and Services Administration (HRSA).
- Bartel S.** Traumatic Brain Injury (TBI) Project STAR 14-15. NC DHHS/Division of Mental Health, Developmental Disabilities and Substance Abuse Services (NC MHDDSAS).
- Bartel S.** Charlotte Brain Injury Resource Center. Brain Injury Association of NC (BIANC), NC DHHS/ Division of Mental Health, Developmental Disabilities and Substance Abuse Services (NC MHDDSAS).
- Beuhler M.** Retrospective Review of Delayed Clinical Effects After Crotalid Envenomation. BTG International.
- Bhutani M.** Evaluating and Targeting Mechanisms of Resistance with Extended Dosing of Lenalidomide in Multiple Myeloma (MM). Carolinas HealthCare Foundation (CHF), Conquer Cancer Foundation.
- Bockenek W.** A Double-Blind, Placebo-Controlled Study of AC105 in Patients with Acute Traumatic Spinal Cord Injury. Acorda Therapeutics, Inc, DOD/Army Medical Research Acquisition Activity (USAMRAA).

- Bonkovsky H.** Role of Anabolic Steroids in DILI in the USA. Duke University, NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).
- Bonkovsky H.** Effect of Heme on mRNA and miRNA Profiles. NIH/National Heart, Lung, and Blood Institute (NHLBI).
- Bonkovsky H.** Drug Induced Liver Injury Network (DILIN). UNC-Chapel Hill (UNCCH), NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).
- Bonkovsky H.** CHF ACG grant. Carolinas HealthCare Foundation (CHF), American College of Gastroenterology (ACG).
- Bonkovsky H.** Extension and Validation of Results for Serum Immune Analytes and Leukocytes Infiltrating Liver Biopsies - US DILIN. Duke University, NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).
- Bosse M.** The Major Extremity Trauma Research Consortium. Johns Hopkins University, DOD/Army Medical Research Acquisition Activity (USAMRAA).
- Bosse M.** A Prospective Randomized Trial to Assess Fixation Strategies for Severe Open Tibia Fractures: Modern ring external fixators or internal fixation with intramedullary nails or plates.
- Bosse M.** rhBMP-2 vs. Autograft for Treating Critical Size Tibial Defects: A multicenter, randomized trial.
- Bosse M.** Assessment of Severe Extremity Wound Bioburden at the Time of Definitive Wound Closure or Coverage: Correlation with subsequent post-closure deep wound infection.
- Bosse M.** Outcomes Following Severe Distal Tibia, Ankle, and/or Foot Trauma: Comparison of limb salvage vs. transtibial amputation.
- Bosse M.** Comparison of Transtibial Amputation with and without a Tibia-Fibula Synostosis.
- Karunakar M.** Predicting Acute Compartment Syndrome using Optimized Clinical Assessment, Continuous Pressure Monitoring, and Continuous Tissue Oximetry.
- Passaretti K.** A Prospective Randomized Trial to Assess PO versus IV Antibiotics for the Treatment of Early Post-op Wound Infection after Extremity Fractures.
- Karunakar M.** Supplemental Perioperative Oxygen to Reduce Surgical Site Infection After High Energy Fracture Surgery.
- Bosse M.** Improving Activity and Quality of Life Following Orthopaedic Trauma: The Trauma Collaborative Care Study.
- Hsu J.** Improving Pain Management in High Energy Orthopaedic Trauma.
- Seymour R.** Streamlining Trauma Research Evaluation with Advanced Measurement (STREAM Study).
- Bosse M.** Local Antibiotic Therapy to Reduce Infection after Operative Treatment of Fractures at High Risk of Infection: A multicenter randomized, controlled trial.
- Brancatto J.** Charlotte Community Health Empowerment Program. American Cancer Society, National Football League (NFL).
- Brennan M.** Clinical Registry of Dental Outcomes in Head and Neck Cancer Patients. NIH/National Institute of Dental and Craniofacial Research (NIDCR).
- Bridges C.** Heart Failure Gene Therapy. NIH/National Heart, Lung, and Blood Institute (NHLBI).

**Bridges C.** Research Study to Conduct a Thorough Pre-Clinical Assessment of Dosing and Delivery Strategies to Optimize a New Breakthrough to Managing Heart Disease with the Intent to Advance Toward a Clinical Trial. Carolinas HealthCare Foundation (CHF), Heineman Research Foundation.

**Brooks B.** Trial of Resistance and Endurance Exercise in ALS. Johns Hopkins University.

**Brooks B.** Natural History of Familial ALS. Washington University, The Muscular Dystrophy Association.

**Brooks B.** Multicenter, Randomized Controlled Study of the NeuRx Diaphragm Pacing System. Massachusetts General Hospital, Research Foundation of State University of New York.

**Brooks B.** A Single-Center, Randomized, Double-Blind, Placebo Controlled, Six-Month Clinical Trial Followed by an Open-Label Extension to Evaluate the Safety, Tolerability, and Clinical Endpoint Responsiveness of Ibudilast (MN-166) in Subjects with Amyotrophic Lateral Sclerosis. MediciNova, Inc.

**Burri S.** Radiation Therapy Oncology Group. American College of Radiology (ACR), NIH/National Cancer Institute (NCI).

**Conway J.** Mechanistic Studies of Phase III Trial with BAF312 in Secondary Progressive Multiple Sclerosis. Regents of the University of Michigan, NIH/National Institute of Allergy and Infectious Diseases (NIAID).

**Dulin M.** Prospective Multicenter Imaging Study for Evaluation of Chest Pain (PROMISE Trial). Duke University, NIH/National Heart, Lung, and Blood Institute (NHLBI).

**Dulin M.** Effect of Standard vs. Intense Clinic-Based Hypertension Management on Nighttime Blood Pressure. University of Minnesota, NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

**Dulin M.** The Systolic Blood Pressure Intervention Trial (SPRINT). Wake Forest University Health Sciences (WFUHS), NIH/National Heart, Lung, and Blood Institute (NHLBI).

**Dulin M.** ACCORDION (ACCORD Follow-on Study). Wake Forest University Health Sciences (WFUHS), NIH/National Heart, Lung, and Blood Institute (NHLBI).

**Dulin M.** RECOVERY OS CER: Evaluation of ARRA Supported Grantee Efforts to Implement and Spread CER Findings. James Bell Associates, Inc, HHS/Agency for Healthcare Research and Quality (AHRQ).

**Dulin M.** A Transdisciplinary Approach to the Evaluation of Social Determinants of Health. NIH/National Center on Minority Health and Health Disparities (NCMHD).

**Evans S.** Mitochondrial-Targeted Antioxidants Prevent Cell Death and Organ Dysfunction and Improve Survival Following Severe Hemorrhage. The American Association for the Surgery of Trauma (AAST).

**Ford M.** Randomized Controlled Trial of an Emergency Department Care Coordination Program in Eleven Emergency Departments of the Carolinas HealthCare System. University of North Carolina at Chapel Hill, HHS/Centers for Disease Control and Prevention (CDC).

**Frick S.** Duration of Brace Wear in Clubfoot Treatment - A Prospective Randomized Trial. Shriners Hospitals for Children.

**Ganapathi R.** Evaluating HRD Score and BRCA 1/2 Deficiency in Paired Samples of Primary and Recurrent High Grade Serous Ovarian Cancer. Myriad Genetics, Inc.

**Garvey L.** Electrocardiographic diagnosis of ST segment elevation myocardial infarction: An evaluation of several automated interpretation algorithms. Philips Healthcare.

**Gilman A.** Study Chair: NIH National Clinical Trial Network (NCTN) Grant (U10CA180886). Children's Hospital of Philadelphia (CHOP), NIH/National Cancer Institute (NCI).

**Gilman A.** A Multicenter, Randomized, Double Blind, Phase III Trial Evaluating Corticosteroids with Mycophenolate Mofetil vs. Corticosteroids with Placebo as Initial Systematic Treatment of Acute GVHD. Children's Hospital of Philadelphia (CHOP), NIH/National Cancer Institute (NCI).



**Griffin T.** Gene Expression in Pediatric Arthritis, Project 1: Pathobiology of PBMC Gene Expression Signatures in Polyarticular and Oligoarticular JIA. Cincinnati Children's Hospital Medical Center, NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**Griffin T.** Gene Expression in Pediatric Arthritis, Project 2: Integrative Genomics in JIA. Cincinnati Children's Hospital Medical Center, NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**Griffin T.** Childhood Arthritis and Rheumatology Research Alliance Registry. Duke University, Arthritis Foundation.

**Gruber H.** Disc Regeneration: Evaluation of Growth and Differentiation Factor-5 (GDF-5; BMP14) Production and Expression Pathways in Human Disc Cells Exposed to Proinflammatory Cytokines. Carolinas HealthCare Foundation (CHF), Cervical Spine Research Society.

**Gruber H.** Do Human Annulus Cells Actively Try to Repel Nerve Ingrowth into the Disc? Carolinas HealthCare Foundation (CHF), North American Spine Society.

**Gruber H.** Cytokine Stimulation of PAPP-A in the Regulate IGF Bioavailability in the Disc: Continued Research Studies. Carolinas HealthCare Foundation (CHF), AO Foundation.

**Hammond F.** TBI Model System Collaborative Study of Amantadine for Post TBI Irritability and Aggression. ED/National Institute on Disability Rehabilitation and Research (NIDRR).

**Hammond F.** Individualized Planning for the First Year following Acute Rehabilitation Project. Ohio State University, ED/National Institute on Disability Rehabilitation and Research (NIDRR).

**Hammond F.** Improving Spinal Cord Injury Rehabilitation Outcomes Study. Indiana University, ED/National Institute on Disability Rehabilitation and Research (NIDRR).

**Harper A.** UCD0305 Longitudinal Study of the Relationship between Impairment, Activity Limitation, Participation and Quality of Life in Persons with Confirmed Duchenne Muscular Dystrophy . Children's Research Institute (CRI), NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**Harper A.** Clinical Trial of Coenzyme Q10 and Prednisone in Duchenne Muscular Dystrophy. Children's Hospital of Pittsburgh, DOD/Army Medical Research Acquisition Activity (USAMRAA).

**Heniford T.** Medlinx Pre-Clinical Histological Study. Medlinx Acacia Pte Ltd.

**Heniford T.** Is Night Float a Better Solution than Traditional Call. Society of American Gastrointestinal and Endoscopic Surgeons (SAGES).

**Heniford T.** A Randomized, Prospective, Double-Blind Clinical Trial using Spy Elite System in Planning Tissue Advancement Flaps and Reducing Wound Complications after Complex Ventral Hernia Repairs. Lifecell Corporation.

**Heniford T.** Effect of Infection on a New Biologic Mesh Derived from Porcine Dermis in a Rat Ventral Hernia Model. Synthes, Inc.

**Holshouser J.** Catheter Ablation Versus Anti-arrhythmic Drug Therapy for Atrial Fibrillation Trial. Duke University.

**Horton J.** A Multicentered, Randomized, Open-Label, Comparative Study to Assess the Safety and Efficacy of a Treatment Algorithm to Reduce the Use of Vancomycin in Patients with Blood Stream Infections due to Staphylococci. Duke University, NIH/National Institute of Allergy and Infectious Diseases (NIAID).

**Iannitti D.** Sonicision Cordless Ultrasonic Dissection System in General Surgery: A Prospective Post-Market Observational Study to Evaluate the Efficacy and Accuracy of a Cordless Ultrasonic Dissection System. Covidien AG.

**Iannitti D.** Pilot Assessment in a Porcine Model of an Image Guidance System Using a Metallic Needle Sheath. InnerOptic Technology, Inc.

**Iannitti D.** Laparoscopic Aquamantys® Device in General Surgery: A Prospective Observational Study to Evaluate the Efficacy and Accuracy. Medtronic Advanced Energy, LLC.

**Iannitti D.** Variable Power Hepatic, Renal, and Lung Microwave Ablation Using 2.45 GHz System in a Porcine Model. Covidien AG.

**Iyengar P.** Platelet-Oriented Inhibition in New TIA and Minor Ischemic Stroke Trial. The EMMES Corporation, NIH/National Institute of Neurological Disorders and Stroke (NINDS).

**Kaplan J.** Cancer Trials Support Unit (CTSU) Phase II Supplemental Payments (N02-62212). Children's Hospital of Philadelphia (CHOP), NIH/National Cancer Institute (NCI).

**Kaplan J.** Workload Intensity NIH National Clinical Trial Network (NTN) Grant (U10CA180886). Children's Hospital of Philadelphia (CHOP), NIH/National Cancer Institute (NCI).

**Kaplan J.** NIH Children's Oncology Group Community Clinical Oncology Program (CCOP) Per Case Reimbursement . Children's Hospital of Philadelphia (CHOP), NIH/National Cancer Institute (NCI).

**Kaplan J.** A Phase III Randomized Trial for Newly Diagnosed High Risk B-precursor Acute Lymphoblastic Leukemia (ALL) Testing Clofarabine (IND#73789, NSC#606869) in the Very High Risk Stratum (BIQSFP-COG AALL1131) . Children's Hospital of Philadelphia (CHOP), NIH/National Cancer Institute (NCI).

**Kaplan J.** A Feasibility Trial Using Molecular-Guided Therapy for the Treatment of Patients with Relapsed and Refractory Childhood Cancer (NMTRC 008). Spectrum Health Hospitals.

**Kaplan J.** A Phase II Randomized Trial of Irinotecan/Temozolomide with Temsirolimus (NSC #683864, IND #61010) or Chimeric 14.18 Antibody (ch14.18) (NSC#623408, IND#4308) in Children with Refractory, Relapsed or Progressive Neuroblastoma (COG ANBL1221). Children's Oncology Group (COG), NIH/National Cancer Institute (NCI).

**Kaplan J.** A Phase I Trial for Refractory or Relapsed Neuroblastoma with DFMO Alone and in Combination with Etoposide. Van Andel Research Institute.

**Kaplan J.** A Randomized, Phase I/II trial of Irinotecan and Temozolomide compared to Irinotecan and Temozolomide in Combination with TPI 287 in Patients with Primary Refractory or Early Relapsed Neuroblastoma. Van Andel Research Institute.

**Kaplan J.** A Phase I/II Trial of TPI 287 in Patients with Refractory or Recurrent Neuroblastoma or Medulloblastoma. Van Andel Research Institute.

**Kaplan J.** A Phase II Preventative Trial of DFMO as a Single Agent in Patients with High Risk Neuroblastoma in Remission. Van Andel Research Institute.

**Kaufman M.** Computerized Cognitive Testing Scores Sensitized by Mental Fatigue. Carolinas Health Care Foundation (CHF), Biogen Idec, Inc.

**Kennelly M.** Minimally Invasive Laser Treatment of Female Stress Urinary Incontinence. University of North Carolina at Charlotte (UNCC), NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

**Lieberman J.** Nutrition Education for Cardiovascular Disease Prevention in Individuals with Spinal Cord Injury. NIH/National Heart, Lung, and Blood Institute (NHLBI).

**Limentani S.** National Breast and Bowel Cancer Treatment Protocols Agreement TFED41S2-762. NSABP Foundation, Inc, NIH/National Cancer Institute (NCI).

**Limentani S.** A Phase III Clinical Trial Comparing Trastuzumab Given Concurrently with Radiation Therapy and Radiation Therapy Alone for Women with HER2-Positive Ductal Carcinoma in Situ Resected by Lumpectomy (Protocol B-43). NSABP Foundation, Inc, NIH/National Cancer Institute (NCI).

**Limentani S.** A Randomized Phase III Trial of Adjuvant Therapy Comparing Chemotherapy Alone (Six Cycles of Docetaxel Plus Cyclophosphamide or Four Cycles of Doxorubicin Plus Cyclophosphamide Followed by Weekly Paclitaxel) to Chemotherapy Plus Trastuzumab in Women with Node-Positive or High-Risk Node-Negative HER2-Low Invasive Breast Cancer (Protocol B-47). NSABP Foundation, Inc, NIH/National Cancer Institute (NCI).

**Livingston M.** SARC024: A Blanket Protocol to Study Oral Regorafenib in Patients with Refractory Liposarcoma, Osteogenic Sarcoma, and Ewing/Ewing-like Sarcomas. Sarcoma Alliance for Research Through Collaboration (SARC).

**Lockhart P.** Oral Hygiene, Periodontal Disease, and Infective Endocarditis. NIH/National Institute of Dental and Craniofacial Research (NIDCR).

**Lu Q.** Pediatric Toxicity and Efficacy in Long-term Systemic Treatment with Anti-sense. Children's Research Institute (CRI), NIH/National Institute of Child Health and Human Development (NICHD).

**Lu Q.** Gene Delivery for Fukutin-related Protein Deficiencies. University of North Carolina at Chapel Hill (UNC), NIH/National Institute of Neurological Disorders and Stroke (NINDS).

**Lu Q.** Study of the Effect of Mini-agrin Expression in FKRP448L Mutant Mice via Crossbreeding with Mini-agrin Transgenic Mice. LGMD2I Research Fund.

**Lu Q.** Antisense Therapy for DMD-Optimization and Toxicology of AON for Exon 45 Skipping. NIH/National Institute of Neurological Disorders and Stroke (NINDS).

**Lu Q.** AAV9 FKRP Gene Delivery for the Treatment of Muscular Dystrophy. Carolinas HealthCare Foundation (CHF).

**Lu Q.** Center for Research Translation of Systemic Exon-Skipping in Muscular Dystrophy - Project 2. Children's Research Institute (CRI), NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**Martinie J.** A Needle Guidance System for Hepatic Tumor Ablation That Fuses Real-Time Ultrasound. InnerOptic Technology, Inc, NIH/National Cancer Institute (NCI).

**Massengill S.** University of Michigan O'Brien Kidney Translational Core Center: Clinical Phenotyping Resource and Biobank Core (C-PROBE). University of Michigan, NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

**Massengill S.** Chronic Kidney Disease in Children (CKiD). Children's Hospital of Philadelphia (CHOP), NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

**Massengill S.** Novel Therapies for Resistant FSGS. New York University School of Medicine, NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

**Massengill S.** PROMIS Pediatrics: Longitudinal Validation & Linking Pediatric & Adult Item Banks. University of Michigan, NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**McWilliams A.** Improving Colon Cancer Screening for Diverse Populations. UNC-Chapel Hill (UNCCH), American Cancer Society.

**Mileham K.** A Pilot Study of Carboplatin with Nab-Paclitaxel in Patients with Advanced Non-Small Cell Lung Cancer of Squamous Histology. Celgene Corporation.

**Niemeier J.** An Acute Neurobehavioral Program for Improving Functional Status after TBI. NIH/National Institute of Child Health and Human Development (NICHD).

**Norton J.** Clinical Inertia in Type 2 Diabetes Mellitus. Merck, Sharp & Dohme Corp.

**Ode G.** Biomechanical Comparison of Novel Patella Tendon Repair Construct vs. Suture Anchor Repair and Standard Suture Repair: A Biomechanical Study. Arthrex, Inc.

**Oesterheld J.** A Phase I Study of 5-Azactidine in Combination with Chemotherapy for Children with Relapsed or Refractory ALL or AML. Children's Hospital Los Angeles.

**Oesterheld J.** A Feasibility Trial Using Molecular-Guided Therapy for the Treatment of Patients with Relapsed and Refractory Childhood Cancer. Spectrum Health Hospitals.

**Oesterheld J.** A Phase II Trial of Nifurtimox for Refractory or Relapsed Neuroblastoma or Medulloblastoma. Spectrum Health Hospitals.

**Oesterheld J.** A Phase II Preventative Trial of DFMO as a Single Agent in Patients with High Risk Neuroblastoma in Remission. Spectrum Health Hospitals.

**Oesterheld J.** A Phase I/II Trial of TPI 287 in Patients with Refractory or Recurrent Neuroblastoma or Medulloblastoma. Spectrum Health Hospitals.

**Oesterheld J.** A Phase I Study of GNKG168 in Pediatric Patients with Acute Lymphoblastic Leukemia or Acute Myeloid Leukemia. Children's Hospital Los Angeles.

**Oesterheld J.** A Pilot Study of Decitabine and Vorinostat with Chemotherapy for Relapsed ALL. Children's Hospital Los Angeles.

**Palikh G.** Platelet-Oriented Inhibition in New TIA and Minor Ischemic Stroke (POINT) Trial. The EMMES Corporation, NIH/National Institute of Neurological Disorders and Stroke (NINDS).

**Patel N.** A Registry of Patients with Primary Immune Deficiency Disorders. United States Immunodeficiency Network (USIDNET), NIH/National Institute of Allergy and Infectious Diseases (NIAID).

**Patel N.** Safety and Efficacy of Hizentra in Patients Less than 5 Years. CSL Behring.





**Patel N.** Assist in Research to Study Effects of Interferon Gamma (IFN gamma) Therapy on Patients with CGD. Carolinas HealthCare Foundation (CHF), Vidara Therapeutics, Inc.

**Piper L.** Approaches and Decisions for Acute Pediatric TBI (ADAPT). University of Pittsburgh, NIH/National Institute of Neurological Disorders and Stroke (NINDS).

**Reese M.** Grant to Help Reduce the Prevalence of Childhood Obesity in Mecklenburg County through Implementation of Strategies from the Blueprint for a Healthier Generation, 2020. Carolinas Health Care Foundation (CHF), Duke Endowment.

**Raghavan D.** Southwest Oncology Group Purchase Service Agreement. Oregon Health and Science University, NIH/National Cancer Institute (NCI).

**Ray R.** Hospital Engagement Network - Leading Edge Advance Practice Topics. HHS/Centers for Medicare & Medicaid Services (CMS).

**Rinaldi M.** A Prospective, Multicenter, Randomized, Double-blind Trial to Assess the Effectiveness and Safety of 12 versus 30 Months of Dual Antiplatelet Therapy (DAPT) in Subjects Undergoing Percutaneous Coronary Intervention (PCI) with either Drug-eluting Stent. Harvard Clinical Research Institute (HCRI).

**Rinaldi M.** Carotid Revascularization Endarterectomy vs Stenting Trial. Rutgers (The State University of New Jersey), NIH/National Institute of Neurological Disorders and Stroke (NINDS).

**Runyon M.** L-carnitine Treatment for Vasopressor Dependent Septic Shock. University of Mississippi Medical Center, NIH/National Institute of General Medical Sciences (NIGMS).

**Salmon S.** A Pilot Study Testing Single-Agent Regorafenib in Advanced Previously-Treated Adenocarcinoma of the Pancreas. Bayer HealthCare Pharmaceuticals, Inc.

**Saxonhouse M.** Antibiotic Safety in Infants with Complicated Intra-Abdominal Infections. Duke University, NIH/National Institute of Child Health and Human Development (NICHD).

**Scannell B.** Assessment of Peripheral Perfusion After Pediatric Supracondylar Humerus Fracture with Near Infrared Spectroscopy (NIRS). Carolinas HealthCare Foundation (CHF), Baxter Foundation.

**Scherer M.** RESCUE: Randomized Evaluation of Patients with Stable Angina Comparing Utilization of Diagnostic Examinations. American College of Radiology (ACR).

**Senturias Y.** FASD South Practice and Implementation Center: A Focus on Primary Care and Social Work. Baylor College of Medicine, HHS/Centers for Disease Control and Prevention (CDC).

**Senturias Y.** Southeast Fetal Alcohol Spectrum Disorders Regional Training Centers. Meharry Medical College, HHS/Centers for Disease Control and Prevention (CDC).

**Seymour R and Hsu J.** Prescription Reporting with Immediate Medication Utilization Mapping (PRIMUM). HHS/Centers for Disease Control and Prevention (CDC).

**Seymour R.** Prosthetic Fit Assessment in Transtibial Amputees Secondary to Trauma (ProFit). University of California, San Francisco, DOD/Army Medical Research Acquisition Activity (USAMRAA).

**Sims S and Peindl R.** Patient Mobility Data Assessment Center. Carolinas HealthCare Foundation (CHF), AO Foundation Strategy Fund.

**Sparks S.** PITT0112 Becker Muscular Dystrophy A Natural History Study to Predict Efficacy of Exon Skipping. Children's Research Institute (CRI), NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**Sparks S.** Center for Research Translation of Systemic Exon-skipping in Muscular Dystrophy. Children's Research Institute (CRI), NIH/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS).

**Sparks S.** A Multicenter Collaborative Study on the Clinical Features, Expression Profiling, and Quality of Life for Pediatric Facioscapulohumeral Muscular Dystrophy. Children's Research Institute (CRI), FSH Society.

**Sparks S.** Cooperative International Neuromuscular Research Group (CINRG) Clinical Evaluator Outcomes Reliability Study. Children's Research Institute (CRI), Foundation to Eradicate Duchenne.

**Sparks S.** A Clinical Outcome Study for Dysferlinopathy. Newcastle upon Tyne Hospitals NHS Foundation Trust, Jain Foundation, Inc.

**Sparks S.** A Multicenter Collaborative Study on the Clinical Features, Expression Profiling, and Quality of Life for Pediatric Facioscapulohumeral Muscular Dystrophy. Children's Research Institute (CRI), FSH Society.

**Spencer M.** Southeastern Diabetes Initiative. Cabarrus Health Alliance Southeastern Diabetes Initiative.

**Stefanidis D.** Development of a Simulation-based Mental Skills Curriculum for Surgeons. HHS/Agency for Healthcare Research and Quality (AHRQ).

**Stefanidis D.** A Secondary Task for Measuring Laparoscopic Skill. Old Dominion University Research Foundation, HHS/Agency for Healthcare Research and Quality (AHRQ).

**Sullivan M.** Emergency Department Sentinel Network for Surveillance of Emerging Infections. Olive View-UCLA Education and Research Institute (ERI), HHS/Centers for Disease Control and Prevention (CDC).

**Swan R.** Use of an Advanced Minimally Invasive Hemodynamic Monitoring for Perioperative Fluid Management in Hepatobiliary and Pancreas Surgery: A pilot study. Edwards Lifesciences, LLC.

**Tapp H.** Comparing Traditional and Participatory Dissemination of a Shared Decision Making Intervention. Patient-Centered Outcomes Research Institute (PCORI).

**Tapp H.** Patient Centered Medical Home: Patient Engagement & Patient Activation. Pitt County Memorial Hospital, Inc. d/b/a Vidant Medical Center, Duke Endowment.

**Todd J.** MISTIE III: A Phase III, Randomized, Open-Label, 500-Subject Clinical Trial of Minimally Invasive Surgery Plus rt-PA in the Treatment of Intracerebral Hemorrhage. Johns Hopkins University, NIH/ National Institute of Neurological Disorders and Stroke (NINDS).

**Usmani S.** Exploratory Study of the Combination of Melphalan and ARRY-520 in Multiple Myeloma. Array BioPharma Inc.

**Usmani S.** A Prospective, Longitudinal, Observational Study in Newly Diagnosed Multiple Myeloma (MM) Patients to Assess the Relationship between Patient Outcomes, Treatment Regimens and Molecular Profiles. Multiple Myeloma Research Foundation, Inc.

**VanderHave K.** Registry for Orthopaedic Trauma in Children (ROTC). Carolinas HealthCare Foundation (CHF), Orthopaedic Trauma Association.

**Weaver, Jr. J.** Integrative Proteomics & Metabolomics for Pediatric Glomerula Disease Biomarkers. The Research Institute at Nationwide Children's Hospital, NIH/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

**Williams C.** Regeneration of Gastrointestinal Tract with Cell/Biomaterial Constructs. Tengion, Inc.

**Williams C.** Biomaterials Evaluation in Porcine Models of Organ Regeneration. Tengion, Inc.

**Williams C.** Dielectric Properties of Brain Tissues During Stress in Swine - a Pilot Study. EMTensor GmbH.

**Williams J.** WIN BIG - Wrapping Interventions around the Next Cohort of Young Drivers to Begin Impacting Long-term Generations of Community Drivers. NC Department of Transportation (NC DOT), US Department of Transportation (DOT).

## PUBLICATIONS

- Advani AS, McDonough S, Copelan E, Willman C, Mulford DA, List AF, Sekeres MA, Othus M, Appelbaum FR. SWOG0919: a Phase 2 study of idarubicin and cytarabine in combination with pravastatin for relapsed acute myeloid leukaemia. *Br J Haematol*. 2014;167:233-7. PMID: 25039477
- Alushi B, Hoffmeier A, Sindermann J, Bose D, Garvey JL, Breuckmann F. Unusual case of a free-floating ball thrombus with preserved attachment to the left atrial appendage causing recurrent obstruction of the left ventricular outflow tract. *Clin Med Insights Cardiol*. 2014;8:5-7. PMID: 25392701
- Amin A, White RL. Interleukin-2 in renal cell carcinoma: a has-been or a still-viable option? *J Kidney Cancer VHL*. 2014;1:74-83.
- Amin H, Vachris J, Hamilton A, Steuerwald N, Howden R, Arthur ST. GSK3beta inhibition and LEF1 upregulation in skeletal muscle following a bout of downhill running. *J Physiol Sci*. 2014;64:1-11. PMID: 23963660
- Anderson PM. Futility versus utility of marrow assessment in initial Ewing sarcoma staging workup. *Pediatr Blood Cancer*. 2014;62:1-2. PMID: 25307292
- Anderson PM, Meyers P, Kleinerman E, Venkatakrishnan K, Hughes DP, Herzog C, Huh W, Sutphin R, Vyas YM, Shen V, Warwick A, Yeager N, Oliva C, Wang B, Liu Y, Chou A. Mifamurtide in metastatic and recurrent osteosarcoma: a patient access study with pharmacokinetic, pharmacodynamic, and safety assessments. *Pediatr Blood Cancer*. 2014;61:238-44. PMID: 23997016
- Anderson PM, Subbiah V, Rohren E. Bone-seeking radiopharmaceuticals as targeted agents of osteosarcoma: samarium-153-EDTMP and radium-223. *Adv Exp Med Biol*. 2014;804:291-304. PMID: 24924181
- Asher AL, Burri SH, Wiggins WF, Kelly RP, Boltes MO, Mehrlich M, Norton HJ, Fraser RW. A new treatment paradigm: neoadjuvant radiosurgery before surgical resection of brain metastases with analysis of local tumor recurrence. *Int J Radiat Oncol Biol Phys*. 2014;88:899-906. PMID: 24606851
- Asimos AW, Ward S, Brice JH, Enright D, Rosamond WD, Goldstein LB, Studnek J. A geographic information system analysis of the impact of a statewide acute stroke emergency medical services routing protocol on community hospital bypass. *J Stroke Cerebrovasc Dis*. 2014;23:2800-8. PMID: 25294057
- Asimos AW, Ward S, Brice JH, Rosamond WD, Goldstein LB, Studnek J. Out-of-hospital stroke screen accuracy in a state with an emergency medical services protocol for routing patients to acute stroke centers. *Ann Emerg Med*. 2014;64:509-15. PMID: 24746847
- Bachanova V, Marks DI, Zhang MJ, Wang H, de Lima M, Aljurf MD, Arellano M, Artz AS, Bacher U, Cahn JY, Chen YB, Copelan EA, Drobyski WR, Gale RP, Greer JP, Gupta V, Hale GA, Kebriaei P, Lazarus HM, Lewis ID, Lewis VA, Liesveld JL, Litzow MR, Loren AW, Miller AM, Norkin M, Oran B, Pidala J, Rowe JM, Savani BN, Saber W, Vij R, Waller EK, Wiernik PH, Weisdorf DJ. Ph+ ALL patients in first complete remission have similar survival after reduced intensity and myeloablative allogeneic transplantation: impact of tyrosine kinase inhibitor and minimal residual disease. *Leukemia*. 2014;28:658-65. PMID: 23989431
- Bam R, Venkateshaiah SU, Khan S, Ling W, Randal SS, Li X, Zhang Q, van Rhee F, Barlogie B, Epstein J, Yaccoby S. Role of Bruton's tyrosine kinase (BTK) in growth and metastasis of INA6 myeloma cells. *Blood Cancer J*. 2014;4:e234. PMID: 25083818
- Bansode RR, Randolph P, Ahmedna M, Hurley S, Hanner T, Baxter SA, Johnston TA, Su M, Holmes BM, Yu J, Williams LL. Bioavailability of polyphenols from peanut skin extract associated with plasma lipid lowering function. *Food chemistry*. 2014;148:24-9. PMID: 24262521

- Basch E, Loblaw DA, Oliver TK, Carducci M, Chen RC, Frame JN, Garrels K, Hotte S, Kattan MW, Raghavan D, Saad F, Taplin ME, Walker-Dilks C, Williams J, Winkquist E, Bennett CL, Wootton T, Rumble RB, Dusetzina SB, Virgo KS. Systemic therapy in men with metastatic castration-resistant prostate cancer: American Society of Clinical Oncology and Cancer Care Ontario clinical practice guideline. *J Clin Oncol*. 2014;32:3436-48. PMID: 25199761
- Baxter SS, Dibble CF, Byrd WC, Carlson J, Mack CR, Saldarriaga I, Bencharit S. Role of cytoskeletal proteins in cerebral cavernous malformation signaling pathways: a proteomic analysis. *Molecular bioSystems*. 2014;10:1881-9. PMID: 24770493
- Bedigrew KM, Patzkowski JC, Wilken JM, Owens JG, Blanck RV, Stinner DJ, Kirk KL, Hsu Jr. C. Can an integrated orthotic and rehabilitation program decrease pain and improve function after lower extremity trauma? *Clin Orthop Relat Res*. 2014;472:3017-25. PMID: 24744130
- Blaeser A, Sparks S, Brown SC, Campbell K, Lu Q. Third International Workshop for Glycosylation Defects in Muscular Dystrophies, 18-19 April 2013, Charlotte, USA. *Brain Pathol*. 2014;24:280-4. PMID: 24397416
- Blair JA, Patzkowski JC, Blanck RV, Owens JG, Hsu JR. Return to duty after integrated orthotic and rehabilitation initiative. *J Orthop Trauma*. 2014;28:e70-4. PMID: 24121984
- Bockenek WL. Physical medicine and rehabilitation residency training and certification in the United States. *JPN J Rehabil Med*. 2014;51:419-22.
- Bockenek WL, Massagli TL, Swing SR, Fischer C. The development of the physical medicine and rehabilitation milestones. *J Grad Med Educ*. 2014;6:204-6. PMID: 24701283
- Boughey JC, McCall LM, Ballman KV, Mittendorf EA, Ahrendt GM, Wilke LG, Taback B, Leitch AM, Flippo-Morton T, Hunt KK. Tumor biology correlates with rates of breast-conserving surgery and pathologic complete response after neoadjuvant chemotherapy for breast cancer: findings from the ACOSOG Z1071 (Alliance) Prospective Multicenter Clinical Trial. *Ann Surg*. 2014;260:608-14; discussion 14-6. PMID: 25203877
- Bozik ME, Mitsumoto H, Brooks BR, Rudnicki SA, Moore DH, Zhang B, Ludolph A, Cudkowicz ME, van den Berg LH, Mather J, Petzinger T, Jr., Archibald D. A post hoc analysis of subgroup outcomes and creatinine in the phase III clinical trial (EMPOWER) of dexamipexole in ALS. *Amyotroph Lateral Scler Frontotemporal Degener*. 2014;15:406-13. PMID: 25125035
- Brennan MT. Sjögren's syndrome. *Oral Maxillofac Surg Clin North Am*. 2014;26:ix. PMID: 24287200
- Brenner AT, Getrich CM, Pignone M, Rhyne RL, Hoffman RM, McWilliams A, de Hernandez BU, Weaver MA, Tapp H, Harbi K, Reuland D. Comparing the effect of a decision aid plus patient navigation with usual care on colorectal cancer screening completion in vulnerable populations: study protocol for a randomized controlled trial. *Trials*. 2014;15:275. PMID: 25004983
- Brixey SN, Weaver NL, Guse CE, Zimmermann H, Williams J, Corden TE, Gorelick MH. The impact of behavioral risk assessments and tailored health information on pediatric injury. *Clin Pediatr (Phila)*. 2014;53:1383-9. PMID: 25189696
- Brooks BR. ALS-Plus - where does it begin, where does it end? *J Neurol Sci*. 2014;345:1-2. PMID: 25073572
- Brooks BR, Swash M. Theodore Leon 'Ted' Munsat MD (1930-2013). *Amyotroph Lateral Scler Frontotemporal Degener*. 2014;15:473-4. PMID: 24809967
- Bruegl AS, Crane EK, Frumovitz M. Successful laparoscopic removal of adnexal mass in a patient with a large ventral hernia. *J Minim Invasive Gynecol*. 2014;21:325-6. PMID: 24291207
- Cabey WV, MacNeill E, White LN, James Norton H, Mitchell AM. Frequent pediatric emergency department use in infancy and early childhood. *Pediatr Emerg Care*. 2014;30:710-7. PMID: 25272073

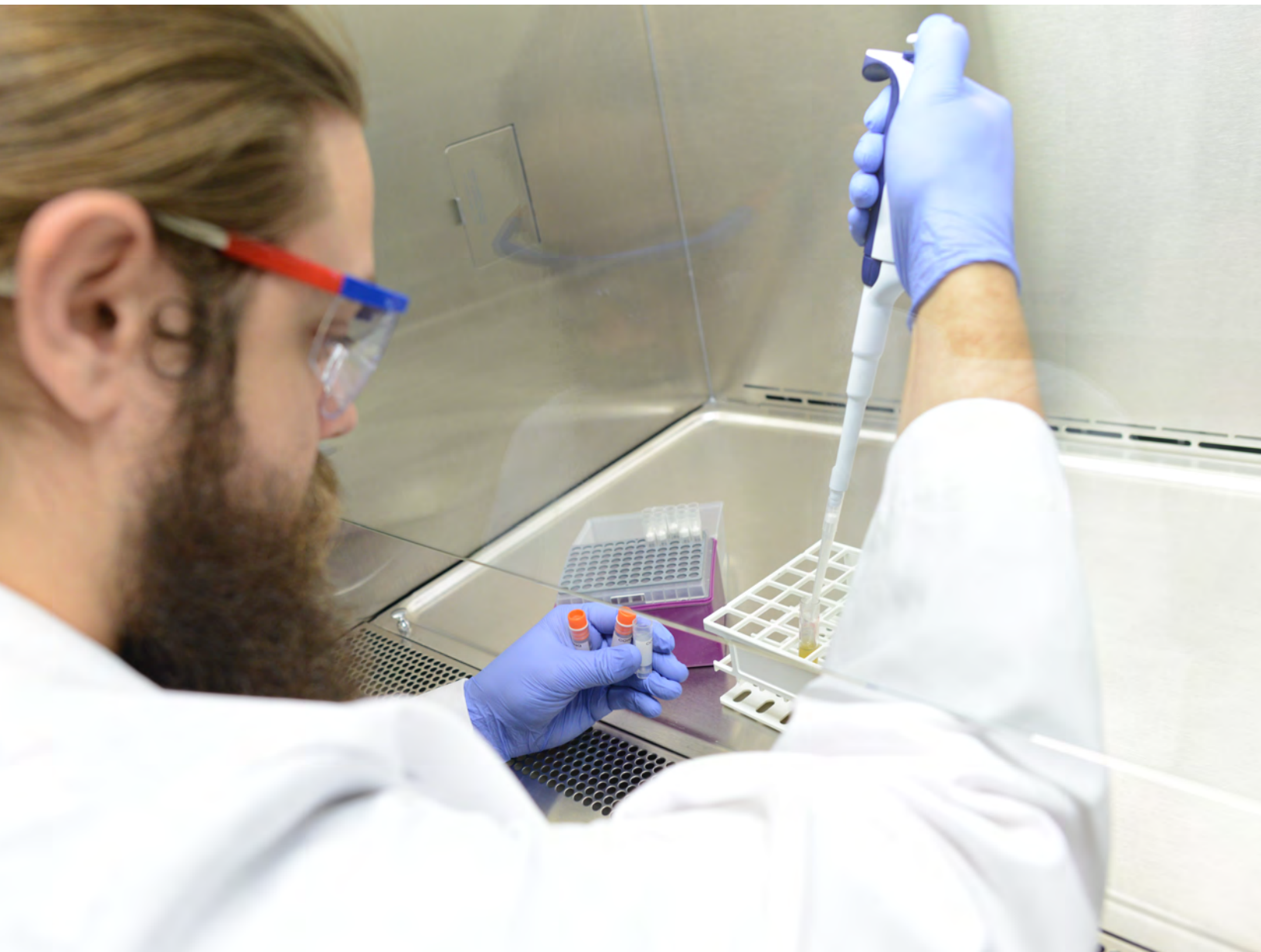


- Calhoun BC, Chambers K, Flippo-Morton T, Livasy CA, Armstrong EJ, 3rd, Symanowski JT, Sarantou Greene FL, White RL, Jr. Breast cancer detection in axillary sentinel lymph nodes: the impact of the method of pathologic examination. *Hum Pathol*. 2014;45:2497-501. PMID: 25449631
- Callaway DW, Noste E, McCahill PW, Rossman AJ, Lempereur D, Kaney K, Swanson D. Time for a revolution: smart energy and microgrid use in disaster response. *Disaster Med Public Health Prep*. 2014;8:252-9. PMID: 24992943
- Cao D, Maynard S, Mitchell AM, Kerns WP, 2nd, Beuhler M. Point of care testing provides an accurate measurement of creatinine, anion gap, and osmolal gap in ex-vivo whole blood samples with nitro methane. *Clin Toxicol (Phila)*. 2014;52:611-7. PMID: 24844579
- Chang SJ, Ross SW, Kiefer DJ, Anderson WE, Rogers AT, Sing RF, Callaway DW. Evaluation of 8.0-cm needle at the fourth anterior axillary line for needle chest decompression of tension pneumothorax. *J Trauma Acute Care Surg*. 2014;76:1029-34. PMID: 24662868
- Christmas AB, Freeman E, Chisolm A, Fischer PE, Sachdev G, Jacobs DG, Sing RF. Trauma intensive care unit 'bouncebacks': identifying risk factors for unexpected return admission to the intensive care unit. *Am Surg*. 2014;80:778-82. PMID: 25105397
- Colavita PD, Belyansky I, Walters AL, Zemlyak AY, Lincourt AE, Heniford BT, Augenstein VA. Umbilical hernia repair with mesh: identifying effectors of ideal outcomes. *Am J Surg*. 2014;208:342-9. PMID: 24793575
- Colavita PD, Tsirlane VB, Belyansky I, Swan RZ, Walters AL, Lincourt AE, Iannitti DA, Heniford BT. Regionalization and outcomes of hepato-pancreato-biliary cancer surgery in USA. *J Gastrointest Surg*. 2014;18:532-41. PMID: 24430889
- Crane AK, Geller EJ, Sullivan S, Robinson BL, Myers EM, Horton C, Matthews CA. Short-term mesh exposure after robotic sacrocolpopexy with and without concomitant hysterectomy. *South Med J*. 2014;107:603-6. PMID: 25279861
- Crane AK, Myers EM, Lippmann QK, Matthews CA. Overlapping sphincteroplasty and posterior repair. *Int Urogynecol J*. 2014;25:1729-30. PMID: 25001576
- Crane EK, Sun CC, Ramirez PT, Schmeler KM, Malpica A, Gershenson DM. The role of secondary cytoreduction in low-grade serous ovarian cancer or peritoneal cancer. *Gynecol Oncol*. 2015;136:25-9. PMID: 25448453
- Cullen MW, Stulak JM, Li Z, Powell BD, White RD, Nkomo VT, Ammash NM. Transesophageal echocardiography-guided cardioversion after cardiac operations. *Ann Thorac Surg*. 2014;98:1325-30. PMID: 25152384
- Cumberbatch M, Tang X, Beran G, Eckersley S, Wang X, Ellston RP, Dearden S, Cosulich S, Smith PD, Behrens C, Kim ES, Su X, Fan S, Gray N, Blowers DP, Wistuba, II, Womack C. Identification of a subset of human non-small cell lung cancer patients with high PI3Kbeta and low PTEN expression, more prevalent in squamous cell carcinoma. *Clin Cancer Res*. 2014;20:595-603. PMID: 24284056
- Dahlquist RT, Sing RF. Hyperdense middle cerebral artery sign after trauma. *J Am Osteopath Assoc*. 2014;114:878. PMID: 25352410
- Das A, Gopalakrishnan B, Druhan LJ, Wang TY, De Pascali F, Rockenbauer A, Racoma I, Varadharaj S, Zweier JL, Cardounel AJ, Villamena FA. Reversal of SIN-1-induced eNOS dysfunction by the spin trap, DMPO, in bovine aortic endothelial cells via eNOS phosphorylation. *Br J Pharmacol*. 2014;171:2321-34. PMID: 24405159
- De La Cruz JF, Myers EM, Geller EJ. Vaginal versus robotic hysterectomy and concomitant pelvic support surgery: a comparison of postoperative vaginal length and sexual function. *J Minim Invasive Gynecol*. 2014;21:1010-4. PMID: 24780383

- de Vries JP, Ouriel K, Mehta M, Varnagy D, Moore WM, Jr., Arko FR, Joye J, Jordan WD, Jr. Analysis of EndoAnchors for endovascular aneurysm repair by indications for use. *J Vasc Surg*. 2014;60:1460-7 e1. PMID: 25284629
- Deeken JF, Marshall JL, Pishvaian MJ, Hwang J, Ahlers CM, Clemens PL, Parker SM, Iacono L, LoRusso PM. A phase I study of oral ixabepilone in patients with advanced solid tumors. *Cancer Chemother Pharmacol*. 2014;73:1071-8. PMID: 24663504
- deLemos AS, Foureau DM, Jacobs C, Ahrens W, Russo MW, Bonkovsky HL. Drug-induced liver injury with autoimmune features. *Semin Liver Dis*. 2014;34:194-204. PMID: 24879983
- deLemos AS, Schmeltzer PA, Russo MW. Recurrent hepatitis C after liver transplant. *World J Gastroenterol*. 2014;20:10668-81. PMID: 25152571
- DeSena A, Graves D, Morriss MC, Greenberg BM. Transverse myelitis plus syndrome and acute disseminated encephalomyelitis plus syndrome: a case series of 5 children. *JAMA Neurol*. 2014;71:624-9. PMID: 24637847
- DeSena A, Graves D, Warnack W, Greenberg BM. Herpes simplex encephalitis as a potential cause of anti-N-methyl-D-aspartate receptor antibody encephalitis: report of 2 cases. *JAMA Neurol*. 2014;71:344-6. PMID: 24473671
- DeSena AD, Greenberg BM, Graves D. "Light switch" mental status changes and irritable insomnia are two particularly salient features of anti-NMDA receptor antibody encephalitis. *Pediatr Neurol*. 2014;51:151-3. PMID: 24938143
- DeSena AD, Greenberg BM, Graves D. Three phenotypes of anti-N-methyl-D-aspartate receptor antibody encephalitis in children: prevalence of symptoms and prognosis. *Pediatr Neurol*. 2014;51:542-9. PMID: 25070939
- Dressler LG, Deal AM, Patel JN. Cancer pharmacogenomics, adoption by oncologists and patient benefit. *Personalized Medicine*. 2014;11:143-53.
- Dulaney CR, Hall WA, Mikell JL, Mittal P, Prabhu RS, Kooby DA, Hanley K, Sarmiento JM, Landry JC. The influence of time interval between diagnostic image acquisition and operative date on pathologic tumor size in pancreatic adenocarcinoma: implications for local therapy. *J Biomed Graph Comput*. 2014;4:15-22.
- Duong HK, Savani BN, Copelan E, Devine S, Costa LJ, Wingard JR, Shaughnessy P, Majhail N, Perales MA, Cutler CS, Bensinger W, Litzow MR, Mohty M, Champlin RE, Leather H, Giral S, Carpenter PA. Peripheral blood progenitor cell mobilization for autologous and allogeneic hematopoietic cell transplantation: guidelines from the American Society for Blood and Marrow Transplantation. *Biol Blood Marrow Transplant*. 2014;20:1262-73. PMID: 24816581
- Efird LM, Mishkin DS, Berlowitz DR, Ash AS, Hylek EM, Ozonoff A, Reisman JI, Zhao S, Jasuja GK, Rose AJ. Stratifying the risks of oral anticoagulation in patients with liver disease. *Circ Cardiovasc Qual Outcomes*. 2014;7:461-7. PMID: 24823958
- Egas-Bejar D, Anderson PM, Agarwal R, Corrales-Medina F, Devarajan E, Huh WW, Brown RE, Subbiah V. Theranostic profiling for actionable aberrations in advanced high risk osteosarcoma with aggressive biology reveals high molecular diversity: the human fingerprint hypothesis. *Oncoscience*. 2014;1:167-79. PMID: 25126591
- Elad S, Jensen SB, Raber-Durlacher JE, Mouradian N, Correa EM, Schubert MM, Blijlevens NM, Epstein JB, Saunders DP, Waltimo T, Yarom N, Zadik Y, Brennan MT. Clinical approach in the management of oral chronic graft-versus-host disease (cGVHD) in a series of specialized medical centers. *Support Care Cancer*. 2014. PMID: 25417041
- Faith Investigators. Fixation using alternative implants for the treatment of hip fractures (FAITH): design and rationale for a multi-centre randomized trial comparing sliding hip screws and cancellous screws on revision surgery rates and quality of life in the treatment of femoral neck fractures. *BMC Musculoskelet Disord*. 2014;15:219. PMID: 24965132

- Fargnoli AS, Katz MG, Williams RD, Margulies KB, Bridges CR.** A needleless liquid jet injection delivery method for cardiac gene therapy: a comparative evaluation versus standard routes of delivery reveals enhanced therapeutic retention and cardiac specific gene expression. *J Cardiovasc Transl Res.* 2014;7:756-67. PMID: 25315468
- Fargnoli AS, Mu A, Katz MG, Williams RD, Margulies KB, Weiner DB, Yang S, Bridges CR.** Anti-inflammatory loaded poly-lactic glycolic acid nanoparticle formulations to enhance myocardial gene transfer: an in-vitro assessment of a drug/gene combination therapeutic approach for direct injection. *J Transl Med.* 2014;12:171. PMID: 24934216
- Forster MR, Rashid OM, Perez MC, Choi J, Chaudhry T, Zager JS.** Chemosaturation with percutaneous hepatic perfusion for unresectable metastatic melanoma or sarcoma to the liver: a single institution experience. *J Surg Oncol.* 2014;109:434-9. PMID: 24249545
- Foureau DM, Amin A, White RL, Anderson W, Jones CP, Sarantou T, McKillop IH, Salo JC.** Sequential immune monitoring in patients with melanoma and renal cell carcinoma treated with high-dose interleukin-2: immune patterns and correlation with outcome. *Cancer Immunol Immunother.* 2014;63:1329-40. PMID: 25205170
- Ganapathi RN, Ganapathi MK.** Pharmacogenomics: new paradigms for targeted therapy based on individual response to drugs. *Urol Oncol.* 2014;32:1-4. PMID: 24360658
- Gerber JM.** Isolated clonal cytogenetic abnormalities after high-dose therapy: do they matter? *Biol Blood Marrow Transplant.* 2014;20:1077-8. PMID: 24953018
- Gillis NK, Patel JN, Innocenti F.** Clinical implementation of germ line cancer pharmacogenetic variants during the next-generation sequencing era. *Clin Pharmacol Ther.* 2014;95:269-80. PMID: 24136381
- Giralt S, Costa L, Schriber J, Dipersio J, Maziarz R, McCarty J, Shaughnessy P, Snyder E, Bensinger W, Copelan E, Hosing C, Negrin R, Petersen FB, Rondelli D, Soiffer R, Leather H, Pazzalia A, Devine S.** Optimizing autologous stem cell mobilization strategies to improve patient outcomes: consensus guidelines and recommendations. *Biol Blood Marrow Transplant.* 2014;20:295-308. PMID: 24141007
- Givens PM, Goldonowicz JM, Littmann L.** The electrocardiogram of chest and limb lead reversal. *Am J Med.* 2014;127:e29-30. PMID: 25205271
- Glower DD, Kar S, Trento A, Lim DS, Bajwa T, Quesada R, Whitlow PL, Rinaldi MJ, Grayburn P, Mack MJ, Mauri L, McCarthy PM, Feldman T.** Percutaneous mitral valve repair for mitral regurgitation in high-risk patients: results of the EVEREST II study. *J Am Coll Cardiol.* 2014;64:172-81. PMID: 25011722
- Gold KA, Kim ES, Liu DD, Yuan P, Behrens C, Solis LM, Kadara H, Rice DC, Wistuba, II, Swisher SG, Hofstetter WL, Lee JJ, Hong WK.** Prediction of survival in resected non-small cell lung cancer using a protein expression-based risk model: implications for personalized chemoprevention and therapy. *Clin Cancer Res.* 2014;20:1946-54. PMID: 24366692
- Grimm BD, Laxer EB, Patt JC, Darden BV.** Mimickers of cervical radiculopathy. *JBJS Reviews.* 2014;2:e2.
- Groeschl RT, Pilgrim CH, Hanna EM, Simo KA, Swan RZ, Sindram D, Martinie JB, Iannitti DA, Bloomston M, Schmidt C, Khabiri H, Shirley LA, Martin RC, Tsai S, Turaga KK, Christians KK, Rilling WS, Gamblin TC.** Microwave ablation for hepatic malignancies: a multiinstitutional analysis. *Ann Surg.* 2014;259:1195-200. PMID: 24096760
- Grogan BF, Blair JA, Blease RE, Cho MS, Hsu JR.** Exposure of the distal humerus using a triceps hemi-peel approach. *Orthopedics.* 2014;37:e455-9. PMID: 24810822

- Gruber HE, Hoelscher GL, Bethea SF, Menscher EA, Ingram JA, Templin MA, Hanley EN, Jr. Cortistatin is endogenous to the human intervertebral disc and exerts in vitro mitogenic effects on annulus cells and a downregulatory effect on TNF-alpha expression. *Spine J.* 2014;14:2995-3001. PMID: 24912122
- Gruber HE, Hoelscher GL, Ingram JA, Bethea S, Hanley EN, Jr. Growth and differentiation factor-5 (GDF-5) in the human intervertebral annulus cells and its modulation by IL-1ss and TNF-alpha in vitro. *Exp Mol Pathol.* 2014;96:225-9. PMID: 24582800
- Gruber HE, Hoelscher GL, Ingram JA, Bethea S, Norton HJ, Hanley EN, Jr. Production and expression of RANTES (CCL5) by human disc cells and modulation by IL-1-beta and TNF-alpha in 3D culture. *Exp Mol Pathol.* 2014;96:133-8. PMID: 24468005
- Gruber HE, Ingram JA, Cox MD, Hanley EN, Jr. Matrix metalloproteinase-12 immunolocalization in the degenerating human intervertebral disc and sand rat spine: Biologic implications. *Exp Mol Pathol.* 2014;97:1-5. PMID: 24768589
- Gruber HE, Phillips R, Ingram JA, Norton HJ, Hanley EN, Jr. Spontaneous age-related cervical disc degeneration in the sand rat. *Clin Orthop Relat Res.* 2014;472:1936-42. PMID: 24515407
- Gruber HE, Sha W, Brouwer CR, Steuerwald N, Hoelscher GL, Hanley EN, Jr. A novel catechol-O-methyltransferase variant associated with human disc degeneration. *Int J Med Sci.* 2014;11:748-53. PMID: 24904231





- Grunwald MR, Tseng LH, Lin MT, Pratz KW, Eshleman JR, Levis MJ, Gocke CD. Improved FLT3 internal tandem duplication PCR assay predicts outcome after allogeneic transplant for acute myeloid leukemia. *Biol Blood Marrow Transplant*. 2014;20:1989-95. PMID: 25240816
- Hadzikadic Gusic L, McGuire KP, Ozmen T, Soran A, Thomas CR, McAuliffe PF, Diego EJ, Bonaventura M, Johnson RR, Ahrendt GM. Margin width is not predictive of residual disease on re-excision in breast conserving therapy. *J Surg Oncol*. 2014;109:426-30. PMID: 24338603
- Haggerty S, Roth S, Walsh D, Stefanidis D, Price R, Fanelli RD, Penner T, Richardson W. Guidelines for laparoscopic peritoneal dialysis access surgery. *Surg Endosc*. 2014;28:3016-45. PMID: 25294537
- Hall WA, Colbert LE, Nickleach D, Switchenko J, Liu Y, Gillespie T, Lipscomb J, Hardy C, Kooby DA, Prabhu RS, Kauh J, Landry JC. The influence of radiation therapy dose escalation on overall survival in unresectable pancreatic adenocarcinoma. *J Gastrointest Oncol*. 2014;5:77-85. PMID: 24772334
- Hall WA, Prabhu RS, Crocker IR, Dhabban A, Ogunleye T, Kandula S, Jiang X, Curran WJ, Shu HK. Repeat whole brain radiation therapy with a simultaneous infield boost: a novel technique for reirradiation. *J Radiotherapy*. 2014;Article ID 403945:8.
- Hamilton BK, Rybicki L, Dabney J, McLellan L, Haddad H, Foster L, Abounader D, Kalaycio M, Sobecks R, Dean R, Duong H, Hill BT, Bolwell BJ, Copelan EA. Quality of life and outcomes in patients 60 years of age after allogeneic hematopoietic cell transplantation. *Bone Marrow Transplant*. 2014;49:1426-31. PMID: 25068430
- Hammond FM, Bickett AK, Norton JH, Pershad R. Effectiveness of amantadine hydrochloride in the reduction of chronic traumatic brain injury irritability and aggression. *J Head Trauma Rehabil*. 2014;29:391-9. PMID: 24263176
- Hanna EM, Hamp TJ, McKillop IH, Bahrani-Mougeot F, Martinie JB, Horton JM, Sindram D, Gharaibeh RZ, Fodor AA, Iannitti DA. Comparison of culture and molecular techniques for microbial community characterization in infected necrotizing pancreatitis. *J Surg Res*. 2014;191:362-9. PMID: 24952411
- Hanna EM, Martinie JB, Swan RZ, Iannitti DA. Fibrin sealants and topical agents in hepatobiliary and pancreatic surgery: a critical appraisal. *Langenbecks Arch Surg*. 2014;399:825-35. PMID: 24880346
- Hart TL, Coon DW, Kowalkowski MA, Zhang K, Hersom JI, Goltz HH, Wittmann DA, Latini DM. Changes in sexual roles and quality of life for gay men after prostate cancer: challenges for sexual health providers. *J Sex Med*. 2014;11:2308-17. PMID: 24888965
- Heuck CJ, Qu P, van Rhee F, Waheed S, Usmani SZ, Epstein J, Zhang Q, Edmondson R, Hoering A, Crowley J, Barlogie B. Five gene probes carry most of the discriminatory power of the 70-gene risk model in multiple myeloma. *Leukemia*. 2014;28:2410-3. PMID: 25079174
- Hirsch M, Hirsch VM. The adaptable brain: biology of social neuroplasticity. *Top Geriatr Rehabil*. 2014;30:2-7.
- Hirsch MA, Sanjak M, Englert D, Iyer S, Quinlan MM. Parkinson patients as partners in care. *Parkinsonism Relat Disord*. 2014;20 Suppl 1:S174-9. PMID: 24262175
- Hirsch MA, Williams K, Norton HJ, Hammond F. Reliability of the timed 10-metre walk test during inpatient rehabilitation in ambulatory adults with traumatic brain injury. *Brain Inj*. 2014;28:1115-20. PMID: 24892222
- Holger JS, Engebretsen KM, Stellpflug SJ, Cole JB, Kerns W, 2nd. Critical care management of verapamil and diltiazem overdose with a focus on vasopressors: a 25-year experience at a single center. *Ann Emerg Med*. 2014;63:91-2. PMID: 24355375
- Holland AA, Graves D, Greenberg BM, Harder LL. Fatigue, emotional functioning, and executive dysfunction in pediatric multiple sclerosis. *Child Neuropsychol*. 2014;20:71-85. PMID: 23216329
- Honaker D, Green J. Blunt traumatic abdominal wall hernias: Associated injuries and optimal timing and method of repair. *J Trauma Acute Care Surg*. 2014;77:701-4. PMID: 25494420

- Hope WW, Richardson W, Fanelli R, Stefanidis D. How do SAGES members rate its guidelines? *Surg Endosc*. 2014;28:1153-7. PMID: 24196562
- Huntington WP, Haines N, Patt JC. What factors influence applicants' rankings of orthopaedic surgery residency programs in the National Resident Matching Program? *Clin Orthop Relat Res*. 2014;472:2859-66. PMID: 24898527
- Hurst BS, Lange SS, Kullstam SM, Usadi RS, Matthews ML, Marshburn PB, Templin MA, Merriam KS. Obstetric and gynecologic challenges in women with Ehlers-Danlos syndrome. *Obstet Gynecol*. 2014;123:506-13. PMID: 24499752
- Hurst BS, Shimp KE, Elliot M, Marshburn PB, Parsons J, Bahrani-Mostafavi Z. Molecular evaluation of proliferative-phase endometrium may provide insight about the underlying causes of infertility in women with endometriosis. *Arch Gynecol Obstet*. 2014;289:1119-24. PMID: 24292148
- Ireland SJ, Guzman AA, O'Brien DE, Hughes S, Greenberg B, Flores A, Graves D, Remington G, Frohman EM, Davis LS, Monson NL. The effect of glatiramer acetate therapy on functional properties of B cells from patients with relapsing-remitting multiple sclerosis. *JAMA Neurol*. 2014;71:1421-8. PMID: 25264704
- Jiang Y, Subbiah V, Janku F, Ludwig JA, Naing A, Benjamin RS, Brown RE, Anderson P, Kurzrock R. Novel secondary somatic mutations in Ewing's sarcoma and desmoplastic small round cell tumors. *PLoS One*. 2014;9:e93676. PMID: 25119929
- Jin PP, Cheng JF, Liu D, Mei M, Xu ZQ, Sun LM. Endoscopic papillary large balloon dilation vs endoscopic sphincterotomy for retrieval of common bile duct stones: a meta-analysis. *World J Gastroenterol*. 2014;20:5548-56. PMID: 24833886
- Johnson TV, Rose GA, Fenner DJ, Rozario NL. Improving appropriate use of echocardiography and single-photon emission computed tomographic myocardial perfusion imaging: a continuous quality improvement initiative. *J Am Soc Echocardiogr*. 2014;27:749-57. PMID: 24726335
- Jordan WD, Jr., Mehta M, Varnagy D, Moore WM, Jr., Arko FR, Joye J, Ouriel K, de Vries JP. Results of the ANCHOR prospective, multicenter registry of EndoAnchors for type Ia endoleaks and endograft migration in patients with challenging anatomy. *J Vasc Surg*. 2014;60:885-92 e2. PMID: 25088739
- Kandula S, Saindane AM, Prabhu RS, Hanasoge S, Patel KR, Shu HK, Curran WJ, Crocker IR. Patterns of presentation and failure in patients with gliomatosis cerebri treated with partial-brain radiation therapy. *Cancer*. 2014;120:2713-20. PMID: 24845411
- Katz MG, Fargnoli AS, Williams RD, Bridges CR. The road ahead: working towards effective clinical translation of myocardial gene therapies. *Ther Deliv*. 2014;5:39-51. PMID: 24341816
- Katz MG, Fargnoli AS, Williams RD, Bridges CR. Surgical methods for cardiac gene transfer. *Future Cardiol*. 2014;10:323-6. PMID: 24976468
- Katz MG, Fargnoli AS, Williams RD, Kendle AP, Steuerwald NM, Bridges CR. miRNAs as potential molecular targets in heart failure. *Future Cardiol*. 2014;10:789-800. PMID: 25495820
- Katz MG, Fargnoli AS, Williams RD, Steuerwald NM, Isidro A, Ivanina AV, Sokolova IM, Bridges CR. Safety and efficacy of high-dose adeno-associated virus 9 encoding sarcoplasmic reticulum Ca(2+) adenosine triphosphatase delivered by molecular cardiac surgery with recirculating delivery in ovine ischemic cardiomyopathy. *J Thorac Cardiovasc Surg*. 2014;148:1065-72. PMID: 25037619
- Khanna R, Jariwala-Parikh K, West-Strum D, Mahabaleshwarkar R. Health-related quality of life and its determinants among adults with autism. *Res Autism Spect Dis*. 2014;8:157-67.
- Killu AM, Grupper A, Friedman PA, Powell BD, Asirvatham SJ, Espinosa RE, Luria D, Rozen G, Buber J, Lee YH, Webster T, Brooke KL, Hodge DO, Wiste HJ, Glikson M, Cha YM. Predictors and outcomes of "super-response" to cardiac resynchronization therapy. *J Card Fail*. 2014;20:379-86. PMID: 24632340

- Kim JS, Kim ES, Liu D, Lee JJ, Solis L, Behrens C, Lippman SM, Hong WK, Wistuba, II, Lee HY. Prognostic implications of tumoral expression of insulin like growth factors 1 and 2 in patients with non-small-cell lung cancer. *Clin Lung Cancer*. 2014;15:213-21. PMID: 24485233
- Kim M, Navarro F, Eruchalu CN, Augenstein VA, Heniford BT, Stefanidis D. Minimally invasive Roux-en-Y gastric bypass for fundoplication failure offers excellent gastroesophageal reflux control. *Am Surg*. 2014;80:696-703. PMID: 24987903
- Kim M, Oommen B, Ross SW, Lincourt AE, Matthews BD, Heniford BT, Augenstein VA. The current status of biosynthetic mesh for ventral hernia repair. *Surg Technol Int*. 2014;25:114-21. PMID: 25396323
- Klima DA, Tsriline VB, Belyansky I, Dacey KT, Lincourt AE, Kercher KW, Heniford BT. Quality of life following component separation versus standard open ventral hernia repair for large hernias. *Surg Innov*. 2014;21:147-54. PMID: 23843156
- Kline JA, Watts J, Courtney D, Lee YY, Hwang S. Severe pulmonary embolism decreases plasma L-arginine. *Eur Respir J*. 2014;43:906-9. PMID: 24232703
- Kowalkowski MA, Chandrashekar A, Amiel GE, Lerner SP, Wittmann DA, Latini DM, Goltz HH. Examining sexual dysfunction in non-muscle-invasive bladder cancer: results of cross-sectional mixed-methods research. *Sex Med*. 2014;2:141-51. PMID: 25356311
- Kowalkowski MA, Day RS, Du XL, Chan W, Chiao EY. Cumulative HIV viremia and non-AIDS-defining malignancies among a sample of HIV-infected male veterans. *J Acquir Immune Defic Syndr*. 2014;67:204-11. PMID: 25078536
- Kowalkowski MA, Goltz HH, Petersen NJ, Amiel GE, Lerner SP, Latini DM. Educational opportunities in bladder cancer: increasing cystoscopic adherence and the availability of smoking-cessation programs. *J Cancer Educ*. 2014;29:739-45. PMID: 24719024
- Kowalkowski MA, Mims MA, Day RS, Du XL, Chan W, Chiao EY. Longer duration of combination antiretroviral therapy reduces the risk of Hodgkin lymphoma: A cohort study of HIV-infected male veterans. *Cancer Epidemiol*. 2014;38:386-92. PMID: 24947588
- Krueger CA, Wenke JC, Cho MS, Hsu JR. Common factors and outcome in late upper extremity amputations after military injury. *J Orthop Trauma*. 2014;28:227-31. PMID: 23912860
- Lack WD, Starman JS, Seymour R, Bosse M, Karunakar M, Sims S, Kellam J. Any cortical bridging predicts healing of tibial shaft fractures. *J Bone Joint Surg Am*. 2014;96:1066-72. PMID: 24990971
- Law JK, Stoita A, Wever W, Gleeson FC, Dries AM, Blackford A, Kiswani V, Shin EJ, Khashab MA, Canto MI, Singh VK, Lennon AM. Endoscopic ultrasound-guided fine needle aspiration improves the pre-operative diagnostic yield of solid-pseudopapillary neoplasm of the pancreas: an international multicenter case series (with video). *Surg Endosc*. 2014;28:2592-8. PMID: 24718662
- Legro RS, Brzyski RG, Diamond MP, Coutifaris C, Schlaff WD, Casson P, Christman GM, Huang H, Yan Q, Alvero R, Haisenleder DJ, Barnhart KT, Bates GW, Usadi R, Lucidi S, Baker V, Trussell JC, Krawetz SA, Snyder P, Ohl D, Santoro N, Eisenberg E, Zhang H. Letrozole versus clomiphene for infertility in the polycystic ovary syndrome. *N Engl J Med*. 2014;371:119-29. PMID: 25006718
- Levin PE, MacKenzie EJ, Bosse MJ, Greenhouse PK. Improving outcomes: understanding the psychosocial aspects of the orthopaedic trauma patient. *Instr Course Lect*. 2014;63:39-48. PMID: 24720292
- Li T, Eheim AL, Klein S, Uschner FE, Smith AC, Brandon-Warner E, Ghosh S, Bonkovsky HL, Trebicka J, Schrum LW. Novel role of nuclear receptor Rev-erb $\alpha$  in hepatic stellate cell activation: potential therapeutic target for liver injury. *Hepatology*. 2014;59:2383-96. PMID: 24497272
- Lieberman J, Goff D, Jr., Hammond F, Schreiner P, James Norton H, Dulin M, Zhou X, Steffen L. Dietary intake relative to cardiovascular disease risk factors in individuals with chronic spinal cord injury: a pilot study. *Top Spinal Cord Inj Rehabil*. 2014;20:127-36. PMID: 25477735



**Lieberman J, Goff D, Jr., Hammond F, Schreiner P, Norton HJ, Dulin M, Zhou X, Steffen L.** Dietary intake and adherence to the 2010 Dietary Guidelines for Americans among individuals with chronic spinal cord injury: a pilot study. *J Spinal Cord Med.* 2014;37:751-7. PMID: 24621049

**Littmann L.** Electrocardiographic STEMI: a common but nonspecific finding in the ICU. *Am J Med.* 2014;127:e17-8. PMID: 24462017

**Littmann L.** Wide QRS complex rhythm with pulseless electrical activity. *Cleve Clin J Med.* 2014;81:81-2. PMID: 24493484

**Littmann L, Bustin DJ, Haley MW.** A simplified and structured teaching tool for the evaluation and management of pulseless electrical activity. *Med Princ Pract.* 2014;23:1-6. PMID: 23949188

**Littmann L, Proctor P.** Real time recognition of the electrocardiographic "spiked helmet" sign in a critically ill patient with pneumothorax. *Int J Cardiol.* 2014;173:e51-2. PMID: 24698249

**Littmann L, Proctor PA, Givens PM.** Cardiac memory during rather than after termination of left bundle branch block. *J Electrocardiol.* 2014;47:948-50. PMID: 25172185

**Lu QL, Cirak S, Partridge T.** What can we learn from clinical trials of exon skipping for DMD? *Mol Ther Nucleic Acids.* 2014;3:e152. PMID: 24618851

**Mahabaleshwarkar R, Khanna R.** National hospitalization burden associated with spinal cord injuries in the United States. *Spinal Cord.* 2014;52:139-44. PMID: 24276419

**Mahajan D, Dong Y, Saxon LA, Cha YM, Gilliam FR, 3rd, Asirvatham SJ, Cesario DA, Jones PW, Seth M, Powell BD.** Performance of an automatic arrhythmia classification algorithm: comparison to the ALTITUDE electrophysiologist panel adjudications. *Pacing Clin Electrophysiol.* 2014;37:889-99. PMID: 24527748



- Mamik MM, Antosh D, White DE, Myers EM, Abernethy M, Rahimi S, Bhatia N, Qualls CR, Dunivan G, Rogers RG. Risk factors for lower urinary tract injury at the time of hysterectomy for benign reasons. *Int Urogynecol J*. 2014;25:1031-6. PMID: 24464470
- Mansfield AS, Symanowski JT, Peikert T. Systematic review of response rates of sarcomatoid malignant pleural mesotheliomas in clinical trials. *Lung Cancer*. 2014;86:133-6. PMID: 25217189
- Marshburn PB, Giddings A, Causby S, Matthews ML, Usadi RS, Steuerwald N, Hurst BS. Influence of ejaculatory abstinence on seminal total antioxidant capacity and sperm membrane lipid peroxidation. *Fertil Steril*. 2014;102:705-10. PMID: 24993799
- Mathew G, Kowalczyk M, Hetaimish B, Bedi A, Philippon MJ, Bhandari M, Simunovic N, Crouch S, Ayeni OR. Radiographic prevalence of CAM-type femoroacetabular impingement after open reduction and internal fixation of femoral neck fractures. *Knee Surg Sports Traumatol Arthrosc*. 2014;22:793-800. PMID: 24488220
- Mauri L, Kereiakes DJ, Yeh RW, Driscoll-Shempp P, Cutlip DE, Steg PG, Normand S-LT, Braunwald E, Wiviott SD, Cohen DJ, Holmes DR, Krucoff MW, Hermiller J, Dauerman HL, Simon DI, Kandzari DE, Garratt KN, Lee DP, Pow TK, Ver Lee P, Rinaldi MJ, Massaro JM. Twelve or 30 months of dual antiplatelet therapy after drug-eluting stents. *New Engl J Med*. 2014;371:2155-66. PMID: 25399658
- Mavilia MG, Sing RF. Postpartum internal hernia. *J Am Osteopath Assoc*. 2014;114:322. PMID: 24677476
- McCahill P, Noste E, Rossman A, Callaway DW. Integration of energy analytics and smart energy microgrid into mobile medicine operations for the 2012 democratic national convention. *Prehosp Disaster Med*. 2014;29:600-7. PMID: 25387543
- McCoy N, Weaver DJ, Jr. Hemolytic uremic syndrome with simultaneous Shiga toxin producing *Escherichia coli* and complement abnormalities. *BMC Pediatr*. 2014;14:278. PMID: 25373393
- McDermott JE, Symanowski JT, Livasy CA, Greger G, Longshore JW. A retrospective analysis of the clinical performance of human papillomavirus testing using SurePath sample collection. *J Am Soc Cytopathol*. 2014;3:165-9.
- McDonald ME, Ramirez PT, Munsell MF, Greer M, Burke WM, Naumann WT, Frumovitz M. Physician pain and discomfort during minimally invasive gynecologic cancer surgery. *Gynecol Oncol*. 2014;134:243-7. PMID: 24887354
- Meininger V, Pradat PF, Corse A, Al-Sarraj S, Rix Brooks B, Caress JB, Cudkowicz M, Kolb SJ, Lange D, Leigh PN, Meyer T, Milleri S, Morrison KE, Orrell RW, Peters G, Rothstein JD, Shefner J, Lavrov A, Williams N, Overend P, Price J, Bates S, Bullman J, Krull D, Berges A, Abila B, Meno-Tetang G, Wurthner J. Safety, pharmacokinetic, and functional effects of the nogo-a monoclonal antibody in amyotrophic lateral sclerosis: a randomized, first-in-human clinical trial. *PLoS One*. 2014;9:e97803. PMID: 24841795
- Merriam KS, Hurst BS. Adenomyosis: diagnosis, treatment, and impact on fertility: erratum. *Postgrad Obstet Gynecol*. 2014;34:1-6.
- Miller RG, Brooks BR, Swain-Eng RJ, Basner RC, Carter GT, Casey P, Cohen AB, Dubinsky R, Forshew D, Jackson CE, Kasarskis E, Procaccini NJ, Sanjak M, Tolin FP. Quality improvement in neurology: amyotrophic lateral sclerosis quality measures. Report of the Quality Measurement and Reporting Subcommittee of the American Academy of Neurology. *Amyotroph Lateral Scler Frontotemporal Degener*. 2014;15:165-8. PMID: 24707820
- Min HK, Sookoian S, Pirola CJ, Cheng J, Mirshahi F, Sanyal AJ. Metabolic profiling reveals that PNPLA3 induces widespread effects on metabolism beyond triacylglycerol remodeling in Huh-7 hepatoma cells. *Am J Physiol Gastrointest Liver Physiol*. 2014;307:G66-76. PMID: 24763554
- Mitumoto H, Brooks BR, Silani V. Clinical trials in amyotrophic lateral sclerosis: why so many negative trials and how can trials be improved? *Lancet Neurol*. 2014;13:1127-38. PMID: 25316019

- Modisett KL, Koyfman A, Runyon MS.** The diagnosis of and emergent care for the patient with subarachnoid haemorrhage in resource-limited settings. *Afr J Emerg Med.* 2014;4:140-9.
- Moerdyk-Schauwecker M, Hwang SI, Grdzlishvili VZ.** Cellular proteins associated with the interior and exterior of vesicular stomatitis virus virions. *PLoS One.* 2014;9:e104688. PMID: 25105980
- Mohanan S, Tapp H, McWilliams A, Dulin M.** Obesity and asthma: pathophysiology and implications for diagnosis and management in primary care. *Exp Biol Med (Maywood).* 2014;239:1531-40. PMID: 24719380
- Morris RT, Joyrich RN, Naumann RW, Shah NP, Maurer AH, Strauss HW, Uszler JM, Symanowski JT, Ellis PR, Harb WA.** Phase II study of treatment of advanced ovarian cancer with folate-receptor-targeted therapeutic (vintafolide) and companion SPECT-based imaging agent (99mTc-etarfolatide). *Ann Oncol.* 2014;25:852-8. PMID: 24667717
- Mukherjee S, Reddy CA, Ciezki JP, Abdel-Wahab M, Tiu RV, Copelan E, Advani AA, Saunthararajah Y, Paulic K, Hobson S, Maciejewski JP, Bolwell BJ, Kalaycio M, Dreicer R, Klein EA, Sekeres MA.** Risk for developing myelodysplastic syndromes in prostate cancer patients definitively treated with radiation. *J Natl Cancer Inst.* 2014;106:djt462. PMID: 24577815
- Myers EM, Geller EJ, Connolly A, Bowling JM, Matthews CA.** Robotic sacrocolpopexy performance and cumulative summation analysis. *Female Pelvic Med Reconstr Surg.* 2014;20:83-6. PMID: 24566210
- Myers EM, Robinson BL, Geller EJ, Wells E, Matthews CA, Fenderson JL, Crane AK, Jannelli M, Connolly A.** Randomized trial of a web-based tool for prolapse: impact on patient understanding and provider counseling. *Int Urogynecol J.* 2014;25:1127-32. PMID: 24652032
- Nair RG, Salajegheh A, Itthagarun A, Pakneshan S, Brennan MT, Samaranayake LP.** Orofacial viral infections--an update for clinicians. *Dent Update.* 2014;41:518-20, 22-4. PMID: 25195484
- Napenas JJ, Rouleau TS.** Oral complications of Sjögren's syndrome. *Oral Maxillofac Surg Clin North Am.* 2014;26:55-62. PMID: 24287193
- Napierala MA, Rivera JC, Burns TC, Murray CK, Wenke JC, Hsu JR.** Infection reduces return-to-duty rates for soldiers with Type III open tibia fractures. *J Trauma Acute Care Surg.* 2014;77:S194-7. PMID: 25159355
- Nazinitsky A, Covington M, Littmann L.** Sinus arrest and asystole caused by a peripherally inserted central catheter. *Ann Noninvasive Electrocardiol.* 2014;19:391-4. PMID: 24286255
- Neavyn M, Murphy C.** Coming to a consensus on informed consent for case reports. *J Med Toxicol.* 2014;10:337-9. PMID: 25135309
- Neuman MG, French SW, French BA, Seitz HK, Cohen LB, Mueller S, Osna NA, Kharbanda KK, Seth D, Bautista A, Thompson KJ, McKillop IH, Kirpich IA, McClain CJ, Bataller R, Nanau RM, Voiculescu M, Opris M, Shen H, Tillman B, Li J, Liu H, Thomes PG, Ganesan M, Malnick S.** Alcoholic and non-alcoholic steatohepatitis. *Exp Mol Pathol.* 2014;97:492-510. PMID: 25217800
- Nguyen VQ, Bock WC, Groves CC, Whitney M, Bennett ME, Lechman TE, Strother R, Grill JH, Stager KW, Chae J.** Fully implantable peripheral nerve stimulation for the treatment of hemiplegic shoulder pain: a case report. *Am J Phys Med Rehabil.* 2014;94:146-53. PMID: 25251248
- Niemeier JP, Perrin PB, Holcomb MG, Rolston CD, Artman LK, Lu J, Nersessova KS.** Gender differences in awareness and outcomes during acute traumatic brain injury recovery. *J Womens Health (Larchmt).* 2014;23:573-80. PMID: 24932911
- Niemeyer DJ, Simo KA, Iannitti DA, McKillop IH.** Ablation therapy for hepatocellular carcinoma: past, present and future perspectives. *Hepatic Oncology.* 2014;1:67-79.
- Odulana A, Kim MM, Green M, Taylor Y, Howard DL, Godley P, Corbie-Smith G.** Participating in research: attitudes within the African American church. *J Relig Health.* 2014;53:373-81. PMID: 22886179

- Odulana AA, Kim MM, Isler MR, Green MA, Taylor YJ, Howard DL, Godley PA, Corbie-Smith G.** Examining characteristics of congregation members willing to attend health promotion in African American churches. *Health Promot Pract.* 2014;15:125-33. PMID: 23493800
- Ottens AK, Stafflinger JE, Griffin HE, Kunz RD, Cifu DX, Niemeier JP.** Post-acute brain injury urinary signature: a new resource for molecular diagnostics. *J Neurotrauma.* 2014;31:782-8. PMID: 24372380
- Palumbo A, Brinchen S, Kumar SK, Lupparelli G, Usmani S, Waage A, Larocca A, van der Holt B, Musto P, Offidani M, Petrucci MT, Evangelista A, Zweegman S, Nooka AK, Spencer A, Dimopoulos MA, Hajek R, Cavo M, Richardson P, Lonial S, Ciccone G, Boccadoro M, Anderson K, Barlogie B, Sonneveld P, McCarthy PL.** Second primary malignancies with lenalidomide therapy for newly diagnosed myeloma: a meta-analysis of individual patient data. *Lancet Oncol.* 2014;15:333-42. PMID: 24525202
- Papanikolaou X, Johnson S, Garg T, Tian E, Tytarenko R, Zhang Q, Stein C, Barlogie B, Epstein J, Heuck C.** Artesunate overcomes drug resistance in multiple myeloma by inducing mitochondrial stress and non-caspase apoptosis. *Oncotarget.* 2014;5:4118-28. PMID: 24948357
- Patel JN.** Application of genotype-guided cancer therapy in solid tumors. *Pharmacogenomics.* 2014;15:79-93. PMID: 24329193
- Patel JN, O'Neil BH, Deal AM, Ibrahim JG, Sherrill GB, Olajide OA, Atluri PM, Inzerillo JJ, Chay CH, McLeod HL, Walko CM.** A community-based multicenter trial of pharmacokinetically guided 5-fluorouracil dosing for personalized colorectal cancer therapy. *Oncologist.* 2014;19:959-65. PMID: 25117066
- Patel KR, Prabhu RS, Kandula S, Oliver DE, Kim S, Hadjipanayis C, Olson JJ, Oyesiku N, Curran WJ, Khan MK, Shu HK, Crocker I.** Intracranial control and radiographic changes with adjuvant radiation therapy for resected brain metastases: whole brain radiotherapy versus stereotactic radiosurgery alone. *J Neurooncol.* 2014;120:657-63. PMID: 25189789
- Paulson JF, Mehta SH, Sokol RJ, Chauhan SP.** Large for gestational age and long-term cognitive function. *Am J Obstet Gynecol.* 2014;210:343 e1-4. PMID: 24211483
- Pearce D, Ani C, Espinosa-Silva Y, Clark R, Fatima K, Rahman M, Diebolt E, Ovbiagele B.** Comparison of in-hospital mortality from acute myocardial infarction in HIV sero-positive versus sero-negative individuals. *Am J Cardiol.* 2014;110:1078-84. PMID: 22762716
- Pearson DA, Shaji S, Merrill M, Hauck M, Baxley J.** Post-cardiac arrest therapeutic hypothermia. *EM Resident.* 2014;41:24-5.
- Pershad A, Fraij G, Massaro JM, David SW, Kleiman NS, Denktas AE, Wilson BH, Dixon SR, Ohman EM, Douglas PS, Moses JW, O'Neill WW.** Comparison of the use of hemodynamic support in patients  $\geq 80$  years versus patients  $< 80$  years during high-risk percutaneous coronary interventions (from the Multicenter PROTECT II Randomized Study). *Am J Cardiol.* 2014;114:657-64. PMID: 25037676
- Phelps KD, Patt JC.** Diagnosis and management of patients with carcinoma metastatic to the spine. *Current Orthopaedic Practice.* 2014;25:525-33.
- Powell BD.** Reply: Avoiding unnecessary aggressive ICD programming after MADIT-RIT and ADVANCE III trials. *J Am Coll Cardiol.* 2014;63:190. PMID: 24140670
- Powell RD, Swet JH, Kennedy KL, Huynh TT, McKillop IH, Evans SL.** Resveratrol attenuates hypoxic injury in a primary hepatocyte model of hemorrhagic shock and resuscitation. *J Trauma Acute Care Surg.* 2014;76:409-17. PMID: 24458046
- Prabhu RS, Hanasoge S, Magliocca KR, Moeller BJ, Milas ZL, Hall WA, El-Deiry M, Wadsworth JT, Higgins KA, Beitler JJ.** Extent of pathologic extracapsular extension and outcomes in patients with nonoropharyngeal head and neck cancer treated with initial surgical resection. *Cancer.* 2014;120:1499-506. PMID: 24510454

- Prabhu RS, Magliocca KR, Hanasoge S, Aiken AH, Hudgins PA, Hall WA, Chen SA, Eaton BR, Higgins KA, Saba NF, Beitler JJ. Accuracy of computed tomography for predicting pathologic nodal extra capsular extension in patients with head-and-neck cancer undergoing initial surgical resection. *Int J Radiat Oncol Biol Phys*. 2014;88:122-9. PMID: 24331658
- Prabhu RS, Won M, Shaw EG, Hu C, Brachman DG, Buckner JC, Stelzer KJ, Barger GR, Brown PD, Gilbert MR, Mehta MP. Effect of the addition of chemotherapy to radiotherapy on cognitive function in patients with low-grade glioma: secondary analysis of RTOG 98-02. *J Clin Oncol*. 2014;32:535-41. PMID: 24419119
- Press RH, Prabhu RS, Appin CL, Brat DJ, Shu HK, Hadjipanayis C, Olson JJ, Oyesiku NM, Curran WJ, Crocker I. Outcomes and patterns of failure for grade 2 meningioma treated with reduced-margin intensity modulated radiation therapy. *Int J Radiat Oncol Biol Phys*. 2014;88:1004-10. PMID: 24661652
- Price DE, McWilliams A, Asif IM, Martin A, Elliott SD, Dulin M, Drezner JA. Electrocardiography-inclusive screening strategies for detection of cardiovascular abnormalities in high school athletes. *Heart Rhythm*. 2014;11:442-9. PMID: 24315964
- Puddy AC, Sunkin JA, Aden JK, Walick KS, Hsu JR. Cast saw burns: evaluation of simple techniques for reducing the risk of thermal injury. *J Pediatr Orthop*. 2014;34:e63-6. PMID: 25075891
- Qiao C, Wang CH, Zhao C, Lu P, Awano H, Xiao B, Li J, Yuan Z, Dai Y, Martin CB, Lu Q, Xiao X. Muscle and heart function restoration in a limb girdle muscular dystrophy 2I (LGMD2I) mouse model by systemic FKRP gene delivery. *Mol Ther*. 2014;22:1890-9. PMID: 25048216
- Raghavan D. Testis cancer: the forgotten poster child. *Clin Cancer Res*. 2014;20:3630-1. PMID: 24812412
- Raghavan D, Bawtinhimer A, Mahoney J, Eckrich S, Riggs S. Adjuvant chemotherapy for bladder cancer-why does level 1 evidence not support it? *Ann Oncol*. 2014;25:1930-4. PMID: 24569916
- Raj VS, Balouch J, Norton JH. Cancer rehabilitation education during physical medicine and rehabilitation residency: preliminary data regarding the quality and quantity of experiences. *Am J Phys Med Rehabil*. 2014;93:445-52. PMID: 24508932
- Rajkumar SV, Dimopoulos MA, Palumbo A, Blade J, Merlini G, Mateos MV, Kumar S, Hillengass J, Kastritis E, Richardson P, Landgren O, Paiva B, Dispenzieri A, Weiss B, LeLeu X, Zweegman S, Lonial S, Rosinol L, Zamagni E, Jagannath S, Sezer O, Kristinsson SY, Caers J, Usmani SZ, Lahuerta JJ, Johnsen HE, Beksac M, Cavo M, Goldschmidt H, Terpos E, Kyle RA, Anderson KC, Durie BG, Miguel JF. International Myeloma Working Group updated criteria for the diagnosis of multiple myeloma. *Lancet Oncol*. 2014;15:e538-e48. PMID: 25439696
- Riggs SB, Burgess EF, Gaston KE, Merwarth CA, Raghavan D. Postchemotherapy surgery for germ cell tumors--what have we learned in 35 years? *Oncologist*. 2014;19:498-506. PMID: 24718515
- Robertson J, McCahill P, Riddle A, Callaway D. Another civilian life saved by law enforcement-applied tourniquets. *J Spec Oper Med*. 2014;14:7-11. PMID: 25344705
- Robicsek F. Founding surgeon reflects on 25 years of UNICAR, the Guatemalan Heart Institute. *Bull Am Coll Surg*. 2014;99:38-41. PMID: 25272422
- Robicsek F. Pericardial coverage of the bronchial stump. *Ann Thorac Surg*. 2014;97:1853-4. PMID: 24792291
- Ross SW, Oommen B, Heniford BT, Augenstein VA. Components separation in complex ventral hernia repair: surgical technique and post-operative outcomes. *Surg Technol Int*. 2014;24:167-77. PMID: 24700223
- Ross SW, Oommen B, Kim M, Walters AL, Green JM, Heniford BT, Augenstein VA. A little slower, but just as good: postgraduate year resident versus attending outcomes in laparoscopic ventral hernia repair. *Surg Endosc*. 2014;28:3092-100. PMID: 24902819



- Rossi M, Tuck J, Kim OJ, Panova I, Symanowski JT, Mahalingam M, Riker AI, Alani RM, Ryu B. Neuropilin-2 gene expression correlates with malignant progression in cutaneous melanoma. *British Journal of Dermatology*. 2014;171:403-8.
- Roy LD, Sahraei M, Schettini JL, Gruber HE, Besmer DM, Mukherjee P. Systemic neutralization of IL-17A significantly reduces breast cancer associated metastasis in arthritic mice by reducing CXCL12/SDF-1 expression in the metastatic niches. *BMC Cancer*. 2014;14:225. PMID: 24674692
- Russell Esposito E, Blanck RV, Harper NG, Hsu JR, Wilken JM. How does ankle-foot orthosis stiffness affect gait in patients with lower limb salvage? *Clin Orthop Relat Res*. 2014;472:3026-35. PMID: 24817379
- Russo MW, Hoofnagle JH, Gu J, Fontana RJ, Barnhart H, Kleiner DE, Chalasani N, Bonkovsky HL. Spectrum of statin hepatotoxicity: experience of the drug-induced liver injury network. *Hepatology*. 2014;60:679-86. PMID: 24700436
- Sachdev G, Gesin G, Christmas AB, Sing RF. Failure of lorazepam to treat alprazolam withdrawal in a critically ill patient. *World J Crit Care Med*. 2014;3:42-4. PMID: 24834401
- Sanjak M, Hirsch MA, Bravver EK, Bockenek WL, Norton HJ, Brooks BR. Vestibular deficits leading to disequilibrium and falls in ambulatory amyotrophic lateral sclerosis. *Arch Phys Med Rehabil*. 2014;95:1933-9. PMID: 24946083
- Sankar V, Noll JL, Brennan MT. Diagnosis of Sjögren's syndrome: American-European and the American College of Rheumatology classification criteria. *Oral Maxillofac Surg Clin North Am*. 2014;26:13-22. PMID: 24287190
- Schenfeld EM, Studnek J, Heffner AC, Nussbaum M, Kraft K, Pearson DA. Effect of prehospital initiation of therapeutic hypothermia in adults with cardiac arrest on time-to-target temperature. *CJEM*. 2014;16:26-33. PMID: 25155649
- Schuch JC, de Hernandez BU, Williams L, Smith HA, Sorensen J, Furuseth OJ, Dulin MF. Por Nuestros Ojos: understanding social determinants of health through the eyes of youth. *Prog Community Health Partnersh*. 2014;8:197-205. PMID: 25152101



- Seshadri RM, Besur S, Niemeyer DJ, Templin M, McKillop IH, Swan RZ, Martinie JB, Russo MW, Iannitti DA. Survival analysis of patients with stage I and II hepatocellular carcinoma after a liver transplantation or liver resection. *HPB (Oxford)*. 2014;16:1102-9. PMID: 24964271
- Sheean AJ, Krueger CA, Hsu JR. Return to duty and disability after combat-related hindfoot injury. *J Orthop Trauma*. 2014;28:e258-62. PMID: 24694555
- Sheean AJ, Krueger CA, Napierala MA, Stinner DJ, Hsu JR. Evaluation of the mangled extremity severity score in combat-related type III open tibia fracture. *J Orthop Trauma*. 2014;28:523-6. PMID: 24378400
- Siewe D, Nichols KB, Furney SL, Littmann L. King of hearts for ace of spades: apical hypertrophic cardiomyopathy. *Am J Med*. 2014;127:31-3. PMID: 24239440
- Simo KA, McKillop IH, McMillan MT, Ahrens WA, Walters AL, Thompson KJ, Kuwada TS, Martinie JB, Iannitti DA, Gersin KS, Sindram D. Does a calculated "NAFLD fibrosis score" reliably negate the need for liver biopsy in patients undergoing bariatric surgery? *Obes Surg*. 2014;24:15-21. PMID: 23934335
- Simo KA, Niemeyer DJ, Hanna EM, Swet JH, Thompson KJ, Sindram D, Iannitti DA, Eheim AL, Sokolov E, Zuckerman V, McKillop IH. Altered lysophosphatidic acid (LPA) receptor expression during hepatic regeneration in a mouse model of partial hepatectomy. *HPB (Oxford)*. 2014;16:534-42. PMID: 24750398
- Sirleaf M, Jefferson B, Christmas AB, Sing RF, Thomason MH, Huynh TT. Comparison of procedural complications between resident physicians and advanced clinical providers. *J Trauma Acute Care Surg*. 2014;77:143-7. PMID: 24977769
- Stavropoulos SW, Sing RF, Elmasri F, Silver MJ, Powell A, Lynch FC, Aal AK, Lansky AJ, Settlege RA, Muhs BE. The DENALI Trial: an interim analysis of a prospective, multicenter study of the Denali retrievable inferior vena cava filter. *J Vasc Interv Radiol*. 2014;25:1497-505, 505 e1. PMID: 25066514
- Stefanidis D. Comment on: Frequency of laboratory testing among gastric bypass patients. *Surgery for Obesity and Related Diseases*. 2014;10:346-7.
- Stefanidis D, Fanelli RD, Price R, Richardson W. SAGES guidelines for the introduction of new technology and techniques. *Surg Endosc*. 2014;28:2257-71. PMID: 24939155
- Stefanidis D, Grewal H, Paige JT, Korndorffer JR, Scott DJ, Nepomnayshy D, Edelman DA, Sievers C. Establishing technical performance norms for general surgery residents. *Surg Endosc*. 2014;28:3179-85. PMID: 24939154
- Stefanidis D, Montero P, Urbach DR, Qureshi A, Perry K, Bachman SL, Madan A, Petersen R, Pryor AD. SAGES research agenda in gastrointestinal and endoscopic surgery: updated results of a Delphi study. *Surg Endosc*. 2014;28:2763-71. PMID: 24789129
- Steuerwald NM, Foureau DM, Norton JH, Zhou J, Chalasani N, Fontana RJ, Hayashi P, Lee WM, Reddy R, Stolz A, Talwalkar J, Davern T, Saha D, Barnhart H, Serrano J, Bonkovsky HL. Serum immune analyte expression profile in drug-induced liver injury and prognostic significance. *PLoS One*. 2014;8.
- Sun GE, Wells BJ, Yip K, Zimmerman R, Raghavan D, Kattan MW, Kashyap SR. Gender-specific effects of oral hypoglycaemic agents on cancer risk in type 2 diabetes mellitus. *Diabetes Obes Metab*. 2014;16:276-83. PMID: 24199848
- Sun Y, Mauerhan DR, Franklin AM, Zinchenko N, Norton HJ, Hanley EN, Jr., Gruber HE. Fibroblast-like synoviocytes induce calcium mineral formation and deposition. *Arthritis*. 2014;2014:812678. PMID: 24963403
- Swan RZ, Niemeyer DJ, Seshadri RM, Thompson KJ, Walters A, Martinie JB, Sindram D, Iannitti DA. The impact of regionalization of pancreaticoduodenectomy for pancreatic Cancer in North Carolina since 2004. *Am Surg*. 2014;80:561-6. PMID: 24887793

- Swet JH, Pacheco HJ, Iannitti DA, El-Ghanam A, McKillop IH. A silica-calcium-phosphate nanocomposite drug delivery system for the treatment of hepatocellular carcinoma: In vivo study. *J Biomed Mater Res B Appl Biomater*. 2014;102:190-202. PMID: 23913418
- Symanowski JT, Kim ES. Gene expression and prognosis in bladder cancer--real progress? Editorial on 'S100A9 and EGFR gene signatures predict disease progression in muscle invasive bladder cancer patients after chemotherapy'. *Ann Oncol*. 2014;25:919-20. PMID: 24608197
- Tapp H, Kuhn L, Alkhazraji T, Steuerwald M, Ludden T, Wilson S, Mowrer L, Mohanan S, Dulin MF. Adapting community based participatory research (CBPR) methods to the implementation of an asthma shared decision making intervention in ambulatory practices. *J Asthma*. 2014;51:380-90. PMID: 24350877
- Tapp H, McWilliams A, Dulin M. Patient engagement and informed decision making regarding medical imaging. *N C Med J*. 2014;75:114-6. PMID: 24663132
- Tapp H, McWilliams A, Ludden T, Kuhn L, Taylor Y, Alkhazraji T, Halladay J, Derkowski D, Mohanan S, Dulin M. Comparing traditional and participatory dissemination of a shared decision making intervention (ADAPT-NC): a cluster randomized trial. *Implement Sci*. 2014;9:158. PMID: 25359128
- Tavadze M, Rybicki L, Mossad S, Avery R, Yurch M, Pohlman B, Duong H, Dean R, Hill B, Andresen S, Hanna R, Majhail N, Copelan E, Bolwell B, Kalaycio M, Sobecks R. Risk factors for vancomycin-resistant enterococcus bacteremia and its influence on survival after allogeneic hematopoietic cell transplantation. *Bone Marrow Transplant*. 2014;49:1310-6. PMID: 25111516
- Tavares AJ, Noor MO, Uddayasankar U, Krull UJ, Vannoy CH. Solid-phase supports for the in situ assembly of quantum dot-FRET hybridization assays in channel microfluidics. *Methods Mol Biol*. 2014;1199:241-55. PMID: 25103813
- Tayo BO, Akingbola TS, Salako BL, McKenzie CA, Reid M, Layden J, Osunkwo I, Plange-Rhule J, Luke A, Durazo-Arvizu R, Cooper RS. Vitamin D levels are low in adult patients with sickle cell disease in Jamaica and West Africa. *BMC Hematol*. 2014;14:12. PMID: 25161768
- Tcheremissine OV, Rossman WE, Castro MA, Gardner DR. Conducting clinical research in community mental health settings: opportunities and challenges. *World J Psychiatry*. 2014;4:49-55. PMID: 25250221
- Temming L, Franco A, Istwan N, Rhea D, Desch C, Stanziano G, Joy S. Adverse pregnancy outcomes in women with nausea and vomiting of pregnancy. *J Matern Fetal Neonatal Med*. 2014;27:84-8. PMID: 23682702
- Tian E, Sawyer JR, Heuck CJ, Zhang Q, van Rhee F, Barlogie B, Epstein J. In multiple myeloma, 14q32 translocations are nonrandom chromosomal fusions driving high expression levels of the respective partner genes. *Genes Chromosomes Cancer*. 2014;53:549-57. PMID: 24638926
- Tinelli A, Mynbaev OA, Mettler L, Hurst BS, Pellegrino M, Nicolardi G, Kosmas I, Malvasi A. A combined ultrasound and histologic approach for analysis of uterine fibroid pseudocapsule thickness. *Reprod Sci*. 2014;21:1177-86. PMID: 24879045
- Traina F, Visconte V, Elson P, Tabarroki A, Jankowska AM, Hasrouni E, Sugimoto Y, Szpurka H, Makishima H, O'Keefe CL, Sekeres MA, Advani AS, Kalaycio M, Copelan EA, Saunthararajah Y, Olalla Saad ST, Maciejewski JP, Tiu RV. Impact of molecular mutations on treatment response to DNMT inhibitors in myelodysplasia and related neoplasms. *Leukemia*. 2014;28:78-87. PMID: 24045501
- Tsirline VB, Keilani ZM, El Djouzi S, Phillips RC, Kuwada TS, Gersin K, Simms C, Stefanidis D. How frequently and when do patients undergo cholecystectomy after bariatric surgery? *Surg Obes Relat Dis*. 2014;10:313-21. PMID: 24462305
- Tucker SL, Gharpure K, Herbrich SM, Unruh AK, Nick AM, Crane EK, Coleman RL, Guenthoer J, Dalton HJ, Wu SY, Rupaimoole R, Lopez-Berestein G, Ozpolat B, Ivan C, Hu W, Baggerly KA, Sood AK. Molecular biomarkers of residual disease after surgical debulking of high-grade serous ovarian cancer. *Clin Cancer Res*. 2014;20:3280-8. PMID: 24756370

- Usmani SZ, Zhang Q, Stratton K, Qu P, Yaccoby S, Hansen E, Steward D, Panozzo S, Petty N, Hoering A, Waheed S, Van Rhee F, Crowley J, Barlogie B. Phase II study of pomalidomide in high-risk relapsed and refractory multiple myeloma. *Leukemia*. 2014;28:2413-5. PMID: 25151956
- van Wegen EEH, Hirsch MA, Huiskamp M, Kwakkel G. Harnessing cueing training for neuroplasticity in Parkinson disease. *Top Geriatr Rehabil*. 2014;30:46-57
- Vannoy CH, Xu L, Keramaris E, Lu P, Xiao X, Lu QL. Adeno-associated virus-mediated overexpression of LARGE rescues alpha-dystroglycan function in dystrophic mice with mutations in the fukutin-related protein. *Hum Gene Ther Methods*. 2014;25:187-96. PMID: 24635668
- Wang M, Wu B, Tucker JD, Lu P, Cloer C, Lu QL. Evaluation of Tris[2-(acryloyloxy)ethyl]isocyanurate cross-linked polyethylenimine as antisense morpholino oligomer delivery vehicle in cell culture and dystrophic mdx mice. *Hum Gene Ther*. 2014;25:419-27. PMID: 24405395
- Wang M, Wu B, Tucker JD, Lu P, Shah SN, Wade S, Lu Q. Synthesis and evaluation of tween 85-LPEI copolymers for gene transfection in vitro and in vivo. *J Nanomed Nanotechnol*. 2014;5:228.
- Weaver NL, Kortlandt V, Williams J, Jupka K, Buskirk TD. Assessing community-based injury prevention services in U.S. Children's Hospitals. *AIMS Public Health*. 2014;1:199-210.
- Weekes AJ, Hwang J, Ghali S. Focused cardiac ultrasonography in the emergent patient. *Ultrasound Clin*. 2014;9:143-71.
- Weekes AJ, Johnson DA, Keller SM, Efuno B, Carey C, Rozario NL, Norton HJ. Central vascular catheter placement evaluation using saline flush and bedside echocardiography. *Acad Emerg Med*. 2014;21:65-72. PMID: 24552526
- Weinberg BA, Wang H, Yang X, Wu CS, Pishvaian MJ, He AR, Marshall JL, Hwang JJ. Maintenance therapy with capecitabine in patients with resected pancreatic adenocarcinoma after adjuvant therapy: a retrospective cohort study. *Gastrointest Cancer Res*. 2014;7:91-7. PMID: 25276262
- Williams KB, Belyansky I, Dacey KT, Yurko Y, Augenstein VA, Lincourt AE, Horton J, Kercher KW, Heniford BT. Impact of the establishment of a specialty hernia referral center. *Surg Innov*. 2014;21:572-9. PMID: 24733063
- Williams KB, Christmas AB, Heniford BT, Sing RF, Messick J. Arterial vs venous blood gas differences during hemorrhagic shock. *World J Crit Care Med*. 2014;3:55-60. PMID: 24892020
- Wills AM, Hubbard J, Macklin EA, Glass J, Tandan R, Simpson EP, Brooks B, Gelinas D, Mitsumoto H, Mozaffar T, Hanes GP, Ladha SS, Heiman-Patterson T, Katz J, Lou JS, Mahoney K, Grasso D, Lawson R, Yu H, Cudkowicz M. Hypercaloric enteral nutrition in patients with amyotrophic lateral sclerosis: a randomised, double-blind, placebo-controlled phase 2 trial. *Lancet*. 2014;383:2065-72. PMID: 24582471
- Wills B, Reynolds P, Chu E, Murphy C, Cumpston K, Stromberg P, Rose R. Clinical outcomes in newer anticonvulsant overdose: a poison center observational study. *J Med Toxicol*. 2014;10:254-60. PMID: 24515527
- Wilson BH, Humphrey AD, Garvey JL. Reply: Is D2B the only metric to determine outcome with STEMI? *JACC Cardiovasc Interv*. 2014;7:340. PMID: 24650411
- Witt CM, Fenstad ER, Cha YM, Kane GC, Kushwaha SS, Hodge DO, Asirvatham SJ, Oh JK, Packer DL, Powell BD. Increase in pulmonary arterial pressure after atrial fibrillation ablation: incidence and associated findings. *J Interv Card Electrophysiol*. 2014;40:47-52. PMID: 24532114
- Wormer BA, Dacey KT, Williams KB, Bradley JF, 3rd, Walters AL, Augenstein VA, Stefanidis D, Heniford BT. The first nationwide evaluation of robotic general surgery: a regionalized, small but safe start. *Surg Endosc*. 2014;28:767-76. PMID: 24196549



- Wormer BA, Swan RZ, Williams KB, Bradley JF, 3rd, Walters AL, Augenstein VA, Martinie JB, Heniford BT.** Outcomes of pancreatic debridement in acute pancreatitis: analysis of the nationwide inpatient sample from 1998 to 2010. *Am J Surg.* 2014;208:350-62. PMID: 24933665
- Yazici C, Niemeyer DJ, Iannitti DA, Russo MW.** Hepatocellular carcinoma and cholangiocarcinoma: an update. *Expert Rev Gastroenterol Hepatol.* 2014;8:63-82. PMID: 24245910
- Zemlyak A, Colavita P, Augenstein V, Walters AL, Lincourt A, Sing RF, Heniford BT.** Nationwide outcomes of nontrauma splenectomy. *Surg Endosc.* 2014;28:1063-7. PMID: 24232049
- Zielinski SM, Bouwmans CA, Heetveld MJ, Bhandari M, Patka P, Van Lieshout EM.** The societal costs of femoral neck fracture patients treated with internal fixation. *Osteoporos Int.* 2014;25:875-85. PMID: 24072404

## Book Chapters

- Agarwal M.** Bronchiolitis. In: Schafermeyer R, Tenebein M, eds. *Strange and Schafermeyer's Pediatric Emergency Medicine.* 4th ed. New York, NY: McGraw Hill Education; 2014:225-8.
- Callaway D, Sanchez LD.** Blast injuries. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaidler JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine.* 6th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014:323-6.
- Callaway DW.** Disaster operations management. In: Kayden S, Anderson PD, Freitas R, Platz E, eds. *Emergency Department Leadership and Management: Best Principles and Practice.* Cambridge, UK: Cambridge University Press; 2014:287-96.
- Christensen RE, Pearson DA.** Fibrocystic breast changes. In: Schaidler JJ, Barkin AZ, Barkin RM, et al., eds. *Rosen & Barkin's 5-Minute Emergency Medicine Consult.* 5th ed. Philadelphia, PA: Wolters Kluwer Health; 2014:416-7.
- Cooley A, DiMaio JM, Arko F, III.** Endovascular treatment of type B aortic dissection. In: Dieter RS, Dieter JRA, Dieter III RA, eds. *Endovascular Interventions.* New York, NY: Springer; 2014:223-42.
- Craig S.** Disorders of sodium and water metabolism. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaidler JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine.* 6th ed. Philadelphia, PA: Wolters Kluwer Health; 2014:1037-43.
- Efune B, Pearson DA.** Foreign body, nasal. In: Schaidler JJ, Barkin AZ, Barkin RM, et al., eds. *Rosen & Barkin's 5-Minute Emergency Medicine Consult.* 5th ed. Philadelphia, PA: Wolters Kluwer Health; 2014:430-1.
- Enright D, Rosamond WD, Goldstein LB.** The 5-minute clinical consult 2014. In: Domino FJ, Baldor RA, Golding J, Grimes JA, eds. *The 5-Minute Clinical Consult 2014.* Philadelphia, PA: Wolters Kluwer Health; 2014:A-34.
- Fox S.** Apparent life threatening events. In: Woolridge D, ed. *EMRA Emergency Medicine's Top Pediatric Clinical Problems: Emergency Medicine Residents' Association;* 2014:11-8.
- Fox SM.** Heat and cold illness. In: Schafermeyer R, Tenebein M, eds. *Strange and Schafermeyer's Pediatric Emergency Medicine.* 4th ed. New York: McGraw Hill Education; 2014:733-45.
- Gruber H, Hanley E, Jr., Shapiro IM, Risbud MV.** The sand rat (*Psammomys obesus obesus*) model of spontaneous, age-related intervertebral disc degeneration. In: *The Intervertebral Disc:* Springer Vienna; 2014:327-39.
- Heffner AC.** Monoarticular arthritis. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaidler JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine.* 6th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014:733-8.

- Hurst BS.** Uterine fibroids. In: Stadtmayer L, Tur-Kaspa I, eds. *Ultrasound Imaging in Reproductive Medicine*. New York: Springer Publishing; 2014:117-31.
- Hwang J, Marshall J.** Esophageal cancer. In: Boyiadzis M, Frame J, Kohler DR, Fojo T, eds. *Hematology - Oncology Therapy*. New York: McGraw-Hill Education; 2014:312-44.
- Johnson JJ, Colucciello SA.** Traumatic eye emergencies. In: Schafermeyer R, Tenebein M, eds. *Strange and Schafermeyer's Pediatric Emergency Medicine*. 4th ed. New York: McGraw Hill Education; 2014:551-6.
- Lee JG, McKinney KQ, Hwang S.** Proteomic differences and linkages between chemoresistance and metastasis of pancreatic cancer using knowledge-based pathway analysis. In: Azmi A, ed. *Molecular Diagnostics and Treatment of Pancreatic Cancer: Systems and Network Biology Approaches*: Elsevier; 2014:221-44.
- Martinie JB, Razzaque S.** Computer-assisted navigation for ultrasound "3-D Ultrasound." In: Hagopian EJ, Machi J, eds. *Abdominal Ultrasound for Surgeons*. New York, NY: Springer; 2014:243-53.
- Murray BL, Sullivan DM.** Soft tissue injury and wound repair. In: Schafermeyer R, Tenebein M, eds. *Strange and Schafermeyer's Pediatric Emergency Medicine*. 4th ed. New York, NY: McGraw Hill Education; 2014:196-208.
- Musey P, Gibbs MA.** Rocky Mountain spotted fever. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaider JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine*. 6th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014:906-8.
- Niemeier JP, Kaholokula JK, Arango-Lasprilla JC, Utsey SO.** A multicultural examination of the effects of acculturation on the mental and physical health of ethnically diverse persons. In: Uomoto J, ed. *Essentials of Multicultural Neurorehabilitation*: Springer Publishing; 2014.
- Niemeyer DJ, Iannitti DA.** Laparoscopic microwave and radiofrequency ablation. In: Palermo M, Gimenez M, Gagner M, eds. *Laparoscopic Gastrointestinal Surgery Novel techniques, extending the limits*. Portugal: Amolca; 2014.
- Niemeyer DJ, Simo KA, Iannitti DA.** Techniques in laparoscopic and intraoperative ultrasound guidance. In: Hagopoian EJ, Machi J, eds. *Abdominal Ultrasound for Surgeons*. New York, NY: Springer; 2014:219-27.
- Oommen B, Kercher KW, Heniford BT, Villineuva I.** Splenectomy. In: *Surgeons ACo*, ed. *Scientific American Surgeon: American College of Surgeons*; 2014:19.
- Pearson DA, Kolshak C.** Otologic trauma, nasal. In: Schaider JJ, Barkin AZ, Barkin RM, et al., eds. *Rosen & Barkin's 5-Minute Emergency Medicine Consult*. 5th ed. Philadelphia, PA: Wolters Kluwer Health; 2014:788-9.
- Reynolds S, York J, Colucciello SA.** Maxillofacial trauma. In: Schafermeyer R, Tenebein M, eds. *Strange and Schafermeyer's Pediatric Emergency Medicine*. 4th ed. New York, NY: McGraw Hill Education; 2014:164-72.
- Sprinkel K, Colucciello SA.** Facial trauma. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaider JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine*. 6th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014.
- Sprinkel K, Colucciello SA.** Maxillofacial injuries. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaider JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine*. 6th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014.
- Stellpflug SJ, Kerns WP, 2nd.** Antidotes in depth: high-dose insulin euglycemia. In: Hoffman R, Howland MA, Lewin N, Nelson L, Goldfrank L, eds. *Goldfrank's Toxicologic Emergencies, Tenth Edition*. New York, NY: McGraw-Hill Education; 2014:A17.

- Stepp KJ, Nair AR.** Single-port laparoscopic hysterectomy. In: Falcone T, ed. *Atlas of Single-Port, Laparoscopy, and Robotic Surgery: A Practical Approach in Gynecology*. New York: Springer Publishing; 2014.
- Stepp KJ, Walters MD.** Anatomy of the lower urinary tract, rectum, and pelvic floor. In: Walters MD, Karram MM, eds. *Urogynecology and Reconstructive Pelvic Surgery*. Philadelphia, PA: Elsevier Saunders; 2014:19-31.
- Tibbles CD, Gibbs MA.** Pelvic fractures. In: Wolfson AB, Cloutier RL, Hendey GW, Ling LJ, Schaidt JJ, Rosen CL, eds. *Harwood-Nuss' Clinical Practice of Emergency Medicine*. 6th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2014:286-94.
- Whitney MP, Hammond F.** Regulatory binder and essential documents. In: Hammond F, Malec J, Buschbacher R, Nick TG, eds. *Handbook for Clinical Research: Design, Statistics, and Implementation*. New York, NY: Demos Medical Publishing; 2014:298-301.
- Whitney MP, Hammond FM.** Adverse effects. In: Hammond FM, Malec J, Nick TG, Buschbacher R, eds. *Handbook for Clinical Research: Design, Statistics, and Implementation*. New York, NY: Demo Medical Publishing; 2014:302-6.
- Whitney MP, Hammond FM.** Protocol deviations and violations. In: Hammond FM, Malec J, Nick TG, Buschbacher R, eds. *Handbook for Clinical Research: Design, Statistics, and Implementation*. New York, NY: Demos Medical Publishing; 2014:307-9.
- Whitney MP, Hammond FM.** Site monitoring and oversight. In: Hammond FM, Malec J, Nick TG, Buschbacher R, eds. *Handbook for Clinical Research: Design, Statistics, and Implementation*. New York, NY: Demos Medical Publishing; 2014:318-22.
- Williams Z, Seita H, Heniford BT.** Laparoscopic ventral hernia repair. In: Iavazzo C, ed. *Laparoscopy: Procedures, Pain Management and Postoperative Complications*. Nova Science Publishers; 2014:107-16.









Carolina's HealthCare System