Abstract submissions:
Limited to a maximum length of 700 words. These 700 words include ALL TEXT in the piece, including titles, affiliations, and captions. If you use images, subtract 100 words from your total word count for each image. Images must also be included as separate graphics files (see below graphics instructions). Do not embed your figures into your Word file.

If the abstract was presented at a meeting, please include the information (e.g., “This abstract was presented as a poster/as a podium presentation at the 19th annual meeting of the International Liver Transplantation Society, Chicago, IL, July 8-11, 2015.”). Please also indicate whether your abstract won any awards at the meeting. This text must fit into the 700-word limit.

Reports from site chiefs, division chiefs, program directors, and laboratory directors:
Limited to 1,400 words minus 100 words per image (if included) for clinical site/hospital/lab reports, and 700 words minus 100 words per image (if included) for clinical subdivision reports.
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MESSAGE FROM THE CHAIR

Over the decades, the University of Pittsburgh/UPMC Department of Anesthesiology and Perioperative Medicine has blossomed into one of the largest and best anesthesiology departments in the nation. When Dr. Safar arrived in Pittsburgh to start the department in 1961, only three physicians and 70+ nurse anesthetists managed all anesthesia services. During FY18, we served 19 clinical sites and were staffed with more than 224 faculty members and over 468 certified registered nurse anesthetists (CRNAs); we managed 315,063 cases throughout the UPMC system, an over 2.8% increase from the FY17 overall UPMC case load.

Our ACGME-accredited anesthesiology residency program is widely considered one of the best in the nation, and we host a combined anesthesiology-pediatrics residency program in collaboration with the UPMC Children’s Hospital of Pittsburgh Department of Pediatrics. We host 10 fellowship training programs: ACGME-accredited fellowships in adult cardiothoracic, pediatric, and obstetric anesthesiology, as well as anesthesiology critical care medicine, pain medicine, and acute pain and regional anesthesiology. Our regional fellowship is one of the largest US programs in the specialty (and just became ACGME-accredited at the beginning of FY18). We also offer fellowships in pediatric cardiothoracic anesthesiology, hepatic transplantation anesthesiology, and neuroanesthesiology, and in FY19, we added a new fellowship program in perioperative medicine. We train about 120 residents and clinical fellows every year. We also host two National Institutes of Health T32 research fellowships to train pain researchers and physician scientists to become the next generation of research leaders in academic anesthesiology. We are one of few anesthesiology departments in the nation to have multiple NIH T32 training grants. Under the expert guidance of Drs. Jonathan Waters and Yan Xu, our clinical and basic research programs continue to be among the finest in the world.

At the beginning of FY19 as this report was being compiled, the department’s name was changed from the Department of Anesthesiology to the Department of Anesthesiology and Perioperative Medicine in the University of Pittsburgh School of Medicine, reflecting the breadth of our institutional interests. Although the change was implemented after the conclusion of FY18, we used the new department name in this publication and renamed the journal Pittsburgh Journal of Anesthesiology & Perioperative Medicine.

We continue to set the standard for academic and clinical greatness by anesthesiology residents, fellows, faculty, CRNAs, and medical students. I would like to commend every member of the department for their outstanding accomplishments over the course of FY18, as well as our colleagues and supporters. Collectively, we have upheld our strong legacy of excellence over the past year and going forward. With our department’s many recent changes and those still underway and planned for the future, we expect to continue to ascend to even greater heights.
MESSAGE FROM THE EDITOR-IN-CHIEF

It is a distinctive pleasure to present the third edition of the Pittsburgh Journal of Anesthesiology & Perioperative Medicine (PJAPM). PJAPM is the official publication of the Department of Anesthesiology & Perioperative Medicine in the University of Pittsburgh School of Medicine and UPMC (University of Pittsburgh Medical Center).

This annual comprehensive review journal showcases the contributions and accomplishments of our department members in the field of anesthesiology and perioperative medicine. You will surely appreciate the passion, dedication, and joy of our faculty, fellows, residents, CRNAs, and staff in serving patients; advancing scientific knowledge in the field; educating the next generation of physician anesthesiologists and nurse anesthetists; supporting the community’s well-being locally, nationally, and internationally; and cherishing our own social lives.

The journal highlights achievements under the department’s three pillars: education, clinical care, and research. The education section introduces our residency, fellowship, and medical student programs. Clinical division reports provide an impressive overview of patient care in our department, which is one of the largest anesthesiology departments in the US. The research section presents our wide variety of accomplishments in basic, translational, and clinical trials research.

I wish to express my utmost gratitude to the individual authors whose hard work, dedication, and timely submissions have expedited the production of this third edition. Production of the PJAPM depends on scholarly grants provided to the department by visiting physicians from Japan, especially from Toyama Prefectural Central Hospital, Toyama, Japan (Kenichi Ogura, MD, PhD, Program Director). Christine Burr (Scientific Writer, Department of Anesthesiology and Perioperative Medicine/Department of Surgery, University of Pittsburgh School of Medicine) should be acknowledged as a major force facilitating publication of the journal with her professional editorial and graphic design work (with valuable guidance and help from the Pitt Office of University Communications).

I sincerely hope you enjoy the third edition of the Pittsburgh Journal of Anesthesiology & Perioperative Medicine!
Aman Mahajan, MD, PhD, MBA
Peter and Eva Safar Professor and Chair

Mark E. Hudson, MD, MBA
Executive Vice Chair

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- David G. Metro, MD, FASA
  Director, Residency Program
- Scott Brancolini, MD, MPH
  Director, Pain Medicine Fellowship
- Patrick M. Callahan, MD
  Director, Pediatric Anesthesiology Fellowship
- Franklyn P. Cladis, MD
  Director, Pediatric Anesthesiology Fellowship
- Patricia Dalby, MD
  Director, Obstetric Anesthesiology Fellowship
- A. Murat Kaynar, MD
  Director, Anesthesiology Critical Care Medicine Fellowship

**Clinical Site/Division Chiefs**
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  Chief, UPMC Palermo (IsMeTT)
- Shawn T. Beaman, MD
  Chief, UPMC Presbyterian/Montefiore
- Peter J. Davis, MD
  Chief, UPMC Children’s Hospital of Pittsburgh
- Gregory J. Godla, MD
  Chief, UPMC South Hills
- Shiv K. Goel, MD
  Interim Chief, UPMC Shadyside
- Calin Gorun-Gorunescu, MD
  Interim Chief, UPMC Mercy
- Stephen Esper, MD, MBA
  Director, Perioperative Services
- Domenico Falcone, MD
  Chief, UPMC Altoona
- Charles Luke, MD, MBA
  Director, Acute & Interventional Perioperative Pain Service/Regional Anesthesiology
- Michael P. Mangione, MD
  Chief, VA Pittsburgh Healthcare System
- David G. Metro, MD, FASA
  Director, Residency Program

**Clinical**
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  Vice Chair for Pain Medicine
- Mark E. Hudson, MD, MBA
  Vice Chair for Clinical Operations

**Education**
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  Vice Chair for Education
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  Director, Pain Medicine Fellowship
- Erin A. Sullivan, MD, FASA
  Director, Cardiothoracic Anesthesiology Fellowship
- Jacques E. Chelly, MD, PhD, MBA
  Director, Regional Anesthesiology Fellowship
- Brian Gierl, MD
  Director, Neuroanesthesiology Fellowship

**CLINICAL**
- Michael P. Mangione, MD
  Director, Medical Student Programs
- Raymond M. Planinsic, MD, FASA
  Director, Hepatic Transplantation Anesthesiology Fellowship
- Erin A. Sullivan, MD, FASA
  Director, Adult Cardiothoracic Anesthesiology Fellowship
- A. Murat Kaynar, MD
  Director, Anesthesiology Critical Care Medicine Fellowship
- Michael L. Kentor, MD
  Chief, UPMC East Chief, UPMC Digestive Health and Endoscopy Center Chief, UPMC Mercy/South Side Surgery Center Chief, UPMC McKeesport Director, UPMC Monroeville Surgery Center

**ORGANIZATIONAL CHART**
chart current at the end of FY18 - June 30, 2018
FACULTY BY SITE/LAB

list current at the end of FY18 - June 30, 2018

UPMC PRESBYTERIAN/MONTEFIORE
Zulfaqar Alam, MD, MBBS – Clinical Assistant Professor
James Baumgardner, MD, PhD - Clinical Assistant Professor
Shawn T. Beaman, MD – Associate Professor; Chief Anesthesiologist
Michael L. Boisen, MD – Clinical Assistant Professor
Charles D. Boucek, MD – Associate Professor
John C. Caldwell, MD – Clinical Associate Professor
Matthew W. Caldwell, MD – Clinical Assistant Professor
Jacques E. Chelly, MD, PhD, MBA - Professor
Derrick Chyu, MD – Clinical Assistant Professor
Sean DeChancie, DO – Clinical Assistant Professor
Tomas Drabek, MD – Associate Professor
Stephen A. Esper, MD, MBA – Assistant Professor
Patrick J. Forte, MD – Associate Professor; Medical Director, Same Day Surgery
Thomas M. Gasior, MD – Clinical Associate Professor
Theresa A. Gelzinis, MD – Associate Professor
Brian T. Gierl, MD – Assistant Professor
John J. Hache, MD – Clinical Assistant Professor
Heather Hayanga, MD, MPH – Clinical Assistant Professor
Ibtesam Hilmi, MB CHB, FRCA – Professor
William Scott Jones, MD – Clinical Assistant Professor
A. Murat Kaynar, MD, MPH – Associate Professor
Robert A. Lawler, MD – Clinical Assistant Professor
Sanford M. Littwin, MD – Visiting Clinical Associate Professor; Clinical Director, PUH Operating Room
Jean-Marc Loubeau, MD – Clinical Assistant Professor
Jose M. Marquez, MD – Clinical Associate Professor
William R. McIvor, MD, FASA – Professor
Fernando E. Melean, MD – Clinical Assistant Professor
Li Meng, MD, MPH – Associate Professor
David G. Metro, MD, FASA – Professor
Lumei Miller, MD – Clinical Assistant Professor
Mario I. Montoya, MD – Assistant Professor
Christopher P. Owsiani, MD – Clinical Assistant Professor
Joanne Owsiani, MD - Clinical Assistant Professor
Beverly Ann Pearce-Smith, MD – Clinical Associate Professor
Dennis P. Phillips, DO – Clinical Assistant Professor
Raymond M. Planinsic, MD, FASA – Professor; Director, Transplantation Anesthesiology
Joseph J. Quinlan, MD – Professor; Director, Operating Room Management for the UPMC System
Hulimangala R. Rakesh, MD-Clinical Assistant Professor
Tetsuro Sakai, MD, PhD, MHA, FASA – Professor
Nicholas J. Schott, MD- Clinical Assistant Professor
Kathirvel Subramaniam, MD, MPH, FASE – Associate Professor
Jill J. Suffield, MD – Clinical Assistant Professor
Erin A. Sullivan, MD, FASA – Associate Professor
John S. Tashman, MD – Clinical Assistant Professor
Jeffrey M. Varga, MD – Clinical Associate Professor
Steven L. Whitehurst, MD – Assistant Professor; Director, Anesthesia and Perioperative Information Technology

UPMC CHILDREN’S HOSPITAL OF PITTSBURGH
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Isabela C. Angelelli, MD- Clinical Assistant Professor
Roberto A. Atiles, MD – Clinical Assistant Professor
Brian Blasie, MD, PhD – Assistant Professor; Director, Sedation and Off-Site Anesthesia Services
Patrick M. Callahan, MD – Clinical Assistant Professor
Antonio Cassara, MD – Clinical Assistant Professor
Thomas M. Chalifoux, MD – Assistant Professor
Franklyn P. Cliadis, MD – Associate Professor
Daniela Damian, MD, PhD – Clinical Assistant Professor
Peter J. Davis, MD – Professor; Chief Anesthesiologist
Clinton L. Fuller, MD – Clinical Assistant Professor
Ayse Fidan Genc, MD – Clinical Assistant Professor
James A. Greenberg, MD – Clinical Associate Professor
Denise M. Hall Burton, MD – Assistant Professor
William Scott Jones, MD – Clinical Assistant Professor
Anne E. Kamarchik, MD- Clinical Assistant Professor
Slava V. Martyn, MD – Clinical Assistant Professor; Director of Anesthesia Services, North Surgery Center
Gregory McHugh, MD – Clinical Assistant Professor
Khoa Nguyen, MD – Assistant Professor
Jerome Parness, MD, PhD – Professor
Aparna S. Phadke, MD – Clinical Assistant Professor
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David B. Rymer, MD – Visiting Clinical Associate Professor
Igor V. Semenov, MD – Clinical Assistant Professor
Plinio Silva, MD, MPH – Clinical Assistant Professor
Elihu Simhi, MD – Clinical Assistant Professor
Erica Sivak, MD – Assistant Professor
Doreen E. Soliman, MD – Associate Professor
Urmila Tirodker, MD - Visiting Clinical Associate Professor
Mihaela Visoiu, MD – Assistant Professor
Kathryn Walker, MD – Clinical Assistant Professor
Charles I. Yang, MD – Assistant Professor

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Thomas M. Chalifoux, MD – Assistant Professor
Ivan V. Colaizzi, MD – Clinical Assistant Professor
Patricia L. Dalby, MD – Associate Professor
Derek J. Davis, MD – Assistant Professor
Joseph DeRenzo, MD – Clinical Associate Professor; Associate Chief Anesthesiologist
Gerhardt Konig, MD – Assistant Professor
Robert G. Krohner, DO – Associate Professor; Residency Site Director
Grace Lim, MD, MS – Assistant Professor; Director, Obstetric Anesthesiology
Gordon L. Mandell, MD – Clinical Associate Professor
Michael T. Maromonte, DO – Clinical Assistant Professor
Susan B. McElroy, DO – Clinical Associate Professor
Rita M. Patel, MD, FASA – Professor
Brenda L. Raphael, MD – Clinical Assistant Professor
Marsha Ritter-Jones, MD, PhD – Assistant Professor
Ryan C. Romeo, MD – Associate Professor
Nicholas J. Schott, MD – Clinical Assistant Professor
David Seng, DO – Clinical Assistant Professor
Marcia Timko-Shannon, MD – Clinical Assistant Professor
Jonathan H. Waters, MD – Professor; Chief Anesthesiologist
Fatima Zahir, MD – Clinical Assistant Professor

Michael D. Ingram, MD – Clinical Assistant Professor
Rama M. Joshi, MD – Clinical Associate Professor
Arie Kandel, MD – Clinical Assistant Professor
Sharad K. Khetarpal, MD – Clinical Associate Professor
Lawrence B. Marr, MD, MBA, FRCP – Clinical Associate Professor
Stephen M. McHugh, MD – Clinical Assistant Professor
Rita B. Merman, MD – Clinical Associate Professor
Carl C. Rest, MD – Clinical Assistant Professor
Daniel P. Sabo, MD – Clinical Associate Professor
Mahesh P. Sardesai, MD - Clinical Assistant Professor
William Simmons, MD – Associate Professor
Jill J. Suffield, MD – Clinical Assistant Professor
Anna A. Uskova, MD – Clinical Associate Professor
Sudhakar R. Yennam, MD – Clinical Assistant Professor

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Amina Mohideen, MD – Clinical Assistant Professor
Milen P. Petkov, MD – Clinical Assistant Professor; Vice Chief Anesthesiologist
Li-Ming Zhang, MD – Associate Professor

UPMC MERCY SOUTHSIDE SURGERY CENTER
Michael L. Kentor, MD – Associate Professor; Chief Anesthesiologist
Douglas S. Bentley, MD – Clinical Assistant Professor
Monica A. Bolland, MD – Clinical Assistant Professor
Kimberly K. Cantees, MD - Clinical Assistant Professor
William B. Ehrman, DO – Clinical Assistant Professor
Tara L. Knizner, MD – Clinical Assistant Professor
Scot K. Muir, DO – Clinical Assistant Professor
Steven L. Orebaugh, MD – Professor; Assistant Chief Anesthesiologist, UPMC Mercy Southside Surgery Center
Revathi R. Toshok, DO – Clinical Assistant Professor

UPMC EAST
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Douglas S. Bentley, MD – Clinical Assistant Professor
Bryce C. Bernard, MD – Clinical Assistant Professor
Monica A. Bolland, MD – Clinical Assistant Professor
Kimberly K. Cantees, MD - Clinical Assistant Professor
William B. Ehrman, DO – Clinical Assistant Professor
Tara L. Knizner, MD – Clinical Assistant Professor
Stuart Charles Law, MD - Clinical Assistant Professor
Scot K. Muir, DO – Clinical Assistant Professor
Louis J. Nitsos, MD – Clinical Assistant Professor
FACULTY BY SITE/LAB

UPMC ST. MARGARET/ UPMC HARMAR SURGERY CENTER
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Richard J. Coyle, MD – Clinical Assistant Professor
Joseph H. Luther, MD – Clinical Assistant Professor
Daniel Pickle, MD – Clinical Assistant Professor
Charles H. Richards, MD – Clinical Assistant Professor
Jay Roskoph, MD – Clinical Assistant Professor; Chief Anesthesiologist
Kelly T. Shannon, MD – Clinical Associate Professor
Paul L. Shay, MD – Clinical Assistant Professor
W. Stephen Stalenski, MD – Clinical Assistant Professor

UPMC SOUTH SURGERY CENTER (BETHEL PARK)
Todd H. Biagini, DO – Clinical Assistant Professor
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Shiv K. Goel, MD – Clinical Assistant Professor
Michael D. Ingram, MD – Clinical Assistant Professor
Sharad K. Khetarpal, MD – Clinical Assistant Professor

UPMC CHRONIC PAIN MEDICINE CENTRE COMMONS
Cheryl D. Bernstein, MD – Associate Professor
Edward K. Heres, MD – Clinical Associate Professor; Medical Director, Chronic Pain Medicine
Ajay D. Wasan, MD, MsC – Professor; Vice Chair for Pain Medicine
Trent Emerick, MD, MBA – Clinical Assistant Professor; Director, Quality and Innovation

UPMC MONTEFIORE
John J. Hache, MD - Clinical Assistant Professor
Trent Emerick, MD, MBA – Clinical Assistant Professor; Director, Quality and Innovation

UPMC ST. MARGARET
Scott A. Brancolini, MD, MPH – Associate Professor

MONROEVILLE
Zong Fu Chen, MD – Clinical Associate Professor; Medical Director, Chronic Pain Medicine, UPMC East

UPMC MERCY
Cheryl D. Bernstein, MD – Associate Professor
Trent Emerick, MD, MBA – Clinical Assistant Professor; Director, Quality and Innovation
Joanne Owsiak, MD – Clinical Assistant Professor
Ajay D. Wasan, MD, MsC – Professor; Vice Chair for Pain Medicine

UPMC PASSAVANT
Edward K. Heres, MD – Clinical Associate Professor; Clinical Director, Chronic Pain Medicine

UPMC HORIZON
Ahdy Nassif, MD – Clinical Assistant Professor

UPMC PALERMO
Antonio Arcadipane, MD – Chief, Anesthesiology and Critical Care Medicine (CCM) Department; Director of Critical Care Unit, ISMETT Operating Room Services
Gaetano Burgio, MD – Director of Operating Room Services, Education Coordinator for Anesthesiology and CCM
Guido Capitanio, MD – Staff Anesthesiologist and CCM Senior Attending
Tiziana Carollo, MD – Staff Anesthesiologist and CCM Senior Attending
Luigi Centineo, MD – Staff Anesthesiologist and CCM Senior Attending
Giuseppe Chiaramonte, MD – Staff Anesthesiologist, CCM Senior Attending, Fiandaca - Simulation Center Director
Laura Cicciarella, MD – Anesthesiologist/Attending Physician
Sara Coppolecchia – Anesthesiologist/Attending Physician
Marco Farbo, MD – Anesthesia CCM Junior attending
Veronica Ferrazza, MD – Anesthesia CCM Junior attending
Giovanni Lino, MD – Staff Anesthesiologist and CCM Junior Attending
Fabio Lullio, MD - Staff Anesthesiologist and CCM Junior Attending
Gennaro Martucci, MD - Staff Anesthesiologist and CCM Senior Attending
Giovanna Occhipinti, MD – Anesthesia CCM Junior attending
Giovanna Panarello, MD – Clinical Director, ICU Staff Anesthesiologist, and CCM Senior Attending – Infectious Disease Attending
Federico Pastore, MD – Staff Anesthesiologist and CCM Junior Attending
Marcello Piazza, MD – Chief of Pediatric Services; Pediatric Senior Attending Anesthesiologist
Maria Scarlata, MD – Anesthesia and CCM Junior Attending

UPMC MERCY
Bryce C. Bernard, MD – Clinical Assistant Professor
Scott D. Brinkmeyer, DO – Clinical Assistant Professor
Brandon Chinn, MD – Clinical Assistant Professor
Eric L. Davidson, MD – Clinical Assistant Professor
Calin Gorun-Gorunescu, MD - Clinical Assistant Professor; Interim Chief Anesthesiologist
Andrew Herlich, DMD, MD, FASA – Professor
Mark E. Hudson, MD, MBA – Professor
Andres J. Jakymec, MD – Clinical Assistant Professor
Vida R. Kasuba, MD - Clinical Assistant Professor
Amy L. Kemp, MD - Clinical Assistant Professor
Robin A. Lawson, MD - Clinical Assistant Professor
Michael D. Minton, MD – Visiting Clinical Associate Professor
Kristin M. Ondecko Ligda, MD, FASA – Assistant Professor
Joel M. Pomerantz, MD – Clinical Assistant Professor; Director, OB Anesthesiology
Susan T. Rooksby, MD – Clinical Assistant Professor
Anjali Rosario, MD – Clinical Assistant Professor
Alison C. Schmeck, MD – Clinical Assistant Professor
David L. Seng, MD – Clinical Assistant Professor
Vladislav I. Shick, MD – Clinical Assistant Professor
Paul Shih, MD – Clinical Assistant Professor
Jafri Syed, MD – Clinical Assistant Professor
Grigore Toma, MD – Clinical Assistant Professor
Keith Vogt, MD, PhD – Assistant Professor
William Wallisch, MD – Clinical Assistant Professor
Anne C. Ward, DO - Clinical Assistant Professor

UPMC PASSAVANT
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David Glover, DO – Clinical Assistant Professor
Wende Goncz, DO - Clinical Assistant Professor
Christopher J. Hodge, MD – Clinical Assistant Professor
Touichi Kawabe, MD – Clinical Assistant Professor
Kevin King, DO - Clinical Assistant Professor
Frank A. Kunkel, MD - Clinical Associate Professor
James V. Kunkel, MD - Clinical Assistant Professor
Stuart Charles Law, MD - Clinical Assistant Professor
Charles Lin, MD – Assistant Professor
Charles B. Luke, MD – Clinical Assistant Professor
Vimala Ramesh, MD –Clinical Assistant Professor
Anthony Silipo, DO – Clinical Assistant Professor
Daniel Sullivan, MD, JD, MBA – Associate Professor; Chief Anesthesiologist; Director, Quality for UPMC Passavant; Patient Safety Officer, Department of Anesthesiology and Perioperative Medicine
Katherine B. Szabo, MD - Clinical Assistant Professor

UPMC BEDFORD MEMORIAL HOSPITAL
Christopher J. Samuel, MD – Clinical Assistant Professor, Chief Anesthesiologist
Joseph F. Talarico, DO – Clinical Associate Professor

UPMC HORIZON/JAMESON
Matthew W. Caldwell, MD – Clinical Assistant Professor

Lakshmi Digumarthi, MD – Clinical Assistant Professor
Mohan Ettyreddy, MD – Clinical Assistant Professor
Sergey Gorgievskiy, MD - Clinical Assistant Professor
Suvir Kovoor, MD – Clinical Assistant Professor
Jhansi R. Lanka, MD – Clinical Assistant Professor
Marivic G. Manrique, MD – Clinical Assistant Professor
Chandresh Shah, MD – Clinical Assistant Professor
Sarah Smolik, MD – Clinical Assistant Professor
Jun Wang, MD – Clinical Assistant Professor
Cynthia Wells, MD - Clinical Assistant Professor; Chief Anesthesiologist

UPMC ALTOONA
Joshua F. Chacon, DO - Clinical Assistant Professor
Domenico Falcone, MD – Clinical Assistant Professor; Chief Anesthesiologist
James H. Garofalo, MD – Clinical Assistant Professor
Joseph A. Martinelli, MD – Clinical Assistant Professor
Elizabeth Mburu, MD – Clinical Assistant Professor
Sal N. Nasser, MD – Clinical Assistant Professor
David M. Rasmussen, MD – Clinical Assistant Professor
Paul S. Schultz, MD – Clinical Assistant Professor
Przemyslaw P. Smolarczyk, MD – Clinical Assistant Professor
Vijay H. Vakharia, MD – Clinical Assistant Professor
Daniel F. VanRiper, MD – Clinical Assistant Professor

BASIC RESEARCH
Vasyl Bondarenko, PhD – Research Instructor
Qiang “Charles” Chen, PhD – Research Instructor
Suzanne Doolen PhD - Research Associate Professor
Howard B. Gutstein, MD – Professor
Gregg E. Homanics, PhD – Professor
Stephanie Puig, PhD - Research Assistant Professor
Ghanshyam Sinha PhD - Research Assistant Professor
Pei Tang, PhD – Professor
Bradley K. Taylor, PhD - Professor
Tommy Tillman, PhD - Research Assistant Professor
Yan Xu, PhD – Professor; Vice Chair for Basic Sciences

UPP RESEARCH COLLABORATORS
Miroslav Klain, MD – Professor Emeritus
Etsuro K. Motoyama, MD – Professor Emeritus
Jan Smith, MBCHB - Clinical Professor; Clinician Emeritus

PETER M. WINTER INSTITUTE FOR SIMULATION, EDUCATION, AND RESEARCH (WISER)
Paul E. Phrampus, MD - Assistant Professor; Director, WISER
EDUCATION

OVERVIEW

In addition to the educational endeavors in which department faculty members participate for the benefit of residents, fellows, medical students, and colleagues, many are involved in educational projects and presentations that contribute to the field of anesthesiology education and give the department national and international prominence.

EDUCATIONAL GRANT

A department Educational Grant program was established in FY17 under the direction of Drs. Metro and Sakai. Departmental funds are now available biannually to support new educational projects for residents, fellows, faculty, and University of Pittsburgh School of Medicine students. This Educational Grant provides a maximum of $8,000 per project. The purpose of the grant is to inspire and assist aspiring anesthesiology investigators who do not have current funding to start an educational project. Both curriculum development projects and research projects are eligible.

Three projects were funded by the department’s Educational Grant in FY18:

- “Evaluation of Anesthesiology Resident Competence and Clinical Impact of a Structured Point-of-Care Ultrasound Training Program.” PI: Daniel R. Mandell, MD (PGY-4 Resident); Faculty Mentors: Michael Boisen, MD & Kathirvel Subramaniam, MD, MPH, FASE
- “Teaching Medical Students Anatomy for Regional Anesthesia Using Ultrasound.” PI: Kaarin Michaelsen, MD, PhD (PGY-4 Resident); Faculty Mentor: Steven L. Orebaugh, MD
- “Implementation of a Formal Objective Structured Clinical Examination (OSCE) for Anesthesiology Residents” Kristin Ondecko Ligda, MD, FASA (PI); Erica Sivak, MD

As curriculum development proposals, the projects by Drs. Mandell et al. and by Ondecko Ligda and Sivak helped to establish Point-of Care Ultrasound and OSCE training programs in the department’s anesthesiology residency program, respectively. The educational research proposal by Drs. Michaelsen and Orebaugh resulted in a poster presentation at the 2018 American Society of Anesthesiology meeting:

- Daniel P. Huettner, MD; Kaarin L. Michaelsen, MD, PhD; Kristin M. Ondecko Ligda, MD, FASA; Steven L. Orebaugh, MD: Enhancing Medical Student Understanding of Regional Anesthesia Anatomy Using Intensive Ultrasound Instruction

GRAND ROUNDS

Under the direction of Dr. Charles Boucek, Director of the Grand Rounds Program, and Dr. David G. Metro, Vice Chair for Education and Faculty Affairs, the Department of Anesthesiology and Perioperative Medicine Grand Rounds series continued with the many innovative program features convenient for faculty, fellows, residents, and medical students in the department. Live streaming capabilities continue to enable the addition of faculty and trainees sessions to the existing digitally recorded modules. Live streaming allowed for more faculty, regardless of distance, to participate in Grand Rounds. Review of recorded modules allows for continuing medical education credit and the modules are maintained online indefinitely as an educational resource.
The UPMC Center for Continuing Education in the Health Sciences provides accreditation for the series, and the University of Pittsburgh Internet-Based Studies in Education and Research website hosts the recorded modules as enduring material.

In 2017-18, faculty members viewed 23 presentations. Journal clubs organized by Dr. Stephen McHugh were held monthly from September through May with great involvement from the Residency Program. The department hosts lectures from visiting professors on various topics as outlined below. Both the journal clubs and visiting professor lectures are integral to the success of the Grand Rounds series. The following schedule details the presentations and speakers:

### Department of Anesthesiology

#### Grand Rounds Lecture (CME Course #142) & Journal Club Schedule, 2017-2018

*Department of Anesthesiology and Perioperative Medicine Presenters*

<table>
<thead>
<tr>
<th>Presentation Date</th>
<th>Presenter(s)</th>
<th>Presentation Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 7, 2017</td>
<td>Kevin Pardo, MD* Kate Petty, MD* Annie Xu, MD*</td>
<td>The Use of Videolaryngoscopy vs. Direct Laryngoscopy in the ICU</td>
</tr>
<tr>
<td>September 21, 2017</td>
<td>Faculty Mentors: Tetsuro Sakai, MD, PhD, MHA, FASA* Keith M. Vogt, MD, PhD*</td>
<td>ASA Rehearsals</td>
</tr>
<tr>
<td>September 28, 2017</td>
<td>Laurent Glance, MD Vice-Chair for Research, Department of Anesthesiology; Professor of Anesthesiology; Professor of Public Health Sciences; Senior Scientist, RADN (adjunct), University of Rochester School of Medicine</td>
<td>Can We Do Better? Can Quality Measurement Help?</td>
</tr>
<tr>
<td>October 5, 2017</td>
<td>Anusari Dewasurendra, MD* Luke Doney, DO*</td>
<td>Randomized Controlled Clinical Trials: The Most Fun You Can Have While Double Blinded</td>
</tr>
<tr>
<td>November 2, 2017</td>
<td>Douglas Adams, MD* Kelsey Mitchell, MD, MPH*</td>
<td>Composite End Points</td>
</tr>
<tr>
<td>November 16, 2017</td>
<td>Grace Lim, MD, MS*</td>
<td>Obstetric Anesthesia in the 21st Century: Past, Present, and Future</td>
</tr>
<tr>
<td>November 30, 2017</td>
<td>William Mclvor, MD, FASA*</td>
<td>Simulation-Based Assessment of the Management of Critical Events by Board-Certified Anesthesiologists</td>
</tr>
<tr>
<td>December 7, 2017</td>
<td>Michael Gemma, MD* Michael Sypert, DO*</td>
<td>Go/No-Go Decision in Anesthesia: wide Variation in Risk Tolerance Among Anesthetists</td>
</tr>
<tr>
<td>January 4, 2018</td>
<td>Lindsay Hahn, MD, Med* Maciej Klosowski, MD*</td>
<td>Association Between Tracheal Intubation During Adult in Hospital Cardiac Arrest and Survival</td>
</tr>
<tr>
<td>January 18, 2018</td>
<td>Alex S. Evers, MD Henry E. Mallinckrodt Professor of Anesthesiology; Professor of Internal Medicine and Developmental Biology, Washington University School of Medicine</td>
<td>The Fallacy of Persistent Post-Operative Cognitive Decline</td>
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<tr>
<td>Date</td>
<td>Speaker(s)</td>
<td>Title</td>
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<tr>
<td>January 25, 2018</td>
<td>Kristin Ondecko Ligda, MD, FASA*</td>
<td>Power and Pitfalls of Social Media for the Physician Anesthesiologist</td>
</tr>
<tr>
<td>February 1, 2018</td>
<td>n/a</td>
<td>“Jeopardy”</td>
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<td>February 15, 2018</td>
<td>Lee Fleisher, MD; Robert Dunning Dripps Professor of Anesthesia; Chair, Department of Anesthesiology and Critical Care, University of Pennsylvania Health System</td>
<td>Strategies to Reduce Cardiac Risk of Noncardiac Surgery</td>
</tr>
<tr>
<td>February 22, 2018</td>
<td>Jerome Parness, MD*</td>
<td>Malignant Hyperthermia: Update</td>
</tr>
<tr>
<td>March 1, 2018</td>
<td>Daniel Bintrim, MD*; Claudia Mulock, MD*</td>
<td>Association Between Handover of Anesthesia Care and Adverse Postoperative Outcomes Among Patients Undergoing Major Surgery</td>
</tr>
<tr>
<td>March 15, 2018</td>
<td>Christopher Gallagher, MD; Retired Professor of Anesthesiology; State University of New York Stony Brook</td>
<td>Scouting Retirement</td>
</tr>
<tr>
<td>March 22, 2018</td>
<td>Jonathan Bloom, MD; Co-founder &amp; Chief Executive Officer, Podimetrics, Inc.</td>
<td>Healthcare Innovation and Entrepreneurship</td>
</tr>
<tr>
<td>March 29, 2018</td>
<td>Treven Pickett, PsyD, ABPP; Department Chief, Research, National Intrepid Center of Excellence, Walter Reed National Military Medical Center</td>
<td>Traumatic Brain Injury and Associated Psychological Health Conditions among US Military Service Members</td>
</tr>
<tr>
<td>April 5, 2018</td>
<td>Sean McDermott, MD*; Donald Miller, MD*</td>
<td>Using Databases for Medical Research</td>
</tr>
<tr>
<td>April 19, 2018</td>
<td>Richard J. Levy, MD, FAAP; Vice Chair for Pediatric Laboratory Research, Department of Anesthesiology; Professor of Anesthesiology and Pediatrics, Columbia University Medical Center</td>
<td>The Mitochondrial Basis of Fragile X Syndrome</td>
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<tr>
<td>April 26, 2018</td>
<td>All Residents</td>
<td>Pennsylvania Anesthesia Resident Research Conference Rehearsals</td>
</tr>
<tr>
<td>May 3, 2018</td>
<td>Sofiane Lazar, MD*; Tyler Smith, MD*</td>
<td>P-Values</td>
</tr>
<tr>
<td>May 17, 2018</td>
<td>Mark S. Roberts, MD, MPP; Professor and Chair, Department of Health Policy and Management; Director, Public Health Dynamics Laboratory, University of Pittsburgh Graduate School of Public Health; Professor of Medicine, Industrial Engineering and Clinical and Translational Science</td>
<td>$100 Billion Here, $100 Billion There: Using the New Treatments for Hepatitis C to Understand Cost Effectiveness Analysis</td>
</tr>
<tr>
<td>May 24, 2018</td>
<td>Keith Vogt, MD, PhD*</td>
<td>Neuroscience of the Brain under Anesthesia: What do we Really Know about Consciousness, Pain, and Memory?</td>
</tr>
</tbody>
</table>
AMERICAN BOARD OF ANESTHESIOLOGY
Drs. Shawn Beaman, Franklyn Cladis, and Erin Sullivan are American Board of Anesthesiology (ABA) board examiners. ABA Examiners help establish and demonstrate the highest standards for board certification through their service. Individuals may be nominated by another ABA diplomate or may nominate themselves. They must possess valid, unexpired board certification in anesthesiology and actively participate in the Maintenance of Certification in Anesthesiology (MOCA) program. Examiners must spend, on average, at least one day per week in clinical practice. Dr. Stephen McHugh became a question writer for the ABA written examination. These faculty are active participants in the semi-annual mock oral sessions directed by Dr. Erin Sullivan, which are provided to anesthesiology residents, fellows, and faculty.

ASSOCIATION OF UNIVERSITY ANESTHESIOLOGISTS
The mission of the Association of University Anesthesiologists (AUA) is to advance the art and science of anesthesiology by encouraging its members to pursue original investigations in the clinic and in the laboratory, develop the method of teaching anesthesiology, and freely and informally interchange ideas. AUA members are nominated and elected based on excellence in teaching, administration, and research. The following current department faculty are AUA members:

- Bruce Ben-David, MD
- Jacques E. Chelly, MD, PhD, MBA
- Franklyn P. Cladis, MD
- Peter Davis, MD
- Howard Gutstein, MD
- Andrew Herlich, MD, DMD, FAAP, FASA
- A. Murat Kaynar, MD, MPH
- David G. Metro, MD, FASA
- Etsuro Motoyama, MD
- Steven L. Orebaugh, MD
- Jerome Parness, MD
- Rita M. Patel, MD, FASA
- Raymond Planinsic, MD, FASA
- Joseph Quinlan, MD
- Tetsuro Sakai, MD, PhD, MHA, FASA
- Erin Sullivan, MD, FASA
- Ajay Wasan, MD, MSc
- Jonathan Waters, MD
- Yan Xu, PhD
- Li-Ming Zhang, MD

AMERICAN SOCIETY OF ANESTHESIOLOGISTS
The American Society of Anesthesiologists (ASA) Annual Meeting is a heavily attended event, with extensive departmental representation. An impressive number of medical students, residents, fellows, and faculty members present every year. The 2017 meeting was held October 21-25 in Boston, MA. Department members delivered 49 presentations. Additionally, 23 faculty members, one resident, two fellows, and two recently graduated alumni served on ASA and ASA-related committees. The department’s yearly alumni reception was held Sunday, October 22nd at Seaport Ballroom, Seaport Hotel & Seaport World Trade Center and was attended by almost 200 faculty, fellows, residents, and alumni.

Many department members participated in pre-ASA meetings such as the Society of Pediatric Anesthesia Annual Meeting and the Society for Education in Anesthesia Fall Meeting. Faculty and residents presented problem-based learning discussions, panels, clinical forums, workshops, scientific papers, and scientific & educational exhibits.

In May 2017, the ASA launched a new designation, Fellows of the American Society of Anesthesiologists (FASA™). FASA identifies and promotes ASA members exhibiting the highest standards in professionalism/leadership, advocacy for the profession and patient safety, and education. Becoming a FASA is a prestigious honor in the specialty, setting its designees apart from their peers. The criteria required for earning the FASA designation demonstrates a candidate’s commitment to advancing the practice and securing the future of anesthesiology. Drs. Andrew Herlich, David Metro, and Erin Sullivan were among the first 100 fellows to receive prestigious FASA designation. In addition, Drs. Rita Patel, William McIvor, Raymond Planinsic, Kristin M. Ondecko Ligda, Tetsuro Sakai, Shawn Beaman, and Charles Boucek were inducted as FASAs during FY18.
### Saturday, October 21, 2017

<table>
<thead>
<tr>
<th>Title/Participants (presenter names in bold)</th>
<th>Begin</th>
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<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Session L102, PBLD: 65-Year-Old with an LVAD for a Non-intubated VATS Theresa A. Gelzinis, MD</td>
<td>8:00 AM</td>
<td>9:00 AM</td>
<td>052A</td>
</tr>
<tr>
<td>HOW, Session 801A: Lifesaving Skills that Every Physician Anesthesiologist Should Know: A Cadaveric Workshop Presentation Faculty: Shawn T. Beaman, MD, et al.</td>
<td>8:00 AM</td>
<td>12:00 PM</td>
<td>156ABC</td>
</tr>
<tr>
<td>Session MCC01: Medically Challenging Case Presentations MCC Facilitator: Ryan D. Ball, MD</td>
<td>10:00 AM</td>
<td>12:00 PM</td>
<td>Exhibit Hall B2</td>
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<tr>
<td>MCC 1111: Proctocolectomy in a Patient with Congenital Myasthenia Gravis and Crohn’s Disease Dependent on Enteral Administration of Amifampridine Chelsey L. Woodrum, MD; Zachary C. Cohen, MD; Liora Yehushua, MD; Charles D. Boucek, MD</td>
<td>10:20 AM</td>
<td>10:30 AM</td>
<td>Monitor 10, Exhibit Hall B2</td>
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<tr>
<td>MCC 1151: Crazy Catecholamines: Should Vasopressin be Standard of Care for Pheochromocytoma Excision? A Pediatric Case of Pheochromocytoma Kelsey M. Bauer, MD, Phillip S. Adams, DO</td>
<td>10:20 AM</td>
<td>10:30 AM</td>
<td>Monitor 14, Exhibit Hall B2</td>
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<tr>
<td>MCC 1229: Hypotension and Airway Compromise During TAVR via Subclavian Artery Approach Diana S. Deandrade, MD; Stephen M. McHugh, MD</td>
<td>1:10 PM</td>
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<tr>
<td>MCC 1398: Pressure Support for Sedation in Super Obese Charles Lin, MD</td>
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<tr>
<td>HOW, Session 801B: Lifesaving Skills that Every Physician Anesthesiologist Should Know: A Cadaveric Workshop Presentation Faculty: Shawn T. Beaman, MD, et al.</td>
<td>1:10 PM</td>
<td>5:10 PM</td>
<td>156ABC</td>
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<tr>
<td>MCC 1218: Vasoplegic Syndrome during Cardiopulmonary Bypass for a Double Lung Transplant Steven A. Bartels, MD; Theresa A. Gelzinis, MD</td>
<td>1:20 PM</td>
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<td>Monitor 01, Exhibit Hall B2</td>
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<tr>
<td>MCC 1431: Regional Anesthesia for Awake Intubation in an Achondroplastic Patient Wayne Wang, MD; Sagar S. Mungekar</td>
<td>2:45 PM</td>
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<td>Monitor 19, Exhibit Hall B2</td>
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<tr>
<td>MCC 1634: Parasternal Intercostal Nerve Block Catheters in a Critically Ill Patient with Sternal and Anterior Rib Fractures Ian M. Brotman, MD; Stephanie Jean-Noel, MD; Joshua D. Eaton, MD</td>
<td>3:40 PM</td>
<td>3:50 PM</td>
<td>Monitor 18, Exhibit Hall B2</td>
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<tr>
<td>MCC 1450: Surgical bypass of Aortic Coarctation in the Setting of Ascending Aortic Aneurysm and Bicuspid Aortic Valve Andrius V. Giedraitis, MD, MBA; Bryant Bunting, DO</td>
<td>4:20 PM</td>
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<td>Monitor 02, Exhibit Hall B2</td>
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<tr>
<td>MCC 1590: Tension Pneumothorax in the Prone Pediatric Patient Alex M. Dressler, MD; Jerome Parness, MD, PhD</td>
<td>4:20 PM</td>
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<tr>
<td>MCC 1466: Intraoperative Cardiopulmonary Collapse during Elective Surgery: The Anesthesiologist's Role in Preventing Failure to Rescue Milap Rakholia, BA; Jeremiah W. Hayanga, MD, MPH; Sean M. DeChancie, DO; Heather K. Hayanga, MD, MPH</td>
<td>5:00 PM</td>
<td>5:10 PM</td>
<td>Monitor 03, Exhibit Hall B2</td>
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<tr>
<td>MCC 1443: Dexmedetomidine Requirements in Alcoholic Nathan S. Hoaglund, MD; Andrew Herlich, DMD, MD, FAAP, FASA</td>
<td>5:10 PM</td>
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<td>Monitor 01, Exhibit Hall B2</td>
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### Sunday, October 22, 2017

<table>
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<tr>
<td>Session PN201, 60-minute Panel: What to Do When the Unexpected Happens!</td>
<td>7:00 AM</td>
<td>8:00 AM</td>
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<tr>
<td>Grace Lim, MD, MS</td>
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</table>

HOW, Session 821A: Perioperative ACLS Simulation Workshop (A-ACLS) Presentation Faculty: William R. McVor, MD  
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MCC 2040: Bovine Hemoglobin-Based Oxygen Carrier Treatment in a Severely Anemic Jehovah’s Witness Patient Following Cystectomy and Nephrectomy  
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PP: Paravertebral Versus Wound Catheters Following Alveolar Bone Grafting  
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<td>11:30 AM</td>
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HOW, Session 821B: Perioperative ACLS Simulation Workshop (A-ACLS)*  
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Session PN217, 120 Minute Panel: Massive Transfusion Protocols in Non-trauma Hemorrhage: An Evidence-based Practice?  
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Session L228, PBLD: 65-Year-Old with an LVAD for a Non-intubated VATS*  
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PD A2214: Teaching Residents to Perform Ultrasound-Guided Cricothyroidotomy on Porcine Trachea: A Novel Training Modality  
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MCC 2222: A Rare Congenital Cause of Dyspnea in a 65-Year-Old Male  
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MCC 2222: Acute Aortitis and Associated Mycotic Aneurysm in a Recently Stented Patient  
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MCC 2221: ”Everyone cross your fingers”: Reaching the End of the Difficult Airway Algorithm on a Patient with a Substernal Cricoid Cartilage  
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MCC 2334: Serotonin Syndrome in the Post-anesthesia Care Unit  
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FAER Medical Student Anesthesia Research Fellowship Symposium  
| OP: Imatinib Prevents EGF-induced Analgesic Tolerance to Morphine in Opioid Naive Rats  
Matthew Orlowski (mentor: Howard B. Gutstein, MD) | 2:00 PM | 5:30 PM | Boston Convention & Exhibition Center, Ballroom East |

MCC 2429: Utilization of High Flow Nasal Cannula in Patient with Obstructive Sleep Apnea and Known Difficult Airway for Umbilical Hernia Repair  
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MCC 2547: Metastatic Femur Fracture in Pregnancy: Obstetric and Anesthetic Considerations  
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PD A2296: Clinical Efficacy of Washed Autotransfusion in Non-cardiac Settings Such as Vascular, Orthopedic and Obstetric Surgery: Subgroup Analysis of a Systematic Review and Meta-analysis of Randomized Control Trials  
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<td>4:00 PM</td>
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**Alumni Reception**  
**Sunday, October 22, 2017, 6:00 PM – 9:00 PM**  
Seaport Ballroom, Seaport Hotel & Seaport World Trade Center  
200 Seaport Blvd, Boston, MA

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**Monday, October 23, 2017**

<table>
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<tr>
<td>Session SM730, Seminar: Presentation Preparation for Professional Development and Advancement: Developing Your Portfolio and Curriculum Vitae</td>
<td>9:00 AM</td>
<td>12:00 PM</td>
<td>159</td>
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<tr>
<td>Kristin Ondecko Ligda, MD</td>
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<thead>
<tr>
<th>Session 831A, HOW: Difficult Airway Workshop with Simulation</th>
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<tr>
<td>Presentation Co-chair: Joseph J. Quinlan, MD</td>
<td>9:00 AM</td>
<td>12:00 PM</td>
<td>157ABC</td>
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<tr>
<td>Presentation Faculty: Shawn T. Beaman, MD; Michael L. Boisen, MD; Theresa A. Gelzinis, MD; Robert Krohner, DO; David G. Metro, MD, FASA; Dennis P. Phillips, DO; Ryan C. Romeo, MD; Cynthia Wells, MD</td>
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<th>Governmental Affairs Committee Meeting</th>
<th>Begin</th>
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<th>Location</th>
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<tbody>
<tr>
<td>Presentation Chair: Erin A. Sullivan, MD, FASA</td>
<td>10:00 AM</td>
<td>12:00 PM</td>
<td>Marina Ballroom I - Westin Boston Waterfront</td>
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<tr>
<th>Session 831B, HOW: Difficult Airway Workshop with Simulation*</th>
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<td>Presentation Co-chair: Joseph J. Quinlan, MD</td>
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<tr>
<td>Presentation Faculty: Shawn T. Beaman, MD; Michael L. Boisen, MD; Theresa A. Gelzinis, MD; Robert Krohner, DO; David G. Metro, MD, FASA; Dennis P. Phillips, DO; Ryan C. Romeo, MD; Cynthia Wells, MD</td>
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<tr>
<th>MCC 3134: Supraventricular Tachycardia in a Parturient with a History of Postpartum Thyroiditis</th>
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<tbody>
<tr>
<td>Shawn R. Palmeri, MD; Kristin Ondecko Ligda, MD</td>
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<tr>
<th>MCC 3403: Regional Anesthesia for Elbow Fracture Dislocation Repair in a Patient with Severe Myasthenia Gravis</th>
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<tr>
<td>Eugene P. Raggi, MD; Kristin Ondecko Ligda, MD</td>
<td>4:45 PM</td>
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**Tuesday, October 24, 2017**

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<tr>
<td>HOW, Session 843A: Workshop on Flexible Endoscopy for Lung Isolation</td>
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<tr>
<td>Presentation Co-moderator: William Simmons, MD</td>
<td>8:00 AM</td>
<td>9:15 AM</td>
<td>162AB</td>
</tr>
<tr>
<td>Presentation Faculty: Andrew Herlich, DMD, MD, FAAP, FASA</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HOW, Session 840A: Peripheral Nerve Block Workshop: Ultrasound, Simulation and Stimulation</th>
<th>Begin</th>
<th>End</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation Faculty: Jacques E. Chelly, MD, PhD, MBA</td>
<td>9:00 AM</td>
<td>12:00 PM</td>
<td>156ABC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PP: The Ability of Anesthesiologists to Distinguish Between Closely Associated Nerve Elements in the Interscalene Groove</th>
<th>Begin</th>
<th>End</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicole Verdecchia, MD; James W. Ibinson, MD; Steven L. Orebaugh, MD</td>
<td>9:00 AM</td>
<td>9:30 AM</td>
<td>Monitor 16, Exhibit Hall B2 - Area D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOW, Session 843B: Workshop on Flexible Endoscopy for Lung Isolation*</th>
<th>Begin</th>
<th>End</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation Co-moderator: William Simmons, MD</td>
<td>9:30 AM</td>
<td>10:45 AM</td>
<td>162AB</td>
</tr>
<tr>
<td>Presentation Faculty: Andrew Herlich, DMD, MD, FAAP, FASA</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HOW, Session 840B: Peripheral Nerve Block Workshop: Ultrasound, Simulation and Stimulation*</th>
<th>Begin</th>
<th>End</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation Co-moderator: William Simmons, MD</td>
<td>1:00 PM</td>
<td>4:00 PM</td>
<td>156ABC</td>
</tr>
<tr>
<td>Presentation Faculty: Jacques E. Chelly, MD, PhD, MBA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOW, Session 843C: Workshop on Flexible Endoscopy for Lung Isolation*</th>
<th>Begin</th>
<th>End</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation Co-moderator: William Simmons, MD</td>
<td>1:00 PM</td>
<td>2:15 PM</td>
<td>162AB</td>
</tr>
<tr>
<td>Presentation Faculty: Andrew Herlich, DMD, MD, FAAP, FASA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tuesday, October 24, 2017

Participants (presenter names in bold)

HOW, Session 843D: Workshop on Flexible Endoscopy for Lung Isolation*
Presentation Co-moderator: William Simmons, MD
Presentation Faculty: Andrew Herlich, DMD, MD, FAAP, FASA

Session POI1-3, PP A4171: Improving Medical Student Knowledge of Anatomy for Regional Anesthesia Using Intensive Ultrasound Instruction
Kaarin L. Michaelsen, MD, PhD; Natalie A. Nakles, BS; Steven L. Orebaugh, MD
3:30 PM 4:00 PM Monitor 04, Exhibit Hall B2 - Area A

60-Minute Panel: Perioperative Management of Destination and Rescue VADs
Theresa A. Gelzinis, MD
3:30 PM 4:30 PM 102AB

Session POI5-4, PP A4202: Post-operative Hyponatremia in Pediatric Craniofacial Surgery Patients: A Comparative Study
Michael Dustin Nicolay, MD (resident from West Penn Hospital mentored by Franklyn P. Cladis, MD)
4:00 PM 4:30 PM Monitor 07, Exhibit Hall B2 - Area B

HOW, Session 843E: Workshop on Flexible Endoscopy for Lung Isolation*
Presentation Co-moderator: William Simmons, MD
Presentation Faculty: Andrew Herlich, DMD, MD, FAAP, FASA

National Representation

Shawn T. Beaman, MD - ASA Committee on Trauma and Emergency Preparedness (adj.); Society for Education in Anesthesia (SEA) Finances Committee
Jacques E. Chelly, MD, PhD, MBA - Regional Anesthesiology and Acute Pain Fellowship Directors Group
Franklyn P. Cladis, MD - SEA Board of Directors; SEA Research Committee; Society for Pediatric Anesthesiology (SPA) Board of Directors; SPA Education Committee; SPA Pediatric Craniofacial Collaborative Group (Chair)
Zachary C. Cohen, MD - Pennsylvania Society of Anesthesiologists (PSA) Resident Board of Directors (President); PSA Resident Committee (Chairperson)
Kathleen O. Coy, MD - Society for Obstetric Anesthesia and Perinatology (SOAP) Resident Affairs Committee
Patricia L. Dalby, MD - SEA Membership Committee; SOAP Education Committee (Awards); SOAP International Outreach Committee; SOAP Membership Committee; SOAP DB Fellowship Committee
Peter J. Davis, MD, FAAP - Anesthesia Patient Safety Foundation Committee on Scientific Evaluation
Tomas Drabek, MD, PhD - ASA Abstract Review Subcommittee on Experimental Circulation
D’Onier Felton, MD - ASA Committee on Uniformed Services and Veterans’ Affairs (adj.)
Patrick J. Forte, MD - SEA Resident Education Committee
Andrew Herlich, DMD, MD, FAAP, FASA - ASA Committee on Ambulatory Surgical Care (adj.); ASA Committee on Communications (adj.); ASA Liaison to the American Dental Association, the American Association of Oral and Maxillofacial Surgeons, and the American Dental Society of Anesthesiologists/ American Society of Dentist Anesthesiologists; PSA Past President; PSA Board of Directors, ASA House of Delegates (delegate); PSA Philanthropy Committee (Chairperson)
Mark E. Hudson, MD, MBA - ASA Committee on Practice Management; PSA Board of Directors, ASA House of Delegates (alternate delegate)
Grace Lim, MD, MS - SEA Simulation Committee; SOAP Education Committee (Awards); SOAP Education Committee, Physician Specialty Education Subcommittee (Chair); SOAP International Outreach Committee
David G. Metro, MD, FASA - SEA Journal of Education in Perioperative Medicine Committee
William R. McVor, MD - ASA Editorial Board for Simulation-based Training; SEA Simulation Committee
Kristin Onderco Ligda, MD - ASA Ad Hoc Committee on Women in Anesthesia; ASA Committee on Professional Diversity (adj.); ASA Committee on Young Physicians (adj.); PSA Board of Directors, ASA House of Delegates (delegate); PSA Continuing Education Committee (Chairperson); SEA Advancement of Technology in Education Committee; SEA Medical Student Education Committee; SEA Resident Education Committee
Jerome Parness, MD, PhD - SPA Quality and Safety Committee; SPA Research Committee
Rita M. Patel, MD - Foundation for Anesthesiology Education and Research (FAER) Academy of Education Mentors in Anesthesiology
Raymond M. Planinsic, MD - ASA Committee of Transplant Anesthesia; Society for the Advancement of Transplant Anesthesia (SATA) Board of Directors
Lindsey E. Rutland, MD - ASA Committee on Membership (adj.); ASA Committee on Patient Safety and Education (adj.)
Tetsuro Sakai, MD, PhD - SEA Research Committee (Designee Chair and member); SATA Board of Directors
David L. Seng, DO - SOAP Membership Committee
Anthony T. Silipo, DO - PSA Board of Directors, ASA House of Delegates (alternate delegate)
Doreen Solomon, MD - SEA Advancement of Technology in Education Committee
Kathirvel Subramaniam, MD, MPH - Society of Cardiovascular Anesthesiologists Newsletter Sub-Committee
Erin A. Sullivan, MD, FASA - ASA Ad Hoc Committee on Patients’ Rights Initiatives (Chair); ASA Committee on Governmental Affairs (Chair); ASA Committee on Governance Effectiveness and Efficiencies; ASA Committee on Large Group Practice (adj.); ASA Committee on Surgical and Procedural Anesthesia; ASA Committee on Anesthesia Care Team (incoming Chair); ASA House of Delegates (delegate); ASA Board of Directors (District IX Director, Pennsylvania); ASA House of Delegates Credentials Committee (Mid-Atlantic Caucus Delegate); ASA Mid-Atlantic State Caucus (Vice Chair)
Jonathan H. Waters, MD - ASA Committee on Patient Blood Management (adj.)
Peter Yeh, MD - SOAP Resident Affairs Committee
UNIVERSITY OF PITTSBURGH ACTIVITIES
The 81-member University of Pittsburgh School of Medicine Academy of Master Educators recognizes and rewards excellence in education, advances education through innovation and professional faculty development, and supports and promotes educational scholarship. Eight department faculty members are academy members: Drs. Scott Brancolini, Steven Orebaugh, Michael Mangione, William McIvor, Rita M. Patel, Shawn T. Beaman, Tetsuro Sakai, and David Metro. Drs. McIvor, Mangione, and Orebaugh are included among those faculty who compose the Mentoring Committee of the Academy. Members of the academy must be involved in the education of medical students, graduate students, and/or residents for the duration of their appointment to the academy. These physicians were selected based upon their exceptional contributions to medical education.

SEA COMMITTEES
Faculty members who hold committee positions include the following:
- Shawn Beaman, MD, FASA – Finance Committee
- Franklyn Cladis, MD – Board of Directors and Research Committee
- Patricia Dalby, MD – Membership Committee
- Patrick Forte, MD – Resident Education Committee
- Grace Lim, MD, MS – Simulation Committee
- William McIvor, MD – Simulation Committee
- David G. Metro, MD, FASA – Journal for Education in Perioperative Medicine Committee
- Kristen Ondeko-Ligda, MD, FASA – Advancement of Technology in Education Committee; Medical Student Education Committee and & Resident Education Committees
- Tetsuro Sakai, MD, PhD, MHA, FASA – Designee, Research Committee Chair
- Doreen Soliman, MD – Advancement of Technology in Education Committee
- K. Karisa Walker, MD, FAAP – Membership Committee (Chair Designee)
Under the leadership of Dr. David G. Metro, the UPMC Anesthesiology Residency Program remains fully-accredited by the Accreditation Council for Graduate Medical Education (ACGME) to provide training and education in anesthesia leading to American Board of Anesthesiology (ABA) certification. Dr. Elizabeth Ungerman served as Chief Resident and Drs. Daniel Mandell and Nicole Verdecchia served as Associate Chief Residents for the 2017-2018 academic year.

In April 2012, the ACGME granted the maximum allowable 10-year accreditation to the Anesthesiology Residency Program, as well as continued 10-year accreditation to the fellowship programs in Pediatric Anesthesiology, Anesthesiology Critical Care Medicine, Adult Cardiothoracic Anesthesiology, and Pain Medicine. In February 2016, the Obstetric Anesthesiology Fellowship Program received a continued accreditation until July of 2022, which is the maximum renewal duration allowed. In July 2017, the Regional Anesthesiology and Acute Pain Medicine Fellowship received its initial ACGME accreditation.

The ACGME annually surveys all residents and core faculty as part of the accreditation process. Data obtained from this survey is used towards accreditation status and identifying areas in need of improvement for all programs. We are pleased to announce that in this year’s survey, 96% of residents and 99% of faculty rated the program as “positive” or “very positive” overall. In addition, the residents rated the program at or above the national average in all areas, including duty hours, faculty, evaluation, educational content, resources, and patient safety/teamwork.

Eighteen residents completed the continuum of education in anesthesia and graduated from the program in 2018 (a complete list with graduation plans is provided at the end of this section). As in previous years, academic year 2017-2018 was a period of excellence and innovation in education, as well as adaptation to the emergent and evolving changes that characterize contemporary graduate medical education.

**CURRICULUM**

The Curriculum Subcommittee, consisting of rotation directors at each site and co-chaired by Drs. Orebaugh and Gelzinis, further reviewed and developed the didactic and clinical curricula. This subcommittee annually updates the residents’ curricula, which outlines and describes important resident and faculty responsibilities, states a complete set of goals and objectives for each clinical rotation, and provides clearly-defined criteria for evaluation. Special lectures, presentations, and educational sessions were included in the curriculum on anesthesia billing, practice management, ethics, patient care, and systems-based practice. Added in the 2017-18 year were a focused curriculum on resident wellness and a structured workshop to address preparation for the new ABA Applied Examination.

**DIDACTIC PROGRAMS**

The academic year was also notable for continued excellence in didactics. The committee coordinated core topics for post-graduate year (PGY)-1, PGY-2, PGY-3, and PGY-4 residents in seminar and lecture series formats. The lectures are cataloged online, allowing residents unlimited access and review. Fourth-year residents participated in a curriculum consisting of evidence-based medicine, case management, and oral board preparatory sessions. Under the continued direction of Dr. Theresa Gelzinis, case-management sessions are presented in American Society of Anesthesiology problem-based learning discussion format to facilitate active learning in small groups.

The educational program is augmented by weekly Grand Rounds under the direction of Dr. Charles Boucek, in which local speakers and visiting professors provide up-to-date reviews of relevant topics. A monthly Journal Club session was included in the Grand Rounds curriculum under the direction of Dr. Stephen McHugh. During these sessions, residents research and present important articles with the goals of increasing their understanding of scientific literature and sharpening their presentation skills.
DEPARTMENT OF ANESTHESIOLOGY AND PERIOPERATIVE MEDICINE

EDUCATION

ANESTHESIOLOGY RESIDENCY PROGRAM

DAVID G. METRO, MD, FASA, Director

An introductory program organized by Dr. Todd Oravitz consists of simulation sessions, one-on-one instruction in the operating room, and didactic teaching. Simulation exercises during the first week of PGY-2 training, under the direction of Dr. William McIvor, provide new residents with a safe and instructive setting in which to gain experience prior to their actual clinical work in the operating room. The introductory course culminates with a performance test held in the simulator prior to residents beginning work in the actual operating room.

REGIONAL ANESTHESIOLOGY ULTRASOUND

The Regional Anesthesia Ultrasound Lab is held the first week of the regional rotation each month. During this half-day activity, residents meet with rotation director Dr. Steven Orebaugh and spend an hour evaluating a previously dissected cadaver to gain an appreciation of the actual three-dimensional gross anatomy that is relevant for the most common sites of extremity and trunk peripheral nerve blockade. This session is followed by two to three hours of ultrasound scanning of a live model at the Peter M. Winter Institute for Simulation Education and Research (WISER), juxtaposed with projected gross anatomy and cross-sectional anatomy photos, to help residents develop an appreciation for the two-dimensional ultrasound images that will be generated at the bedside.

POINT OF CARE ULTRASOUND

Physician-performed point-of-care ultrasonography (POCUS) has become central to the practice of perioperative and critical care medicine. In 2016-17, the core residency program launched a new POCUS curriculum to complement the extensive existing training residents receive in ultrasound for regional anesthesiology and central venous cannulation. The curriculum was developed by a task force of expert faculty led by Dr. Michael Boisen and consists of online learning modules with knowledge assessments followed by workshops in the fall and spring that utilize an ultrasound simulator and human model patients. Current modules include cardiac/transthoracic ultrasound and hemodynamic assessment, pulmonary ultrasound, abdominal ultrasound (FAST and gastric contents), and vascular ultrasound, including lower extremity deep vein thrombosis; plans for expansion include airway applications and optic sheath diameter for intracranial pressure.

INTERNATIONAL MISSION ROTATION

The ever-popular Advanced Pediatric Rotation with an international component provides a unique opportunity for PGY-4 residents to advance their knowledge of pediatric anesthesiology and prepare to become members of global medical outreach programs. International mission trip rotations allowed anesthesiology residents and faculty to supply medical care for populations in developing countries and prepared residents to function as valuable team members on international missions, stressing advanced planning, cultural sensitivity, and strict adherence to ASA standards of care.

In FY18, residents Nicole Verdecchia and Sara Straesser, along with faculty member David G. Metro, served on a Surgicorps international mission trip in Guatemala. They cared for about 100 patients for conditions including cleft lips and palates and burn contracture repairs. Additional missions to Bhutan, Vietnam, and Zambia were supported by resident/faculty teams from our department. The ability to participate in mission trips is one of the attractive aspects of this residency program and is frequently mentioned by residents as a highlight of their training.

Nicole Verdecchia, MD; David G. Metro, MD; and Sara Straesser, MD on the 2017 survival mission trip in Guatemala
UPMC/ISMETT INTERNATIONAL ROTATION
The International Anesthesia Experience at the Mediterranean Institute for Transplantation & Advanced Specialized Therapies/Istituto Mediterraneo per i Trapianti e Terapie ad alta Specializzazione (ISMETT) (UPMC Palermo, Italy) for PGY-4 residents, under the direction of Maria Scarlata, MD, is designed to allow senior anesthesiology residents apply and refine their knowledge, enhance their judgment, and expand their skills in the practice of anesthesiology and critical care medicine at an international facility.

This two-month rotation takes place at the UPMC Palermo facility and is elective. During this rotation, residents can participate in the care of general surgery, cardiothoracic surgery, and solid organ transplant patients. Preoperative, intraoperative, and postoperative care are all addressed during this rotation, which takes place both in the operating rooms and the critical care units. Clinical and didactic teaching are included throughout the rotation. English is the official language used at ISMETT.

SIMULATION TRAINING
Many educational sessions are conducted at WISER. These courses provide both didactic and hands-on experience in the management of problems that are uncommon, or common but clinically challenging. In simulation courses offered this past year, residents could sharpen their skills and build confidence in crisis leadership, fiberoptic endotracheal intubation, central venous cannulation, Advanced Cardiac Life Support, and difficult airway management. In addition, residents were given the opportunity to orient or receive additional training for subspecialty rotations in regional, obstetric, pediatric, and liver transplantation anesthesiology.

MEDICAL STUDENT TEACHING
A standard requirement in the residents’ curricula is participation in at least one session of the Clinical Procedures Course sponsored by the University of Pittsburgh School of Medicine. This allows residents the opportunity to teach medical students in a traditional classroom setting, in addition to clinical teaching during the medical student clerkships and electives.

QUALITY INITIATIVES
Resident participation in patient safety and quality improvement initiatives increased this year. Dr. Daniel Mandell and the Junior Chiefs of Patient Safety and Quality Improvement, Drs. Hayden Hundley and Andrea Ibarra, spearheaded this initiative both departmentally and system-wide. Residents hold important roles in departmental, hospital, and system groups such as the Patient Safety and Quality Improvement Committee. This committee provides summary reports related to organizational performance and improvement, adverse events, regulatory encounters, vulnerabilities, and environmental safety. It also promotes house staff education, engagement, and participation in quality and patient safety initiatives and recommends priorities for quality and safety improvement.

ABA BOARD EXAMINATION PREPARATION
Under the direction of Dr. Erin Sullivan, the PGY-2 and PGY-4 curriculum continues to include mock oral examination sessions proctored by department faculty members in the fall and spring of each year. Subspecialty rotations during the PGY-3 year also continue to include mock oral board examinations as part of the rotation.
EDUCATION

ANESTHESIOLOGY RESIDENCY PROGRAM
DAVID G. METRO, MD, Director

EVALUATION AND COMPETENCE
The Evaluation and Competence Subcommittee, chaired by Dr. James Ibinson, closely monitors resident educational progress and works to develop policies regarding resident responsibilities, resident incentives, and academic progress. This year, the subcommittee reviewed existing program policies and updated those necessary to keep current with ACGME requirements. The committee continued to work on strategies to improve resident performance on standardized exams, clinical performance, and professionalism. The committee continued their work on incorporating milestones into the residency program. In this process, objective data evaluating each resident in 25 different areas was collected and assessed.

PROGRAM REVIEW
The Program Review Subcommittee ensures that educational policies and procedures are in place, reviews program design and function, and collects and compiles an extensive amount of data regarding the program and the activities of faculty members and residents. This committee oversees the planning of the Annual Program Review. The entire residency program was reviewed in detail. The information gained and discussions that ensued are used to make improvements to the residency program annually.

PARRC
The UPMC Anesthesiology Residency Program attended the 12th annual PARRC conference in Philadelphia, PA on May 19, 2018, which was sponsored by Drexel University. PARRC is an opportunity for residents and faculty to learn about current cutting-edge research conducted by anesthesiology residents from all eight programs across the commonwealth of Pennsylvania. Both original research and case reports were submitted in both the oral presentation and poster categories, representing scholarly activities performed at each institution. UPMC was well-represented, with the following residents winning awards (winner names bolded).

Oral Original Abstract Awards (among the top 10 abstracts):
1st Place - Neal Shah, MD (PGY-1) (Mentors: Drs. Hudson and Littwin): Utilizing a “Value” Incentive to Rapidly Introduce Evidence Based Practice Across a Large Multihospital Health Care System

3rd Place - Evan Lebovitz, MD (PGY-3) (Mentors: Drs. Hudson and Littwin): Comparison of Clinical Productivity Metrics between Anesthesiology Divisions within a Large Academic Medical Center

Oral Case Report Abstract Winner (among the top 10 abstracts):
1st Place - Ian Brotman, MD (PGY-4) (Mentor: Dr. Waters): Jehovah’s Witness Who Underwent a Cystoprostatectomy and Radical Nephrectomy with a Postoperative Hemoglobin Nadir of 4.5 g/dL who Received the HBOC Sanguinate (PEGylated Carboxyhemoglobin Bovine)

Poster Case Report Abstract Award:
1st Place - Michael Gemma, MD (PGY-2) (Mentor: Dr. Gelzinis): Intraoperative Airway Compression during Transcatheter Aortic Valve Replacement via Subclavian Artery Approach

RESIDENT SCHOLARLY ACTIVITY
Resident scholarly activity is overseen by Dr. Tetsuro Sakai, Director of Resident Research. The ACGME mandates that residents complete an academic assignment prior to the completion of their training. This assignment may include “grand rounds presentations, preparation and publication of review articles, book chapters, manuals for teaching or clinical practice, or similar academic activities.” Additionally, a resident may elect to participate in either clinical or laboratory research, the outcomes of which are expected to be suitable for presentation at the local, regional, or national level. In addition to departmental recognition, several residents received accolades for their scholarly activity in a variety of forums. Residents made the following presentations at regional, national, and international meetings:
<table>
<thead>
<tr>
<th>PGY-4 Authors</th>
<th>Title</th>
<th>Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ezeldeen Abuelkasem</td>
<td>Critical Evaluation of Clotting Times of Rotational Thromboelastometry</td>
<td>71st Post Graduate Assembly in Anesthesiology (PGA); New York City, NY</td>
</tr>
<tr>
<td>Ezeldeen Abuelkasem</td>
<td>Factor IX from Prothrombin Complex Concentrate Augments Low Tissue Factor Triggered Thrombin Generation - An Exploratory In Vitro Study</td>
<td>Association of University Anesthesiologists 2018 Meeting; Chicago, IL</td>
</tr>
<tr>
<td>Ezeldeen Abuelkasem</td>
<td>Factor IX from Prothrombin Complex Concentrate Augments Low Tissue Factor Triggered Thrombin Generation - An Exploratory In Vitro Study</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
</tr>
<tr>
<td>Kelsey Bauer</td>
<td>Crazy Catecholamines: Should vasopressin be standard of care for pheochromocytoma excision? A Pediatric Case of Pheochromocytoma</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Anna Carpenter</td>
<td>Quadratus Lumborum Nerve Block as an Alternative to Neuraxial Anesthesia in a Chronic Pain Patient on Anticoagulation</td>
<td>2017 American Society of Regional Anesthesia Conference; Orlando, FL</td>
</tr>
<tr>
<td>Kathleen Coy</td>
<td>General Anesthesia for Cesarean Delivery as Metric for Quality</td>
<td>2018 Society for Obstetric Anesthesia and Perinatology (SOAP) Meeting; Miami, FL</td>
</tr>
<tr>
<td>Diana DeAndrade</td>
<td>Hypotension and Airway Compromise During TAVR via Subclavian Artery Approach</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Alex Dressler</td>
<td>Tension Pneumothorax in the Prone Pediatric Patient</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Daniel Mandell</td>
<td>Preliminary Evaluation of Resident Structured Point-of-Care Ultrasonography (POCUS) Program</td>
<td>PARRC 2018; Philadelphia, PA</td>
</tr>
<tr>
<td>Daniel Mandell</td>
<td>Teaching Residents to Perform Ultrasound-Guided Cricothyroidotomy On Porcine Trachea: A Novel Training Modality</td>
<td>PARRC 2018; Philadelphia, PA</td>
</tr>
<tr>
<td>Daniel Mandell</td>
<td>Teaching Residents to Perform Ultrasound-Guided Cricothyroidotomy On Porcine Trachea: A Novel Training Modality</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Vladyslav Melnyk</td>
<td>A Case of Perioperative Cocaine-Induced Takotsubo Cardiomyopathy</td>
<td>2018 Society of Cardiovascular Anesthesiologists Meeting; Phoenix, AZ</td>
</tr>
<tr>
<td>Eugene Raggi</td>
<td>Regional Anesthesia for Elbow Fracture Dislocation Repair in a Patient with Severe Myasthenia Gravis</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Daniel Springer</td>
<td>Procedure Requiring Second Team in Operating Room (PRESTO): Experience with a New Approach</td>
<td>2018 SOAP Meeting; Miami, FL</td>
</tr>
<tr>
<td>Sara Straesser</td>
<td>A 10-Year Experience in International Mission Rotations in Anesthesiology Residency</td>
<td>PARRC 2018; Philadelphia, PA</td>
</tr>
<tr>
<td>Sara Straesser</td>
<td>Incidence of Medication Errors in Pediatric Anesthesia: A Retrospective Observational Study for Identification of a Possible Interventional Target</td>
<td>PARRC 2018; Philadelphia, PA</td>
</tr>
<tr>
<td>Lieu Tran</td>
<td>Red Blood Cell Transfusion in Pediatric Orthotopic Liver Transplantation: An Evaluation in 278 Cases</td>
<td>2018 Society for Pediatric Anesthesia (SPA)/ American Academy of Pediatrics (AAP) Meeting; Phoenix, AZ</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
<td>Meeting</td>
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<tr>
<td>Lieu Tran</td>
<td>Assessing Risk Factors for Challenging Pain Control in Patients Undergoing Major Abdominal Surgery with Enhanced Recovery After Surgery Program</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
</tr>
<tr>
<td>Elizabeth Ungerman</td>
<td>Burnout in Junior Anesthesiology Trainees: Effect of a Mindfulness Intervention</td>
<td>Society for Education in Anesthesia (SEA) 2018 Spring Meeting; Louisville, KY</td>
</tr>
<tr>
<td>Nicole Verdecchia</td>
<td>Incidental Finding of Severe Aortic Root Dilation and Aortic Insufficiency in a Child with Undiagnosed Connective Tissue Disorder</td>
<td>2018 SPA/AAP Meeting; Phoenix, AZ</td>
</tr>
<tr>
<td>Nicole Verdecchia</td>
<td>Effect of Low Volume, Analgesic Femoral Nerve Block on Sensation of the Lateral Femoral Cutaneous Nerve and the Saphenous Nerve</td>
<td>2018 World Congress on Regional Anesthesia &amp; Pain Medicine; New York, NY</td>
</tr>
<tr>
<td>Nicole Verdecchia</td>
<td>Can Anesthesiologists Distinguish Closely Associated Nerve Elements in the Interscalene Groove?</td>
<td>ASA 2017; Boston, MA.</td>
</tr>
<tr>
<td>PGY-3 Authors</td>
<td>Title</td>
<td>Meeting</td>
</tr>
<tr>
<td>Jonah Abraham</td>
<td>Central Cord Syndrome After Prolonged Fixation in Head Pins: A Case Report</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
</tr>
<tr>
<td>Steven Bartels</td>
<td>Vasoplegic Syndrome While on Cardiopulmonary Bypass for a Double Lung Transplant Treated with High-Dose vitamin B12 (Hydroxycobalamin)</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Lucas Davanzo</td>
<td>Anesthetic Management of Endovascular Embolization of a Mycotic Aneurysm in a patient with Hypoplastic Left Heart Syndrome</td>
<td>2018 SPA/AAP Meeting; Phoenix, AZ</td>
</tr>
<tr>
<td>Philip Carullo</td>
<td>Medical Device Innovation: Esophageal Occlusion Prior to Emergency Intubation</td>
<td>Society for Airway Management Annual Meeting; Newport Beach, CA</td>
</tr>
<tr>
<td>Philip Carullo</td>
<td>Acute Aortitis and Associated Mycotic Aneurysm in a Recently Stented Patient</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Nathan Hoaglund</td>
<td>How Much is Too Much? A Case of Using High Dose Dexmedetomidine in Alcoholic Patient</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Hayden Hundley</td>
<td>Designing a Total Care Clinic: An Anesthesiologists Utility in a Multidisciplinary Musculoskeletal Health Clinic at a Large Academic Medical Center</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Andrea Ibarra</td>
<td>Serotonin Syndrome in the Post-Operative Care Unit After Remifentanil Infusion: A Case Report and Literature Review</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Evan Lebovitz</td>
<td>Comparison of Clinical Productivity Metrics within an Academic Medical Center</td>
<td>PARRC 2018; Philadelphia, PA</td>
</tr>
<tr>
<td>Evan Lebovitz</td>
<td>Tracking Value Metrics in Anesthesiology Following Cessation of the Incentive Period: After the Thrill is Gone</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
</tr>
<tr>
<td>Evan Lebovitz</td>
<td>Mandatory Environmental Savings Initiative (MESI): Cost Comparison of Anesthetic Techniques in a Large University Hospital System</td>
<td>2018 ASA Practice Management Meeting; New Orleans, LA</td>
</tr>
<tr>
<td>Evan Lebovitz</td>
<td>Productivity Factors Impacting Generation of Total ASA Units Per Full-Time Equivalent in Anesthesiology</td>
<td>2018 ASA Practice Management Meeting; New Orleans, LA</td>
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<tr>
<td>Shawn Palmeri</td>
<td>Supraventricular Tachycardia in a Parturient with a History of Postpartum Thyroiditis</td>
<td>ASA 2017; Boston, MA</td>
</tr>
<tr>
<td>Shawn Palmeri</td>
<td>Competing Goals: Cesarean Delivery During Acute Chest Syndrome with Delayed Hemolytic Transfusion Reaction and Hyperhemolysis Syndrome</td>
<td>2018 SOAP Meeting; Miami, FL</td>
</tr>
<tr>
<td>Shawn Palmeri</td>
<td>General Anesthesia for Cesarean Delivery as Metric for Quality</td>
<td>2018 SOAP Meeting; Miami, FL</td>
</tr>
<tr>
<td>Brandon Staub</td>
<td>Understanding Revenue Streams: Prevalence of Substance Abuse in Inpatient Chronic Pain Patients at a Large, University-based Hospital</td>
<td>2018 ASA Practice Management Meeting; New Orleans, LA</td>
</tr>
<tr>
<td>Brandon Staub</td>
<td>Utilization of High Flow Nasal Cannula in Patient with Obstructive Sleep Apnea and Known Difficult Airway for Umbilical Hernia Repair.</td>
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<tr>
<td>Chelsey Woodrum</td>
<td>Competing Goals: Cesarean Delivery During Acute Chest Syndrome with Delayed Hemolytic Transfusion Reaction and Hyperhemolysis Syndrome</td>
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<tr>
<td>Chelsey Woodrum</td>
<td>Proctocolectomy in a Patient with Congenital Myasthenia Gravis and Crohn's Disease Dependent on Enteral Administration of Amifampridine</td>
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<tr>
<td>Liora Yehushua</td>
<td>Proctocolectomy in a Patient with Congenital Myasthenia Gravis and Crohn's Disease Dependent on Enteral Administration of Amifampridine</td>
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</tr>
</tbody>
</table>

**PGY-2 Authors**

<table>
<thead>
<tr>
<th>Title</th>
<th>Meeting</th>
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<tbody>
<tr>
<td>Financial Incentive, in Place of Non-Clinical Time, Improves Faculty Involvement and Increases Resident Didactic Evaluation Scores</td>
<td>SEA 2018 Spring Meeting; Louisville, KY</td>
</tr>
<tr>
<td>Resident Participation in a Fiberoptic Bronchoscopy Simulation Course is Associated with Increased Confidence and Competence</td>
<td>PARRC 2018; Philadelphia, PA</td>
</tr>
<tr>
<td>Gender Differences in Perioperative Hormonal and Inflammatory Stress Response During Cardiac Surgery: An Exploratory Data Analysis</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
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<tr>
<td>Assessing Risk Factors for Challenging Pain Control in Patients Undergoing Major Abdominal Surgery with Enhanced Recovery After Surgery Program</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
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<tr>
<td>Intraoperative Airway Compression in TAVR via Subclavian Artery Approach</td>
<td>PARRC 2018; Philadelphia, PA</td>
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<tr>
<td>Serratus Plane Block with PEC I/II Blocks Used to Prevent an ICU Admission for a Patient with Significant Medical Comorbidities</td>
<td>PARRC 2018; Philadelphia, PA</td>
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<td>Awake Ex. Lap: Diagnostic Exploratory Laparotomy Successfully Conducted Under Monitored Anesthetic Care with High Flow Nasal Cannula</td>
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</table>
## ANESTHESIOLOGY RESIDENCY PROGRAM

**DAVID G. METRO, MD, Director**

<table>
<thead>
<tr>
<th>PGY-1 Authors</th>
<th>Title</th>
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<tbody>
<tr>
<td>Leath Abdullah</td>
<td>Superficial Thoracic Plane Blocks as an Alternative to a Deep Regional Technique in Anticoagulated Patients</td>
<td>2018 World Congress on Regional Anesthesia &amp; Pain Medicine; New York, NY</td>
</tr>
<tr>
<td>Samuel Goldstein</td>
<td>Use of an Erector Spinae Plane (ESP) Block for Post-Operative Analgesia following Single Lung VATS in an Anticoagulated Patient</td>
<td>2018 World Congress on Regional Anesthesia &amp; Pain Medicine; New York, NY</td>
</tr>
<tr>
<td>Samuel Goldstein</td>
<td>Bilateral Serratus Anterior Plane Catheters for Post-Operative Analgesia after Double Lung Transplantation</td>
<td>2018 World Congress on Regional Anesthesia &amp; Pain Medicine; New York, NY</td>
</tr>
<tr>
<td>Alejandra Hernandez</td>
<td>Spinae Plane Block for Abdominal Surgery in Pediatrics Case Report</td>
<td>2018 World Congress on Regional Anesthesia &amp; Pain Medicine; New York, NY</td>
</tr>
<tr>
<td>Alejandra Hernandez</td>
<td>The Erector Spinae Plane (ESP) Block Provides Long Term Pain Relief in Chronic Pelvic Pain</td>
<td>2018 World Congress on Regional Anesthesia &amp; Pain Medicine; New York, NY</td>
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<tr>
<td>Christian Molzahn</td>
<td>Productivity Factors Impact Generation of Total ASA Units Per Full-Time Equivalent in Anesthesiology</td>
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<td>Neal Shah</td>
<td>Utilizing a “Value” Incentive to Rapidly Introduce Evidence Based Practice Across a Large Multihospital Health Care System</td>
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<td>Christopher T. Smith</td>
<td>Dysuria and Sterile Pyuria in a Kidney Transplant Patient: Ureaplasma Urealytica Urethritis</td>
<td>Society of General Internal Medicine Annual Meeting; Denver, CO</td>
</tr>
<tr>
<td>Christopher T. Smith</td>
<td>Midazolam Sedation During the Periodic Experience of Pain Decreases Functional Connectivity Both Within and Between Brain Systems for Pain Processing and Memory Encoding</td>
<td>IARS 2018 Annual Meeting and International Science Symposium; Chicago, IL</td>
</tr>
</tbody>
</table>

### SYSTEM-BASED PRACTICE PROJECTS

A system-based practice project is required of every PGY-4 resident. This project consists of identifying a system-wide problem/issue, addressing it by conducting appropriate research, and presenting an executive summary to the department’s site chiefs and key faculty upon completion. These projects represent complete investigations and potential solutions to departmental and system-wide clinical issues.
Dr. Rita M. Patel has directed the senior resident system-based practice projects since 1996. She provides the senior residents with two didactics sessions, introducing them to the process and formulation of a system-based practice project.

This year’s graduating residents presented the following projects under the mentorship of Dr. Patel, who provided direction and guidance during the project formulation process, oversaw the projects, and moderated the residents’ presentations to the faculty.

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Ezeldeen Abuelkasem</td>
<td>Preliminary UPMC Institutional Protocol for Fast Track Extubation of Liver Transplant Recipients: An Evidence-Based Approach</td>
</tr>
<tr>
<td>Kelsey Bauer</td>
<td>Suboxone and Perioperative Management</td>
</tr>
<tr>
<td>Ian Brotman</td>
<td>Sugammadex Versus Neostigmine for Neuromuscular Blockade Reversal: For the Patient and the Pocketbook</td>
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<tr>
<td>Anna Carpenter</td>
<td>Stocking Line Carts: Creating and Implementing a Checklist</td>
</tr>
<tr>
<td>Kathleen Coy</td>
<td>Modifiable Factors Associated with General Anesthesia for Cesarean Delivery</td>
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<tr>
<td>Douglas Curphey</td>
<td>Video-Education for Patients with Ambulatory Nerve Block Catheters</td>
</tr>
<tr>
<td>Diana DeAndrade</td>
<td>Counseling Patients Regarding Birth Control Drug Interactions</td>
</tr>
<tr>
<td>Alex Dressler</td>
<td>Pain Outcome Tracking: Patient Reported Outcome Data and Its Use in Improvement of Patient Care</td>
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<tr>
<td>Andrius Giedraitis</td>
<td>The Introduction of Vitamin B12 as a Standard Medication in the OR Pharmacy for Treatment of Vasoplegia</td>
</tr>
<tr>
<td>Daniel Mandell</td>
<td>Simplifying Perioperative Blood Ordering Sets: Educating Hands-on Providers</td>
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<tr>
<td>Vladyslav Melnyk</td>
<td>Facilitating OB Anesthesia New Trainee Orientation Through Pocket Reference Card</td>
</tr>
<tr>
<td>Kaarin Michaelsen</td>
<td>A Dangerous Game of Hide and Seek: Identifying the Anesthesia Code Button in UPMC Presbyterian and Montefiore ORs</td>
</tr>
<tr>
<td>Daniel Springer</td>
<td>Should I Stay Or Should I Go Now? Go! Go! Go!</td>
</tr>
<tr>
<td>Sara Straesser</td>
<td>Initiative to Reduce Medication Errors in Pediatric Anesthesia</td>
</tr>
<tr>
<td>Lieu Tran</td>
<td>Post-Operative Patient Hand-Off in the PICU: Increasing Use of the Cognitive Aid in Care Transition of the Pediatric Patient</td>
</tr>
<tr>
<td>Elizabeth Ungerman</td>
<td>Touch Here: McKesson Fingerprinting</td>
</tr>
<tr>
<td>Nicole Verdecchia</td>
<td>Glucometer Training: How Sweet It Is!</td>
</tr>
</tbody>
</table>

**SUMMARY**

Excellent clinical teaching and experience combined with a high volume and diversity of cases has always been a prominent feature of the program. Residents complete subspecialty rotations in pediatric, obstetric, critical care medicine, chronic and acute pain medicine, cardiac, neuro, thoracic, liver transplantation, and regional/ambulatory anesthesiology, PACU, and pre-operative evaluation.

The residency program continues to be nationally renowned for the quality of education provided, diversity and volume of clinical cases, and resident performance.
SIMULATION EDUCATION for Residents

Simulation training is an indispensable method used in resident clinical education. All anesthesiology simulation training takes place at the Peter M. Winter Institute for Simulation, Education, and Research (WISER), 230 McKee Place Suite 300, 3rd Floor Pittsburgh, PA 15213. WISER is a University of Pittsburgh institute with a mission to conduct research and training programs utilizing simulation-based education to provide a safer environment for patients of UPMC and its affiliates.

COURSES

ADVANCED CARDIAC LIFE SUPPORT (ACLS) (all residents)
Director: Theresa A. Gelzinis, MD
Traditional ACLS course taught by instructor. Specific content for anesthesiology residents.

CENTRAL VENOUS CANNULATION TRAINING (PGY-1 and PGY-2)
Director: Ryan C. Romeo, MD
Course content focuses on proper central line placement, including the use of ultrasound guidance and manometry for locating and verifying venous access sites. The course includes a web-based multimedia didactic emphasizing patterns of injury, site anatomy, central venous catheter indications and alternatives, as well as complication recognition and corrective maneuvers. A hands-on practical component is then undertaken at WISER using partial task trainers to develop psychomotor skills for the placement of internal jugular, subclavian and femoral lines. A strong focus is placed on ultrasound use and sterile techniques. Patient safety is emphasized at every opportunity.

INTRODUCTION TO ANESTHESIOLOGY SIMULATION (PGY-2)
Directors: William R. McIvor, MD, FASA; David G. Metro, MD, FASA
This course uses high-fidelity human patient simulation to help students develop the skills necessary for their first day of clinical care. Students practice airway management skills (facemask ventilation and endotracheal intubation via direct laryngoscopy), rehearse intravenous inductions of GET, establish maintenance anesthesia, and manage emergence. They also practice operating room set up, anesthesia machine check, and post-anesthesia care unit transport and admission. Prior to completing the course, participants perform a simulation that encompasses all the aforementioned aspects of anesthetic care.

DIFFICULT AIRWAY MANAGEMENT (PGY-2)
Directors: Joseph J. Quinlan, MD; Shawn T. Beaman, MD
All anesthesiology residents and fellows participate yearly in this simulation and Intranet-based training to develop a working knowledge of the American Society of Anesthesiologists (ASA) guidelines for approach to the difficult airway.

BASIC CRISIS RESOURCE MANAGEMENT (PGY-2)
Directors: Miriam Cremer, MD, MPH; William R. McIvor, MD, FASA
The goal of this course for participants to develop skills associated with the initial approach to common changes in the physiological status of patients receiving general anesthesia. Topics include an introduction to crisis resource management principles and basic first approaches to hypotension, hypertension, hypoxia, tachycardia, bradycardia, hypocarbia, and hypercarbia.

POCUS (Point of Care Ultrasound) (PGY-2)
Directors: Marek A. Radomski, DO, FACEP, RDMS; Christopher Schott, MD, MS
This rotation introduces trainees to the use of POCUS over four weeks. Students are exposed to the use of focused...
POCUS to make bedside clinical decisions for the care of acutely ill patients. POCUS is one of the most rapidly growing skills in contemporary medicine. It has spread from specific use in cardiology, obstetrics, and radiology to broader applications for virtually any organ system or procedural guidance.

**PERIOPERATIVE ULTRASOUND WORKSHOP (PGY-2)**  
*Director: Michael Boisen, MD*  
This course is designed to provide POCUS mini-lectures and skill stations covering the lungs/pleurae, cardiac ultrasound, abdominal/focused assessment with sonography for trauma, vascular ultrasound, and deep vein thrombosis to anesthesiology residents.

**NEURAXIAL INTRODUCTORY WORKSHOP**  
*Directors: Robert Krohner, DO; Kristin M. Odecko Ligda, MD, FASA*  
This introductory workshop covers neuraxial anesthesia topics.

**ANESTHESIA CRISIS LEADERSHIP TRAINING (PGY-2 through PGY-4)**  
*Directors: Thomas M. Chalifoux, MD; Joseph S. Goode Jr., MSN, CRNA; William R. McIvor, MD, FASA*  
All anesthesiology residents, fellows, and nurse anesthesia students participate yearly in this simulation and Intranet-based training to develop an understanding of potential medical errors and practice crisis-management skills.

**FIBEROPTIC BRONCHOSCOPY (PGY-2 through PGY-4)**  
*Director: Stephen M. McHugh, MD*  
All anesthesiology residents and fellows participate yearly in this simulation and web-based training to develop basic and advanced skills in fiberoptic bronchoscopy.

**ADVANCED DIFFICULT AIRWAY MANAGEMENT (PGY-3 through PGY-4)**  
*Directors: Shawn T. Beaman, MD; Joseph J. Quinlan, MD*  
This course teaches advanced concepts in the application of the ASA Difficult Airway Management algorithm.

**ANESTHESIA FOR LIVER TRANSPLANTATION (PGY-4)**  
*Directors: Charles D. Boucek, MD; Ibtesam A. Hilmi, MB, CHB, FRCA*  
The Department of Anesthesiology offers this six- to eight-hour course at WISER for anesthesiologist, residents, CRNAs, SRNAs, and fellow-visitors. This hands-on experience gives trainees the chance to provide anesthesia for orthotopic liver transplantation (LTX) in a simulation setting. The course is conducted by individuals with a special interest and experience in LTX anesthesia and emphasizes a multidisciplinary team approach that includes:

- Pre-operative assessment
- Operating room set up
- Placement of central venous access and insertion of wide bore venous lines for infusion of large volume
- Invasive monitoring
- Management of massive blood transfusion, coagulopathy, metabolic abnormalities, physiological hemostatic variables
- Special emphasis on veno-venous bypass issues

The course is conducted in the format of the most commonly seen clinical scenarios. After the end of each scenario, the instructor conducts debriefing and the whole episode is discussed in detail with the aid of video recording that is monitored during the performance. Attendees are given and expected to review reading materials prior to the course. A written test (multiple choice) is given before and after the course. Upon completing the course, attendees should understand perioperative management of LTX patients and be comfortable with invasive monitoring, assembling and using the rapid infusion system, thrombelastography interpretation, and management of massive blood loss and physiological hemostasis.
RESIDENCY PROGRAM - Clinical Base Year (PGY-1)

HISTORY
The UPMC Anesthesiology Residency Program first offered a clinical base year (CBY) program during the 2005-2006 academic year. Previously, the program had only offered advanced positions to residents after completing an internship in another department or program. Although many residency programs offer post-graduate year (PGY)-1 training spots, our department was one of the first of our peer programs to integrate a PGY-1 year curriculum within anesthesiology. The CBY program was designed for the 2005-2006 academic year by Drs. John P. Williams (former Chair, Department of Anesthesiology), Rita M. Patel (then Anesthesiology Residency Program Director and Vice Chair for Education), David G. Metro (then Associate Anesthesiology Residency Program Director), Joseph DeRenzo (department faculty member and inaugural director of the CBY program), and Shawn T. Beaman (Anesthesiology Chief Resident).

The first CBY class of six highly competitive interns completed rotations in acute pain, anesthesiology, critical care medicine (two months), emergency medicine (one month adult and one month pediatric), internal medicine (two months, inpatient floors), preoperative evaluation clinic, and general surgery (two months). This initial curriculum also allowed an elective month. Dr. Beaman served as director of the CBY program from 2006 until 2016 and strongly shaped it into its current dynamic training experience.

KEITH M. VOGT, MD, PHD
Director

PRESENT PROGRAM
Currently, 17 PGY-1 residents match into our CBY program each year. Mostly based at UPMC Presbyterian and UPMC Montefiore, all our interns now complete rotations in the following areas:

- Acute pain
- Anesthesiology
- Anesthesiology professional practice
- Cardiology consultation
- Cardiovascular ICU at UPMC Mercy
- Emergency medicine
- Head and neck surgery
- Internal medicine
- Medical ICU
- Pediatric emergency medicine at UPMC Children’s Hospital of Pittsburgh
- Transfusion medicine at UPMC Magee-Womens Hospital

Some representative clinical experiences that make our CBY program unique include the opportunity to surgically create and manage tracheostomies, discuss blood therapy with hematology experts, and care for both adult and pediatric medical and surgical patients across a wide variety of care settings and acuities. Residents finish the CBY year well-prepared to care for patients as they begin their advanced clinical anesthesiology training.

This breadth of clinical training would not be possible without the contributions from many excellent physician educators. We are thankful to the many faculty within and outside our department who helped develop these rotations and continually provide excellent educational experiences for the CBY program. The CBY residents also have their own monthly didactic series that includes faculty lectures as well as peer-education, as they each give a clinical presentation to their classmates.
The non-clinical opportunities provided as part of the CBY year are unparalleled in other anesthesiology training programs. First, the Anesthesiology Professional Practice rotation covers a broad spectrum of topics relevant to anesthesiology and the practice of medicine in general. As part of this rotation, all CBY residents are afforded the opportunity to attend the American Society of Anesthesiologists Annual Meeting in October. Finally, many CBY residents become active members of our department, often engaging in educational, quality improvement, or research projects during their first year of residency. Opportunities for independent conference presentations and publications are not uncommon during the CBY year, and these endeavors are fully supported.

RESIDENCY PROGRAM - APP ROTATION
KEITH M. VOGT, MD, PHD & TETSURO SAKAI, MD, PHD, MHA, FASA, Co-Directors

The Anesthesiology Professional Practice (APP) rotation for our clinical base year (PGY-1) residents was created in 2014, thanks to the vision and hard work of many in the residency program leadership. Since its inception, this dedicated one-month, non-clinical rotation has grown stronger each year. During the APP rotation, our new physician trainees come together as a class and learn about many broad issues surrounding the modern practice of anesthesiology and medicine. A complete listing of sessions is too long to include, but the didactic sessions center around content areas including the following:

- Research techniques and statistical methods
- Evidence-based medicine
- Authorship and publication
- Professional and licensure issues
- Leadership and mentorship
- Operation room management
- Quality improvement
- Patient safety
- Litigation involving medical practice
- Medical education
- Business of medicine
- Coping with patient complications
- Technology transfer
- Environmental impact of medical practice
- Resident wellness

The APP rotation also allows the interns to experience interactive sessions that intersect with these topic areas in which they hone their presentation skills, expand their computer knowledge, and shadow the charge anesthesiologist at UPMC Presbyterian. Along the way, each of them learns insightful things about themselves and how they interact with others while bonding as a residency class.

Finally, the APP rotation culminates with an opportunity for the entire class to attend the American Society of Anesthesiologists annual meeting. This mentored conference experience gives them broad exposure to the issues facing anesthesiologists nationally and allows them to explore in-depth their interests from the topics above covered in the rotation curriculum.

This unique rotation is a highlight of our residency training program. The APP experience lays a strong foundation for our residents’ subsequent clinical anesthesiology training and is extremely well-liked by the residents that have completed it. Our goal in providing this early exposure to these important topics is that we position each of our residents to become leaders in their future practices, regardless of what that setting ultimately becomes. We also hope to inspire them to become consummate physician professionals whose contributions to our specialty extend beyond providing clinical care.
2017-2018 RESIDENTS

PGY-1

Leath Abdullah, MD
Dustin Elswick, MD
Melissa Giraldo Duque, MD MS
Samuel Goldstein, MD
Alejandra Hernandez, MD
Daniel Huettner, MD

George Karam, MD
Andrew McNicol, MD
Christopher McNulty, MD
Christian Molzahn, MD MS
Kylie Muraski, MD
Lilinet Polsunas, MD*

Constantin Robles, MD
Neal Shah, MD
Aisha Ullah, MD
David Wang, MD
Michelle Yanik, MD
Edgar Zamora, MD

*Combined Pediatrics and Anesthesiology Residency Program

PGY-2

Douglas Adams, MD
Daniel Bintrim, MD
Anusari Dewasurendra, MD
Luke Doney, DO
Michael Gemma, MD
Lindsay Hahn, MD, Med

Maciej Klosowski, MD
Sofiane Lazar, MD
Sean McDermott, MD
Donald Miller, MD
Kelsey Mitchell, MD, MPH
Claudia Mulock, MD
PGY-2, CONTINUED

Kevin Pardo, MD  Kate Petty, MD  Tyler Smith, MD  Michael Sypert, DO  Annie Xu, MD

PGY-3

Jonah Abraham, MD  Marshall Bahr, MD  Steven Bartels, MD  Philip Carullo, MD  Luke Davanzo, MD  Nathan Hoaglund, MD

Hayden Hundley, MD MPH  Andrea Ibarra, MD  Patrick Kennedy, MD  Evan Lebovitz, MD  Eric Magda, MD  Courtney Mechling, MD

Shawn Palmeri, MD  Brandon Staub, MD MS  Chelsey Woodrum, MD  Liora Yehushua, MD
## GRADUATING RESIDENTS - JUNE 2018

<table>
<thead>
<tr>
<th>Name</th>
<th>Post-grad Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ezeldeen Abuelkasem, MBBCh</td>
<td>Faculty, UPMC</td>
</tr>
<tr>
<td>Kelsey Bauer, MD</td>
<td>Pain Medicine Fellowship, UPMC</td>
</tr>
<tr>
<td>Ian Brotman, MD</td>
<td>Pediatric Anesthesiology Fellowship, Children’s Hospital of Philadelphia</td>
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<td>Anna Carpenter, MD</td>
<td>Pain Medicine Fellowship, UPMC</td>
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<tr>
<td>Kathleen Coy, MD</td>
<td>Pain Medicine Fellowship, UPMC</td>
</tr>
<tr>
<td>Douglas Curphey, MD</td>
<td>Private Practice, Midwest Physician Anesthesia Services in Columbus, OH</td>
</tr>
<tr>
<td>Diana DeAndrade, MD</td>
<td>Adult Cardiothoracic Anesthesiology Fellowship, UPMC</td>
</tr>
<tr>
<td>Alex Dressler, MD</td>
<td>Pain Medicine Fellowship, UPMC</td>
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<td>Kaarin Michaelsen, MD PhD</td>
<td>Pediatric Anesthesiology Fellowship, Nationwide Children’s Hospital</td>
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<tr>
<td>Eugene Raggi, MD</td>
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The Resident Recruitment and Selection Committee is responsible for all aspects of resident selection. The 2018 interview season started in September with the opening of the Electronic Residency Application Service (ERAS). This is a service of the Association of American Medical Colleges that allows applicants to prepare their applications and then apply to multiple programs. In FY18, 1,126 ERAS candidates applied for 20 positions; 17 categorical, two advanced, and one combined anesthesiology-pediatrics. After the initial screening, applicants were offered interview spots with a target of approximately 16 applicants per interview day. Twelve interview days were conducted from mid-October through late January. Applicants were invited to an informal gathering of current residents the night before the interview. A casual atmosphere allowed applicants to meet all resident attendees and ask pointed questions about the program. The interview days started with a detailed overview of the residency program, including information about didactics, clinical experience, research opportunities, and clinical sites. The applicants were then welcomed by the Chair and the day was split into two interview sessions. Half of the candidates were interviewed in the morning by the Program Director, Associate Program Director, Chair of the Selection Committee, and two other attendings, while the other half were given a tour of UPMC Presbyterian and Montefiore. After a lunch attended by current residents, the groups were switched in the afternoon. In FY18, 185 applicants were interviewed for the 20 positions. After the final interview day, the entire Resident Education Committee met to review and assign a numerical score to each applicant. All committee members and current residents in attendance were voting members in the process. A final rank list was then prepared and submitted to the National Residency Matching Program. The process culminated with Match Day on March 16, 2018.

Our submitted rank list contained 179 applicants. As in past years, after the match, surveys were sent to the top 100 applicants who did not match with UPMC, asking them to compare multiple aspects of our program to the program they ultimately matched into. The information gained from these surveys helps the committee make changes to the interview process and perhaps changes to the program itself.

2018 MATCH RESULTS / 2018-2019 INCOMING RESIDENTS

Categorical Four-year Positions (PGY-1)
- Samuel Atherton, MD, University of Kansas School of Medicine
- Julian Broad, MD, Sidney Kimmel Medical College at Thomas Jefferson University
- Amanda Deis, MD, MS, University of Kansas School of Medicine
- Zachary Denham, MD, Ohio State University College of Medicine
- Michael Desciak, MD, Lewis Katz School of Medicine at Temple University
- Stephen Frabilitore, MD, The Brody School of Medicine at East Carolina University
- Tyson Gillmen, DO, Lake Erie College of Osteopathic Medicine
- Kevin Hansen, MD, University of Texas Southwestern Medical Center Southwestern Medical School
- Ryan Holden, MD, Drexel University College of Medicine
- Francesca Jung, MD, West Virginia University School of Medicine
- Anh Vinh Nguyen, MD, University of Pittsburgh School of Medicine
- Felicia Nip, MD, Michigan State University College of Human Medicine - Upper Peninsula (Marquette)
- Anthony Pannunzio, MD, Case Western Reserve University School of Medicine
- Elizabeth Pickle, MD, Georgetown University School of Medicine
- Holly Turula, MD, Lewis Katz School of Medicine at Temple University
- Wu Yin, MD, MBA, Vanderbilt University School of Medicine
- Aamir Zariwala, MD, Indiana University School of Medicine

Advanced Three-year Positions (PGY-1)
- Semerjit Bains, MD, Florida International University Herbert Wertheim College of Medicine
- Maria Cohen, MD, Northeast Ohio Medical University

Combined Anesthesiology/Pediatrics
- Stephanie Parry, MD, BSPH University of Nebraska College of Medicine
RESIDENT LEADERSHIP, 2017-2018

Resident leadership in AY18 focused on furthering resident wellness and providing more opportunities for residents to learn on both a professional and personal level. The academic year started with the establishment of a new junior chief role: Junior Chief of Wellness. This role would be geared towards providing residents with outlets to deal with the stress of residency and promoting resident wellbeing. Mentoring was also reinforced, both on a peer and faculty level. Faculty mentors were chosen by the chief residents and protected time was dedicated for residents to meet with their mentors at outside settings on various occasions. Peer mentoring sessions focused on open conversation between residents and provided residents exposure to meditation. One session also featured a financial planner who gave an informative lecture on the stressful topics of finances and disability insurance.

The chief residents made their goals known early by assisting with PGY-1 orientation and scheduling and participating in the APP rotation. They were also very active in recruitment and were consistently present during interview season. Each chief was responsible for overseeing two junior chief roles and were active in establishing, facilitating, and achieving different goals with each junior chief. Each chief was also responsible for serving on miscellaneous committees, both within the department and the Graduate Medical Education (GME) community. Additionally, the chiefs facilitated medical student mentoring, anesthesia interest, and resident mentoring for those seeking it.

From an education front, a monthly morning report was established at UPMC Presbyterian. This resident-driven and faculty-facilitated session was held throughout the academic year. The goal of this effort was to facilitate open discussion about complex case management amongst residents of all levels. The morning report has been very successful and has received fantastic feedback from both the residents and faculty.

Chief Positions

Elizabeth Ungerman, MD, MS – Chief Resident
Elizabeth entered the residency program from Drexel University College of Medicine. She has a BS in Chemistry from Carnegie Mellon University and a MS in Pharmacology from Georgetown University. Elizabeth completed her intern year in Internal Medicine at Allegheny General Hospital, where she was awarded Intern of the Year for 2015. After joining UPMC, she served as the Junior Chief of Advocacy, coordinating resident involvement and education on community, state, and national levels. She was involved in the Pennsylvania Society of Anesthesiologists (PSA) and attended the ASA Legislative Conference multiple times during her residency. She served as the Resident PSA Delegate at the 2016 ASA Conference and ran for office. She has three publications to her name and has presented posters at ASA, PARRC, SEA, SCA, and the UPMC GME conferences. In 2018, she was awarded one of the Best Poster awards at the GME conference. She was selected to give oral presentations at both the GME and SEA conferences. Elizabeth has been a member of the Allegheny County Medical Society (ACMS) and has served on the Board of Directors for the last two years. Additionally, she was selected to serve on the ACMS Awards Committee during that time. In AY18, she was involved in the Resident Education Committee (REC), the Professional Practice Committee, and the Graduate Medical Education Committee’s Subcommittee on Accreditation, Review, and Quality (ARQC). Elizabeth is currently an Adult Cardiothoracic Anesthesiology Fellow at UPMC and will be joining the cardiac team at UPMC Presbyterian starting in July 2019.

Nicole Verdecchia, MD – Associate Chief Resident
Nicole entered the program from Ohio State University College of Medicine, where she earned membership in the Alpha Omega Alpha Honor Medical Society prior to graduation. She has an undergraduate degree from the University of Pittsburgh. She served as one of the Junior Chiefs of Recruitment, successfully organizing over a dozen interview dinners. She has a multitude of research projects under her belt that have earned her four publications; on three of those, she was the first author. She has presented nine posters at national meetings, two of which have earned her Best Abstract awards. She has attended ASA, ASRA, SPA, and SOAP meetings. As a chief, she has actively served on the Competency Committee and the GME Committee. She has also been involved in the REC and Professional Practice Committee and has been instrumental in planning mentor/mentee sessions and mentoring the current Junior Chiefs of Recruitment. She is currently a pediatric fellow at UPMC Children’s Hospital of Pittsburgh and will be completing an Acute Pain fellowship at UPMC starting in July 2019.

Daniel Mandell, MD – Associate Chief Resident
Daniel entered the program as a graduate from Case Western University in Cleveland, Ohio. Prior to medical school, he obtained his undergraduate degree from the University of Pittsburgh. Dan previously served as one of the Junior Chiefs of Quality Improvement, becoming involved in many
projects, including implementation of low-dose tPA protocols during liver transplantation. Dan has been active in resident education, helping develop curricula for simulating invasive airway techniques on porcine trachea, teaching bedside echocardiographic examination of hemodynamically unstable patients, and organizing a new resident-run case conference series. As an Associate Chief Resident, Dan additionally ran quarterly resident patient-safety meetings and represented the residency program at system-wide patient safety meetings. Dan’s efforts have translated into six abstract presentations and two peer-reviewed publications. Dan is currently an Adult Cardiothoracic Anesthesiology fellow at UPMC and will be joining the cardiac team at UPMC Shadyside.

Junior Chief Positions

Advocacy: Philip Carullo, MD
Philip was very active as Junior Chief of Advocacy. He continued the long-standing tradition of our residents having 100% ASA Political Action Committee (ASAPAC) donations. At the 2017 ASA Conference, he served as the resident delegate, representing UPMC at the PSA meeting. He was also selected to serve on PSA’s Strategic Planning Committee, where he worked to help develop next year’s mission and agenda. He organized an interdepartmental charity event that raised over $8,500 for Light of Life. The event was sponsored by PSA, Pennsylvania Association of Nurse Anesthetists, and UPMC’s My Health. He was subsequently invited to attend the press release for National Safety Council’s Stop Everyday Killers, a reference to the opioid addiction epidemic. As Junior Chief of Advocacy, he led UPMC to the semi-finals in ASAPAC’s March Mayhem competition.

Wellness: Liora Yehushua, MD
Liora stepped into the new Junior Chief of Wellness position and made it her own. She did a fantastic job coordinating multiple anesthesia and interdepartmental events for residents. She helped organize multiple resident extracurricular activities and was instrumental in assisting with the charity event to benefit the Light of Life mission. She was responsible for assisting with Peer Mentoring and provided residents with wellness resources to promote overall wellbeing and satisfaction.

Education: Marshall Bahr, MD; Steven Bartels, MD
Marshall and Steven did a fantastic job furthering resident education in the department. They helped to organize a new monthly Morning Report at UPMC Presbyterian. This conference allowed residents to present difficult cases while residents of all levels worked through differential diagnoses and management. The program was faculty-moderated and received great feedback throughout the year. They also sent out board-style questions each week to engage residents in proactive studying. In addition, they created case cards for PGY-2 residents that summarized anesthetic plans for common cases at each clinical site. They were active members of the resident education committee and contributed to curriculum and lecture improvements.

Journal Club & Grand Rounds: Jonah Abraham, MD; Evan Lebovitz, MD
Jonah and Evan organized and facilitated the monthly Journal Club meetings that were led by the PGY-2 class. They assisted Dr. Stephen McHugh with mentoring and working through material with residents preparing for their respective presentations. During Grand Rounds, they both provided lectures on statistics and research methods. Jonah and Evan also were responsible for organizing resident presenters at national meetings, running mock presentations and facilitating research opportunities for residents.

Patient Safety/Quality Improvement: Hayden Hundley, MD; Andrea Ibarra, MD
Hayden and Andrea’s Junior Chief roles focused on reviewing two to three cases per month involving perioperative adverse events. Notably, they continued working on the Difficult Airway Management Project, which analyzed issues and outcomes during difficult airway cases. They were also responsible for continuing an interdepartmental project screening patients with penicillin allergies. They played an instrumental role in organizing patient safety meetings and represented the department at UPMC system-wide quality improvement (QI) meetings.

Recruitment: Courtney Mechling, MD; Shawn Palmeri, MD; Chelsey Woodrum, MD
Diana, Alex, and Nicole planned and coordinated all aspects of 12 unique pre-interview recruitment dinners during the 2016-17 resident recruitment season. They managed correspondence with applicants and coordinated logistics among current resident volunteers and potential residents, as well as helped plan interview days.

Technology: Eric Magda, MD
As Junior Chief of Technology, Eric was responsible for maintaining the MedHub resident page. He made it more user-friendly and worked with other junior chiefs to keep their projects updated and available. He was available throughout the year for resident references.

REC Subcommittees
- GME: Nicole Verdecchia, MD
- Clinical Competency Subcommittee: Nicole Verdecchia, MD
- QI: Daniel Mandell, MD
- REC Resident Representatives: Elizabeth Ungerman, MS, MD; Daniel Mandell, MD; Nicole Verdecchia, MD
- Professional Practice: Elizabeth Ungerman, MS, MD; Daniel Mandell, MD; Nicole Verdecchia, MD
- PSA House of Delegates: Philip Carullo, MD
- ARQC: Elizabeth Ungerman, MS, MD
The UPMC Anesthesiology Residency Program Class of 2018 (18 residents) engaged in many scholarly activities during their training. Of note, nine residents (Ezeldeen Abuelkasem, MBBCh; Anna Carpenter, MD; Diana DeAndrade, MD; Alex Dressler, MD; Daniel Mandell, MD; Sara Strasser, MD; Lieu Tran, MD; Elizabeth Ungerman, MD, MS; and Nicole Verdecchia, MD) elected to complete a one to six month research rotation in their junior/senior year to augment and complete scholarly activities. Dr. Abuelkasem completed a two-month research rotation in his junior year and the remaining four months of his senior year and spent several weeks at the University of Maryland under the research mentorship of Kenichi Tanaka, MD, MSc. His dedication in liver transplantation anesthesia and coagulation yielded 11 peer-reviewed publications, including nine original research articles, during his tenure of anesthesiology residency. Dr. Abuelkasem was awarded the Best Resident Scholar Prize at the 2018 Residency Program graduation ceremony.

We reviewed all scholarly activities reported to the Accreditation Council for Graduate Medical Education (ACGME). Resident scholarly activities based on work prior to entering our residency program were excluded. Also, intramural presentations (e.g. lectures, morbidity and mortality rounds presentations, journal club presentations) were excluded. Abstracts from the same study but at presented at different conferences were counted independently. Works authored by multiple residents were counted independently.

163 total scholarly products (9.1 products per resident) were generated by the Class of 2018:

- 29 peer-reviewed publications [19 (65.5%) articles first-authored by residents]:
  - 20 original articles (one article had two residents as co-authors)
  - four reviews
  - four case reports
  - one letter to the editor
- 121 abstract presentations:
  - 84 original studies and 37 case reports
  - 99 presented at national/international meetings and 22 at state/local meetings
- Two Department of Anesthesiology and Perioperative Medicine Educational Seed Grants (Drs. Daniel Mandell and Kaarin Michaelsen served as PIs of each respective grant)
- Four book chapters
- Four IRB study protocols
- Two other publications (society bulletin and online publication)

Peer-reviewed Publications Authored by the Class of 2018

Original Articles


Reviews


Case Reports


Letter to the Editor

We offer PGY-4 residents an opportunity to experience international anesthesiology at ISMETT. This two-month rotation allows residents to work with Sicilian anesthesiologists who specialize in cardiac, transplant and pediatric anesthesiology. Left to right: Drs. Gaetano Burgio and Giuseppe Chiarmonte; Chiara (anesthesia nurse); Drs. Maria Scarlata, Fabio Lullo, and Marco Farbo.

Living in Sicily for two months not only allows PGY-4 residents to experience anesthesiology on an international level, but also allows them the opportunity to learn about Sicilian culture. Here, Dr. Farbo and Dr. Pastore share an evening at Vucciria Market with PGY-4 resident Elizabeth Ungerman and introduce her to typical Sicilian street food; also pictured are some of sites and foods in Palermo.
The Anesthesiology Professional Practice rotation fully immerses our anesthesiology interns in both scholarly activities and anesthesiology professional practice knowledge for four weeks. In FY18, they visited the laboratories of Drs. Gregg Homanics, Yan Xu, and Pei Tang.

Team UPMC crushing it at the 5k Run for Warriors at ASA 2017

PSA luncheon at ASA 2017

PGY-2 residents Michael Sypert and Michael Gemma present at Journal Club

Resident PSA Meeting at ASA
We were excited to welcome a new group of residents to the UPMC Department of Anesthesiology and Perioperative Medicine Class of 2022, including incoming resident Vin Nguyen, MD pictured here with Dr. Metro at the Match.

PGY-4 resident Ian Brotman practices TEE with Dr. Subramaniam at WISER before starting his TEE elective.

Residents touring ISC Kentucky Cooperage before the SEA Conference in Louisville, KY.
PGY-2 resident Doug Adams posing with a statue of J. Graham Brown in front of the Brown Hotel in Louisville, KY at SEA 2018

Diana DeAndrade giving her final presentation during her research month. Her project focused on examining myocardial strain. PGY-4 residents have the opportunity to take research months to dedicate time to focused projects

UPMC Anesthesiology was well-represented at PARRC 2019 in Philadelphia

Nicole Verdecchia, Andy Hulme (class of 2017), and Dr. Steve Orebaugh at ASRA 2018

Dr. Kathirvel Subramaniam hard at work teaching PGY-4 residents TEE
PEDIATRICS-ANESTHESIOLOGY COMBINED RESIDENCY PROGRAM

PETER J. DAVIS, MD, Professor; Program Director  
ERICA L. SIVAK, MD, Assistant Professor; Associate Program Director  
KATHRYN (KARISA) WALKER, MD, Assistant Professor; Associate Program Director  
RHETT LIEBERMAN, MD, Assistant Professor of Pediatrics; Associate Program Director

The Departments of Pediatrics and Anesthesiology jointly offer this dual board acceptable opportunity to train in both specialties. The combined residency program is approved by both the American Board of Anesthesiology and the American Board of Pediatrics. At the end of the five-year program, residents will be eligible to become board-certified in both specialties. This rigorous academic program has complete and enthusiastic support from both departments.

The program is ideally suited for the applicant who is dedicated to the care of pediatric patients, but also desires adult anesthesiology experience, which is required for application for anesthesiology board certification. Candidates for this program will most likely have a desire to pursue further training in pediatric critical care, pediatric emergency medicine, pediatric anesthesiology, or pediatric pain medicine. Residents will be excellent and highly sought out candidates for fellowship programs throughout the country.

Peter J. Davis, MD, who is certified in both pediatrics and anesthesiology, is the program director for the combined residency. He is closely supported by Associate Program Directors Rhett Lieberman, MD, Department of Pediatrics Division of Pediatric Emergency Medicine, and Erica L. Sivak, MD, Department of Anesthesiology at UPMC Children’s Hospital of Pittsburgh. The program also has the full support and resources of Stephanie Dewar, MD and Andrew Nowalk, MD, PhD, Program Directors of the Pediatrics Residency, and David G. Metro, MD, Program Director of the Anesthesiology Residency.

Combined residents in the departments are afforded the same benefits that anesthesiology and pediatrics residents enjoy. The combined program fully complies with ACGME graduate medical trainee duty hour regulations and must comply with the ACGME core program requirements of each specialty.

During the 2016-2017 academic year, the program successfully recruited its first intern from a pool of 27 applications that were received. The program is approved for one resident per year of training. In 2017-2018, the program successfully recruited its second resident.

The first year of the combined program is similar to that for categorical pediatric residents, including continuity clinic. Additionally, residents attend one half day of anesthesia didactic sessions per month. Rotations include: General Inpatient Pediatrics, Subspecialty Experiences, Emergency Medicine, Neonatal Intensive Care Unit, and Term Newborn. The combined program residents will join clinical base year anesthesiology residents during the one-month Anesthesiology Professional Practice rotation.

The second year will be the same as that of a first-year anesthesiology resident, including the following rotations: Basic Anesthesiology, Post-Anesthesia Care Unit, and Pediatric Anesthesiology and the Preoperative Clinic. Beginning in the second year, the combined resident will maintain close ties with the Department of Pediatrics by maintaining a monthly continuity clinic – conducting both well child visits and acute illness follow-up appointments. The resident will also attend monthly pediatric didactic sessions. The Department of Anesthesiology values these responsibilities as imperative to the resident’s training and attendance at the pediatric clinic and didactics are guaranteed.

The program’s remaining three years will consist of advanced subspecialty rotations and elective time. The resident will alternate every six months between pediatrics and anesthesiology. Throughout the entire program, residents will maintain pediatric continuity clinic and didactics while on anesthesiology rotations and will attend anesthesiology didactics while on pediatrics rotations.
ADULT CARDIOTHORACIC ANESTHESIOLOGY

The Department of Anesthesiology and Perioperative Medicine offers an ACGME-accredited Adult Cardiothoracic Anesthesiology (ACTA) Fellowship Program with a clinical training length of one year and four fellow positions. Graduates of ACGME-accredited anesthesiology residency programs who seek advanced training in the management of patients presenting for adult cardiac, thoracic, and vascular surgery are invited to apply. The fellowship program received initial accreditation with commendation in July 2010 for three years, the maximum cycle length for a newly accredited program. In April 2014, the program received full continued ACGME accreditation with two commendations for the program’s substantial compliance with the ACGME’s Program and Institutional Requirements for Graduate Medical Education, as well as the quality of leadership, organization, record of scholarship, and the dedication of one morning each week for teaching. The ACTA fellowship program received its most recent ACGME Continued Accreditation in January 2018 as well as a commendation for the program’s demonstrated substantial compliance with the ACGME’s Program Requirements and/or Institutional Requirements without any new citations. The fellowship program is scheduled for a self-study evaluation and site visit in 2023.

Education/training occurs at two hospital locations: UPMC Presbyterian and UPMC Shadyside. An elective rotation is also available at UPMC Passavant. ACTA fellows receive advanced training in the subspecialty inclusive of: emergency and elective complex cardiothoracic surgery, perfusion/ventricular assist device theory and operation, surgical management of patients with electrophysiologic cardiac disturbances requiring cryoablation therapy and implantation of AICD/pacemakers, management of patients for minimally invasive implantable cardiac devices in the cardiac catheterization and electrophysiology lab, cardiothoracic critical care medicine, and heart/lung transplantation. The UPMC Presbyterian cardiac anesthesiology team participates in the ALIVE study, a minimally invasive technique for treatment of patients with left ventricular aneurysm.

In addition to advanced clinical training for the perioperative management of cardiothoracic and vascular surgery patients, ACTA fellows also obtain extensive experience with diagnostic perioperative transthoracic echocardiography (TEE) to develop their skills and meet the requirements necessary for certification in Advanced Perioperative TEE by the National Board of Echocardiography (NBE). A formal one-month introductory intraoperative TEE rotation is offered at UPMC Presbyterian to introduce fellows to the principles of echocardiography and methods to perform a diagnostic exam. This rotation is directed by the cardiothoracic anesthesiology faculty. A two-week elective in transthoracic echocardiography is also offered.

Fellows receive rotation goals and objectives at the beginning of the academic year for each clinical rotation along with a list of required reading material. One day per week is dedicated solely to academics. Didactic programs consist of intraoperative clinical teaching, weekly lectures, and case reviews based on topics related to cardiothoracic anesthesiology and quality improvement. Fellows participate in a weekly TEE review moderated by the cardiothoracic anesthesiology faculty and a monthly interdepartmental echocardiography conference that is held jointly with cardiothoracic anesthesiology, cardiology, cardiac surgery, critical care medicine fellows and faculty. A combined adult cardiothoracic anesthesiology faculty and fellow conference is held quarterly and includes case presentations, morbidity and mortality discussions, journal club, and quality improvement topics. Fellows also attend cardiothoracic surgery education sessions and departmental grand rounds that are held weekly.
FELLOWSHIP PROGRAMS

Fellows are encouraged to submit scholarly work for presentation at the annual Society of Cardiovascular Anesthesiologists (SCA) meeting. Fellows have been active participants in the SCA meeting over the past five years and have received recognition for outstanding presentations.

The ACTA fellowship program conducted another successful recruitment season, filling all their positions in the San Francisco Match with the program’s top choices. We look forward to having these fellows join us for the 2019-2020 academic year.

We are also happy to report that our program continues to enjoy a 100% first attempt passing rate for both the American Board of Anesthesiology Applied Exam and the NBE Advanced Perioperative TEE Exam. Congratulations to our fellows and our cardiothoracic anesthesiology faculty for this outstanding accomplishment!

FY18 Scholarly Activity

**Patrick Darga, MD**
- Internal presentation, Left Ventricle Systolic Quantification, 3/15/2018
- Interdisciplinary Echo Conference, ALIVE Trial: ALIVE Trial and TEE requirements, 9/26/2017

**Amany Gorgy, MD**
- Poster Presentation - Proximal Migration of TAVR into Left Ventricular Outflow Tract, SCA 40th Annual Meeting and Workshops, Phoenix, AZ, 4/28/2018
- Interdisciplinary Echo Conference presentation, PTE, 3/27/2018
- UPMC Grand Rounds: Pregnancy in Eisenmenger Patient, 3/14/2018
- Interdisciplinary Echo Conference, TAVR for Unicuspid Aortic Valve

**David Maerz, MD**
- Poster presentation: Hydroxocobalamin as a Rescue for Vasoplegic Syndrome, SCA 40th Annual Meeting and Workshops, Phoenix, AZ, April 28-May 2, 2018

**Timothy Rohman, MD**
- TEE Workshop Podium Presentation: Hemodynamic Evaluation and Calculations, 6/9/2018
- Poster Presentation: Less Invasive Ventricular Enhancement-The First in the United States, SCA 40th Annual Meeting and Workshops, Phoenix, AZ, 4/28/2018
- Interdisciplinary Echo Conference - The Disappearing and Reappearing Left Atrial Mass, 2/27/2018

ACA Fellow Post-graduation Plans

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<th>Name</th>
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<tr>
<td>Patrick Darga, MD</td>
<td>Adult Cardiothoracic Anesthesiology staff, Traverse Anesthesia Associates, Traverse City, Michigan</td>
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<tr>
<td>Amany Gorgy, MD</td>
<td>Adult Cardiothoracic Anesthesiology faculty, Temple University, Philadelphia, PA</td>
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<tr>
<td>David Maerz, MD</td>
<td>Adult Cardiothoracic Anesthesiology faculty, VA Pittsburgh Healthcare System</td>
</tr>
<tr>
<td>Timothy Rohman, MD</td>
<td>Adult Cardiothoracic Anesthesiology staff, Commonwealth Anesthesia Associates, Richmond, VA</td>
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The Critical Care Medicine (CCM) Fellowship Program in anesthesiology is one of the oldest and most established programs in the world. Fellows are trained to be excellent bedside physicians, educators, and researchers, following in the footsteps of giants like Drs. Peter Safar, Ake Grenvik, Jan Smith, Miroslav Klain, and James Snyder. The spirit of those leaders is still alive and most of the faculty work in perioperative settings in the operating room as well as the intensive care units (ICUs). In fall 2018, the arrival of a new chair in our department and an appropriate change in our name of the Department to “Anesthesiology and Perioperative Medicine” heralds even brighter horizons.

The program is unique in that it crosses two prominent departments in the School of Medicine, the Department of Anesthesiology and Perioperative Medicine and the Department of Critical Care Medicine. In addition, it is an integral part of the Multi-Disciplinary CCM Training Program, established by Drs. Peter Safar and Grenvik in the early 1960s. Fellowship training encompasses 12 months following the completion of an ACGME-accredited anesthesiology residency.

Fellows are exposed to a variety of critically-ill patients in diverse ICUs within UPMC. In addition to clinical care, fellows are exposed to research opportunities, scholarly projects, and instruction in teaching to prepare them for future careers. In addition to enhancing the clinical and educational aspects of the program, the fellowship program emphasizes research. Because of the 12-month duration of the fellowship, bench-based projects are not feasible. Therefore, fellows are provided the opportunity to continue research through second- or third-year NIH T-32 training grants. With abundant and excellent resources, faculty, facilities, patient volume and variety, the Anesthesiology CCM Fellowship Program provides exceptional experience and education in the field.

Murat Kaynar, MD, MPH was recognized for his leadership of the Anesthesiology Critical Care Medicine Fellowship, as well as his outstanding teaching, at the Department of Critical Care Medicine’s graduation ceremony on Saturday, June 2nd, 2018.

Dr. Kaynar successfully initiated international collaborations and will be visiting the University of Evry, Paris to further increase his collaborative research for an R01 grant on the role of zinc and other trace elements in the resolution of inflammation. Dr. Kaynar received a UPP grant to further his project on the same theme.

Nationally, the number of applicants to critical care anesthesiology programs has been decreasing over the last 10 years. However, after discussions with Drs. Rita M. Patel, David G. Metro, Mark Hudson, and Derek Angus, the visibility of Anesthesiology Critical Care Medicine as a career choice has been enhanced through the following efforts and the number of applicants to our program increased by over 30% despite the national decrease:

- A CCM interest group was established within the School of Medicine in addition to the fourth-year medical school elective. The Critical Care Medicine elective course (CCM 5430 MSIV), taught by Drs. Christopher Schott and Christopher Brackney, continues to have one of the highest enrollments amongst senior medical students (55 Pitt students and four visiting students).
- Anesthesiology residents now participate together with fellows in the CRISMA research seminars in the Department of Critical Care Medicine to expose them to research opportunities. Dr. Kaynar is the primary mentor for Dr. Michael Schnetz, NIH Research Scholar.
- Cooperation has increased between the Departments of Anesthesiology and Perioperative Medicine and Critical Care Medicine to identify prospective faculty from the training program. Dr. John Wallisch was recruited as a faculty member with an appointment to both departments. Fellowships 2017 graduate...
Alexander Preus, MD was appointed as Clinical Assistant Professor with Critical Care Medicine, performing services at UPMC Mercy. He also has an Anesthesiology appointment at the VA Pittsburgh Healthcare System.

- The program experienced a 3% increase in the number of residents (192) who rotated through intensive care units compared to FY17 and continues to host visiting residents both internally and nationally. Highly qualified and top rotation performers are prospective applicants to the Anesthesiology Critical Care Medicine Fellowship Program.

These efforts led to the seventh consecutive year of filling all four anesthesiology/CCM fellowship positions for academic year 2018-19, with a fellow mix of internal and external candidates. The program received 66 applications and interviewed 31 applicants for four positions. In addition to fellow recruitment efforts, the program continually sought new methods to improve recruiting current fellows for UPMC faculty positions.

Summary of Post-doctoral Fellows and Activities
The ACGME Anesthesiology Residency Review Committee reviewed the program and accredited it again for 10 years with commendations.

During FY18, the Anesthesiology Critical Care Medicine Fellowship Program experienced innovations and improvements such as the following:

- New Critical Care Medicine Faculty in the Cardiac Intensive Care Unit
- Involvement in the Recruitment Process of Future Fellows
- Assigning of a CCM Liaison in the Anesthesiology Residency Program
- Quality Improvement (QI) Projects
- Quality measures of teaching efforts
- New teaching programs, courses, and educational innovations

### Anesthesiology CCM Fellow Post-graduation Plans

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<th>Name</th>
<th>Future Plans</th>
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<tbody>
<tr>
<td>Rachel Pool, MD</td>
<td>St. Luke’s Hospital University Health Network, Bethlehem, PA</td>
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<tr>
<td>Jessica Cassavaugh, MD</td>
<td>Beth Israel Deaconess Medical Center</td>
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<tr>
<td>Hassan Aijazi, MD</td>
<td>Swedish Medical Center, Seattle</td>
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<tr>
<td>Devin Caswell, MD</td>
<td>Cleveland Clinic</td>
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**HEPATIC TRANSPLANTATION ANESTHESIOLOGY**

Hepatic Transplantation Anesthesiology (HTA) Fellowship training takes place at UPMC Presbyterian, a leading center of organ transplantation of the liver, small bowel, pancreas, and multiviscera. The HTA team is comprised of uniquely-qualified anesthesiologists who pioneered and developed the field of transplantation anesthesiology, including founding the International Liver Transplantation Society. The HTA fellowship program provides a comprehensive curriculum emphasizing perioperative care, with ample collaborative research opportunities with colleagues in surgery, hematology, and critical care medicine. By the end of the training year, fellows achieve sufficient qualification to become a Director of HTA in other major medical centers, thus joining the vast alumni of this highly-successful fellowship program.
Fellows’ primary responsibilities include preoperative assessment of transplant candidates, participation in candidate selection, intraoperative management, and postoperative visits. Preoperative consultation of transplant candidates is the main strength of the service. As true consultants, anesthesiologists provide hepatologists and surgeons with valuable information on extrahepatic organ function. All candidates are evaluated at the Thomas E. Starzl Transplantation Outpatient Clinic or as inpatients at UPMC. Preoperative information is discussed at weekly multi-departmental transplant morbidity and mortality conferences. Clinical information is exchanged on individual patients to improve patient care and recommendations are made to optimize patients for transplantation.

NEUROANESTHESIOLOGY

UPMC Presbyterian has an extraordinarily busy neurosurgical service, performing over 4,400 cases annually, with over 3,000 of those cases involving neurophysiologic monitoring. This translates into 10-12 neurosurgical operating rooms daily. In addition, we regularly provide patient care in interventional neuroradiology and for other diagnostic studies. A wide variety of cases are performed: spine and spinal cord work, surgical cases for carotid artery disease and intracranial vascular disease, microvascular decompression on cranial nerves, and a broad variety of tumor surgery and skull base work, much involving stereotactic or image guidance and trauma neurosurgery. Pediatric neurosurgery is performed at UPMC Children’s Hospital of Pittsburgh (CHP). In addition to adult neurosurgical cases at UPMC Presbyterian, fellowship rotations include neurophysiologic monitoring, neuroradiology, neurosurgical intensive care, and pediatric neuroanesthesiology at CHP. Research activities in neuroanesthesiology, brain resuscitation, and neurosurgical critical care continue to expand.

Opportunities exist for collaborative work with members of the Departments of Neurological Surgery, Neurocritical Care, or Neurophysiology, or with members of the UPMC Presbyterian neuroanesthesiology division, as well as work within the Safar Center of Resuscitation Research.

Monthly neuroanesthesiology division meetings are held at UPMC Presbyterian as part of the weekly UPMC Presbyterian anesthesiology conferences. Additionally, fellows attend weekly stroke conferences and the neurosurgical department meetings, including morbidity and mortality conferences.

Didactics focus heavily on intraoperative teaching, although non-clinical time is scheduled for academic pursuits, and a broad range of reference materials are available within the department. As fellows progress, they contribute to the teaching of the PGY-2-4 residents who rotate on the neuroanesthesiology service.

Clinical excellence in providing neuroanesthesiology care is the first goal of the fellowship. Individuals interested in developing teaching and research skills will have ample opportunity to do so. On completion of the neuroanesthesiology fellowship, the anesthesiologist will be ready to enter academic practice or assume a leadership position in neuroanesthesiology within a non-academic group.

The neuroanesthesiology fellowship program did not train any neuroanesthesiology fellows in academic year 2017-18, but continued to train fellows from various UPMC Critical Care Medicine programs and UPMC Neurology residents.
The Department of Anesthesiology at UPMC Magee-Womens Hospital (MWH) offers an Obstetric (OB) Anesthesiology Fellowship, with two positions available per year. MWH is one of the leading woman-care centers in the country, performing over 8,000 OB deliveries annually. Utilizing all methods and techniques of contemporary OB anesthesiology, the one-year fellowship offers fellows the opportunity to manage high-risk OB patients. Fellows’ responsibilities include clinical teaching and supervision of residents, medical students, and nurse anesthesia students. Scholarly activity includes the organization and preparation of didactic lectures, educational sessions, national presentation of research, facilitation of University of Pittsburgh School of Medicine courses, and seminars. In addition to teaching and instruction, special emphasis is placed on consulting, multidisciplinary coordination of patient care, improving oral presentation and writing skills, and academic research. Fellows receive interdisciplinary training in maternal fetal medicine, antepartum fetal testing, ICU, and neonatology. Additional instruction and education is provided in difficult OB airway management, ultrasound use, and OB crisis simulation and team training.

Opportunities to perform clinical research studies or basic science investigations in the discipline are numerous and scholarly activity is encouraged. Fellows participate in all facets of research, including study design, Institutional Review Board (IRB) protocol submission and approval, project implementation, data analysis, and manuscript preparation and submission for publication. Fellows initiate their own quality assurance and quality investigational studies through MWH’s own committee. The nationally-recognized Maternal-Fetal Medicine and Neonatology Departments and the Magee-Women’s Research Institute further enhance the environment for education in clinical research. Opportunities are available for active involvement and participation in a monthly multidisciplinary OB Crisis Team Training course. Fellows involved in the American Board of Anesthesiology oral or written board process participate in annual departmental review courses, if desired. A fellowship-specific fiber optic bronchoscopy and difficult airway management course specific to the OB patient is a requirement of the fellowship. A one-month elective opportunity is offered in a unique combined neurology and transfusion medicine elective.

Fellows are prepared for careers in academic medicine or leadership roles in an OB anesthesiology division of a major medical center. Faculty present and publish numerous research abstracts, case reports, and problem-based learning discussions at major anesthesiology meetings. OB faculty and fellows have presented at meetings including those of the Society for Obstetric Anesthesia (SOAP), American Society of Anesthesiologists (ASA), the International Anesthesia Research Society (IARS), Society for Education in Anesthesia (SEA), as well as various international and local meetings.

In the past year, two new teaching faculty members were added to the program: Dr. Nicholas Schott, who has expertise in regional anesthesia techniques and acute pain management, and Dr. Gerhardt Konig, who has expertise in biomedical engineering.

In June 2015, the OB Anesthesiology Fellowship program underwent a three-year site review by the Accreditation Council for Graduate Medical Education (ACGME) and was granted continued accreditation through April 2022.

Scholarly Activity
OB faculty and fellows authored 25 presentations, four electronic publications, and 22 journal papers in FY18, as well as nine book chapters and 11 abstracts.
The Department of Anesthesiology and Perioperative Medicine is proud to offer trainees a top-ranked highly competitive ACGME-accredited Pain Medicine Fellowship Program. The nationally recognized program and winner of the American Academy of Pain Medicine’s 2016 Pain Medicine Fellowship Excellence Award is the only one in the country that has received a maximum five-year ACGME accreditation three consecutive times. In April 2012, the ACGME accredited the program for five years with no citations and special commendation for the specific course of research programs. The program meets and exceeds the ACGME requirements set forth for pain medicine.

One of the unique aspects of the program is the truly multidisciplinary environment in which the fellows practice daily. Fellows are exposed to faculty within the division who bring expertise from a variety of medical specialties including anesthesiology, physical medicine and rehabilitation (PM&R), psychiatry, and neurology. Elective rotations afford fellows the opportunity to work with the palliative care service, the pediatric pain service at UPMC Children’s Hospital of Pittsburgh (CHP), neuroradiology, and a National Cancer Institute-designated Comprehensive Cancer Center at UPMC Shadyside. Fellows are exposed to additional services ranging from pain rehabilitation to interventional therapies to acute pain medicine to addiction medicine, which affords opportunities to learn from psychologists, physical therapists, and occupational therapists. Rotations with the neurosurgery and interventional radiology departments may be incorporated in the curriculum for additional surgical procedures performed at UPMC Presbyterian. The division also provides fellows the opportunity to participate in a unique group-based therapy programs designed for fibromyalgia, headache, and generalized chronic pain.

Scott Brancolini, MD, MPH is the Pain Medicine Fellowship Program Director. He was elected to the Board of the Association of Pain Program Directors as Secretary/Treasurer in FY16 and is now currently the President. Part of his service for this organization includes the development of a national curriculum that is based on his own work that can be disseminated to educate and be available to all pain medicine fellowships. He is an active member of the Society of American Anesthesiology Associations and Perioperative Medicine (SAAAPM). Additionally, he is a member of the American Society for Anesthesiology (ASA), the Society for the Education in Anesthesia (SEA), the American Society of Regional Anesthesia (ASRA), and the American Academy of Pain Medicine (AAPM). Dr. Brancolini is also the Chronic Pain Medicine Rotation Director for both residents (including those from anesthesiology, internal medicine, neurology, psychiatry, PM&R, family medicine, geriatric medicine, and radiology) and the University of Pittsburgh School of Medicine rotation for medical students. He is an active member of the UPMC Graduate Medical Education Committee, the Anesthesiology Resident Education Committee, and the Medical Student Education Committee. Dr. Brancolini newly also oversees the Pediatric Chronic Pain Medicine services at CHP.

Dr. Trent Emerick is the newly appointed Co-Associate Program Director. A former graduate of UPMC’s Anesthesiology Residency Program and Pain Medicine fellowship, Dr. Emerick also is the Chief of Quality Improvement (QI) for the Pain Medicine Division. He brings with him a wealth a valuable educational and research experiences to his new role.

Dr. John Hache continues to serve as CO-Associate Program Director. Also a former graduate of the UPMC Anesthesiology Residency and Pain Medicine Fellowship programs, he works in the fields of both pain medicine and anesthesiology and serves on multiple interdisciplinary committees, bringing valuable knowledge to our pain medicine fellows.

Recruitment
The UPMC Pain Medicine Fellowship hosts eight fellows entering at the PGY-5 level. The recruitment and interviewing process begins in June/July for the following academic year; the faculty that comprise the selection committee that interviews is truly multidisciplinary in that the fields of anesthesiology, PM&R, psychiatry, and neurology are all represented. Prospective fellows spend a day interviewing with key faculty and touring clinics within the division in the Pittsburgh area. In recent years, fellows have entered the program after completing accredited
residencies in anesthesiology, PM&R, neurology, emergency medicine, family medicine, and psychiatry. Physicians who have completed an ACGME-accredited residency may apply for a fellowship beginning each July. In 2017, the Pain Medicine Fellowship interviewed 56 applicants over the course of three days; the program participates in the National Residency Matching Program and the Electronic Residency Application Service. A total of 281 applications were submitted for the 2018-2019 academic year (AY). In the 2019 AY, the UPMC Pain Medicine Division faculty warmly and excitedly welcomed 2018 pain medicine fellow graduate and T32 scholar Dr. Benedict Alter, who will both continue his research and work clinically, seeing patients at UPMC St. Margaret.

Tracks
The program offers three tracks for fellows to achieve a first-rate education and training in pain medicine. The first track is a traditional one-year, clinically-based fellowship. The second track is for anesthesiology residents interested in continuing research and receiving clinical research training. The third option is for physicians who are interested in pursuing clinical or basic science research for a longer period; they receive more extensive training by completing a one-year fellowship followed by two years of research funded in part by NIH T32 programs. The Department of Anesthesiology and Perioperative Medicine is one of a select group of academic medical centers in the country accredited to offer two NIH-funded T32 positions per academic year. Productive research and scholarly activities are encouraged and supported.

Education
The UPMC Pain Medicine education and clinical training occurs at multiple locations: UPMC Montefiore and Presbyterian, UPMC St. Margaret, Centre Commons in Shadyside, UPMC McKeesport, UPMC Passavant, UPMC Mercy, UPMC Southside PM&R, CHP, and UPMC Monroeville Surgery Center. Multiple locations expose trainees to a variety and multitude of physicians and practice settings. Fellows spend approximately two months at each site to enhance the longitudinal clinical experience as well as required education in the disciplines of neurology (eight weeks), psychiatry (eight weeks), PM&R (four weeks), radiology, palliative care, cancer pain, neurosurgery, and elective time (four weeks, combined). With the addition of Dr. Brancolini to CHP, fellows will now be able to gain further exposure to pediatric pain medicine.

Fellows receive goals and objectives at the beginning of each clinical rotation and a list of required reading materials. Educational programs consist of written didactics, internet websites, clinical and cadaver courses, tutorials, morbidity and mortality conferences, journal clubs, a pharmacology course, and a pain board key word course to aid in preparation for board certification. This fundamental knowledge is complemented by assigned readings from the literature and clinical presentations about pain syndromes and pain management. Additionally, journal clubs and morbidity & mortality conferences are held quarterly regarding up-to-date subject matter, and the entire division congregates biannually for a pain medicine retreat that focuses on best practice, patient safety, and other medical knowledge and systems-based practice competencies.

The fellowship made changes to the AY17-18 curriculum based on new developments and prior feedback. The Pain Medicine Fellowship Grand Rounds Series (CME-approved) was revised based on feedback from last year’s evaluations. Multiple new lectures were added; examples include new overviews of medical cannabis, buprenorphine for substance abuse disorder, and the treatment of psychiatric disorders. Last year, the Pain Medicine Fellowship also offered a four-week ultrasound workshop course and additional new didactics in the form of our annual Pain Medicine Retreat and UPMC Update in Anesthesia, Pain, and Intensive Care Conference. The fellowship continued to update and develop the preexisting key word database bank to help their study and preparation for the In-Training and Pain Medicine Board exams. The Pain Medicine Board pass rate for our previous fellows is currently 100% for all fellows able to take the exam.

Under the direction of Drs. Brancolini and Emerick, the UPMC Pain Medicine Research Committee will be entering its fourth year of collaboration between trainees interested in pain medicine and faculty sponsoring research projects. This ongoing multidisciplinary committee meets annually to attract trainees and students interested in pain medicine research. Also, ongoing in the past year was the continuation of the Pain Medicine Patient Safety Committee. Meeting weekly under the direction of Dr. Brancolini, fellows are required to present a patient safety
case study. In these group discussions, elements of patient safety, “near miss” situations, and root cause analyses are reviewed.

**Evaluation and Competence**
Fellows are evaluated by faculty at the end of every clinical rotation based on the ACGME milestone guidelines. These evaluations are then made available to the fellows for their review. Evaluations, clinical progress, and any other issues are also discussed with the program director during their semi-annual meetings. Fellows evaluate both the faculty and the educational value of each clinical rotation. Lastly, 360-degree evaluations, where feedback is solicited from nurses and other ancillary staff regarding the performance and attitude of the fellows, are a required component of the fellowship program. The ACGME pain medicine milestones are fully incorporated into the fellow evaluation system. In this process, objective data evaluating each fellow in different areas must be collected and assessed in compliance with ACGME guidelines.

**Pain Medicine Fellow Post-graduation Plans**

<table>
<thead>
<tr>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>Jessica Albasha, DO</td>
<td>Private practice in Chicago, Illinois</td>
</tr>
<tr>
<td>Benedict Alter, MD, PhD</td>
<td>T-32 scholar, Pain Medicine faculty at UPMC St. Margaret</td>
</tr>
<tr>
<td>Youngeun Cho, MD</td>
<td>Private practice in Portland, Oregon</td>
</tr>
<tr>
<td>Hans Knopp, DO</td>
<td>Private practice, pain medicine, Hartford, Connecticut</td>
</tr>
<tr>
<td>Jaisha Mathew-Samuel, MD</td>
<td>Assistant Clinical Professor, Division of Interventional Pain, Department of Supportive Care Medicine, City of Hope, Duarte, CA</td>
</tr>
<tr>
<td>Abhishek Patel, DO</td>
<td>Private practice pain management group, Synovation Medical Group, Palm Springs, California</td>
</tr>
<tr>
<td>Daniel Sandusky, MD</td>
<td>Private practice, pain medicine, Lehigh Valley, PA</td>
</tr>
<tr>
<td>Aaron Trimble, MD</td>
<td>Private Practice, General Anesthesiology, Rochester, NY</td>
</tr>
</tbody>
</table>

**PEDIATRIC ANESTHESIOLOGY**

The ACGME-accredited Pediatric Anesthesiology Fellowship Program is designed to develop trainees’ clinical skills in pediatric anesthesiology and prepare graduates to be leaders in their field.

Over 80 candidates apply through the National Residency Matching Program for nine ACGME-approved positions each year in the UPMC Pediatric Anesthesiology Fellowship Program. The program is now getting ready for its seventh year in the match. In Spring 2017, pediatric anesthesiology fellowships began using Electronic Residency Application Service.

Dr. Erica Sivak moved from Pittsburgh. We made two Associate Program Director positions; Drs. K. Karisa Walker and Greg McHugh will each bring their expertise to the fellowship program. Dr. Walker completed her anesthesiology residency at Yale and her pediatric anesthesiology fellowship at The Children’s Hospital of Boston. She is currently working towards her Masters of Medical Education. Dr. McHugh completed both his anesthesiology residency and pediatric anesthesiology fellowship at UPMC. He is one of the operating room board runners and is administratively involved with the perioperative management of the operating room.

Program director Dr. Franklyn Cladis was promoted to a Full Part Two Examiner for the American Board of Anesthesiology (ABA) and was a co-editor of the ninth edition of the textbook Smith’s Anesthesia for Infants and
Children released in January 2017. In addition, he serves on the board of directors for the Society for Education in Anesthesia (SEA). He is also a member of the board of directors for the Society for Pediatric Anesthesia (SPA) and President of the Pediatric Anesthesia Program Directors Association.

Over the past six years, three workshops have been developed for the pediatric anesthesiology fellows. These include a pediatric hands-on regional workshop, a hands-on point-of-care ultrasound workshop, and a conflict resolution workshop.

Pediatric anesthesiology fellows continue to participate with in situ simulation. Every other Thursday, pediatric attendings, PACU nurses, and fellows run an on-site multidisciplinary mock code in the PACU. Feedback is provided immediately after the code. This process has helped improve system-based issues and improve patient care at UPMC Children’s Hospital of Pittsburgh (CHP).

The ABA continues to offer sub-specialty certification in pediatric anesthesiology. Dr. Franklyn Cladis continues to participate in the question-writing process as a Senior Exam writer. The CHP faculty members are subspecialty-certified in Pediatric Anesthesiology. All the 2017-18 fellows that took the Part 2 ABA Applied Exam passed and are now board-certified anesthesiologists.

The Pediatric Pain Medicine Service continues to significantly augment fellows’ experience with peripheral nerve blocks. The ACGME requires fellows perform a minimum of 11 peripheral nerve blocks. Each pediatric fellow performs on average 50-60 peripheral nerve blocks; the service provides approximately 2,000 pediatric peripheral nerve blocks per year and is one of the most well developed pediatric regional services in the country.

Pediatric anesthesiology fellows have a one-month critical care experience in the cardiac ICU (CICU). They must complete a two-month pediatric cardiac anesthesiology rotation prior to the CICU rotation. The cardiac anesthesiology rotation prepares them with patient care, medical knowledge, system-based practice, and interpersonal skills to manage CICU patients. During the CICU month, the fellow is expected to become part of the care team and participate in daily rounds. They also provide sedation care for patients that must travel to off-site locations (interventional radiology, MRI) for imaging or interventions.

CHP continues to be one of the highest volume centers for pediatric liver transplantation. Fellows provide anesthesia for two to three pediatric liver transplants on average throughout the year. We insure that each fellow has the opportunity to perform anesthesia for liver transplants through a home-call system. In addition to in-house call, fellows can be called in from home only for transplants. Since implementing this home-call system, all fellows perform two to three liver transplants.

Pediatric Anesthesiology Fellow Post-graduation Plans

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Mallory Bugel, MD</td>
<td>Attending at UPMC Children’s Hospital and UPMC Mercy Hospital, Pittsburgh PA</td>
</tr>
<tr>
<td>Melanie Hodge, MD</td>
<td>Attending at UPMC Children’s Hospital and UPMC Mercy Hospital, Pittsburgh PA</td>
</tr>
<tr>
<td>Meagan Horst, MD</td>
<td>Private Practice in Chambersburg, PA</td>
</tr>
<tr>
<td>Ashley Kydes, MD</td>
<td>New York University (NYU), New York</td>
</tr>
<tr>
<td>Scott Licata, MD</td>
<td>Attending at UPMC Children’s Hospital of Pittsburgh, Pittsburgh PA</td>
</tr>
<tr>
<td>Stephanie Pan, MD</td>
<td>Acute Pain and Regional Anesthesia Fellowship at UPMC GME program</td>
</tr>
<tr>
<td>Garrett Roney, MD</td>
<td>Oakland Children’s Hospital, Oakland, CA</td>
</tr>
<tr>
<td>Lindsey Rutland, MD</td>
<td>Dell Children’s Hospital, Austin, TX</td>
</tr>
<tr>
<td>Lindsay Stollings, MD</td>
<td>Attending at UPMC Children’s Hospital of Pittsburgh, Pittsburgh PA</td>
</tr>
</tbody>
</table>
**PEDIATRIC CARDIOTHORACIC ANESTHESIOLOGY**

The Pediatric Cardiotoracic Anesthesiology Fellowship program offers advanced training in the anesthetic management of patients with congenital heart disease and includes surgical and non-surgical intervention, as well as critical care management. The program requires that the fellow applicant has completed an approved pediatric anesthesiology fellowship.

The program training length is 12 months. The fellowship is structured with six months spent in the pediatric cardiac operating room working alongside other pediatric anesthesia fellows, two months spent in the cardiac intensive care unit, one month of cardiac imaging, one month working with perfusion, and one month of research/elective work. Fellows will spend approximately one day a week during throughout their fellowship functioning as an attending in the general OR and cath lab.

**REGIONAL ANESTHESIOLOGY**

The Regional Anesthesiology and Acute Pain Medicine Fellowship Program consists of 12 months of subspecialty training for qualified physicians who have completed an ACGME-accredited anesthesiology residency. Fellowship training is concerned with the development of expertise in the practice and theory of acute pain management and regional anesthesiology and the understanding of the related physiology and pharmacology in the provision of patient care.

The core clinical curriculum includes five months focusing on regional anesthesiology, three months on acute pain medicine, and two weeks on chronic pain medicine. Experiences in pediatric regional anesthesia and trauma complete the curriculum. Fellows choose electives based on their area of interest and include: research, acupuncture, scientific auriculotherapy, neurology, and blood banking. Fellows rotate at UPMC Presbyterian, UPMC Shadyside, UPMC Mercy, UPMC Passavant, UPMC Children’s Hospital of Pittsburgh, and UPMC Magee-Womens Hospital for the inpatient regional and acute pain rotations. For ambulatory training, fellows rotate at UPMC South Surgery Center, UPMC Passavant Cranberry, and the UPMC Harmarville ambulatory centers. Fellows rotate through the outpatient pain medicine clinic at UPMC St. Margaret, which directed by Scott Brancolini, MD, MPH, Pain Medicine Fellowship Director for the chronic pain rotation.

Fellows were asked to attend mandatory Regional Anesthesiology and Acute Pain Medicine Grand Rounds every Wednesday from 5:00-6:00pm. This series was organized by Drs. Anna Uskova and Sharad Khetarpal. The Grand Rounds series is composed of lectures, cases, and audience participation sessions to address medical knowledge, clinical care, communications, professionalism, systems-based practice, and practice-based improvement, as well as a monthly journal club. In addition, the curriculum included pediatric regional ultrasound workshops and anatomic cadaveric workshops. The pediatric regional ultrasound workshop is organized by Dr. Franklin Cladis and attended by both pediatric anesthesia and regional anesthesia fellows to stress a multidisciplinary approach; live standardized patients are utilized in these workshops. The anatomic cadaveric workshops led by Dr. Steven Orebaugh focus on upper and lower extremity nerves for regional anesthesia anatomy. Regional fellows are split...
into two groups while learning to properly and successfully perform neuraxial and peripheral nerve blocks (PNBs) in patients.

This Grand Rounds series is attended by fellows and faculty. The series’ goals and objectives are to keep faculty and fellows updated on the knowledge of regional anesthesia and acute pain medicine, provide a platform to discuss the latest guidelines and techniques to provide optimum patient care, and maintain up to date knowledge on the current literature and guidelines to better inform patients about the risks and benefits of regional anesthesia and acute pain. The list of the didactic lectures for FY18 is listed as follows:

**Summation of Grand Rounds Topics and Didactics**

- Introduction to AIPPS
- Informed consent and medico-legal considerations
- Paravertebral Block
- Transverse abdominis plane (TAP) and other supplemental blocks
- Ultrasound: basic principles, knobology, safety, applications, and limitations
- Pediatric Regional Ultrasound Symposium
- Multimodal analgesia
- Upper and lower extremity: anatomy review
- Lower extremity blocks: lumbar plexus, femoral nerve, adductor canal, obturator, etc.
- Lower extremity blocks: different approaches to the sciatic nerve block
- Enhanced Recovery After Surgery (ERAS) protocols (orthopedic surgery, colorectal surgery)
- Chronic pain / treating acute pain in chronic pain patients
- Upper extremity blocks: approaches, practical applications
- Toward your next job: Applying the Acute Pain Medicine Fellowship
- Opioid pharmacology (including patient-controlled analgesia, alternative opioids, alternative method of administration)
- Spinal and epidural for postoperative analgesia
- Neuraxial (spinal and epidural) anesthesia/ Adjuvants for surgical Anesthesia
- Local anesthetic adjuvants
- Pediatric regional anesthesia
- Acute pain medicine and patient outcome (short term, long term)
- Local anesthetic pharmacology and toxicity
- Opioids, opiate abuse and dependence
- Neurologic outcomes of PNB
- Closed claims and liability
- Maintenance of Certification in Anesthesia
- Anticoagulation and regional anesthesiology
- Regional Anesthesia in trauma/burn patients
- Death by PowerPoint
- Auriculotherapy
- Oncologic aspects of anesthesia and pain management
- Regional anesthesia for ambulatory surgery
- Controversies in regional and acute pain medicine
- Billing and compliance in acute interventional pain service
- Acupuncture
- Anticonvulsants in pain management
• Complications in regional anesthesia
• Case studies: complications of regional anesthesia
• Organizing a pain service: where do I start?
• Blocks of the head and neck (airway blocks, facial blocks; blocks for thyroid and carotid surgery)
• How to develop an acute pain and regional anesthesia service

During the five-month of regional anesthesiology rotation, fellows are expected to achieve the necessary level of expertise to be familiarized with the indications, contraindications, techniques, and complications of regional anesthesia techniques including neuraxial blocks and PNBs. Under appropriate supervision, fellows perform lower and upper extremity nerve blocks, paravertebral blocks, thoracic truncal blocks (PECS I, PECS II, serratus anterior), and quadratus lumborum and TAP blocks. Blocks involved both single shot and continuous techniques. Emphasis was placed on both ultrasound-guided and neuro-stimulation techniques. A unique experience in pediatric regional anesthesia is provided through a rotation at UPMC Children’s Hospital of Pittsburgh under the direction of Dr. Mihaela Visoiu. The regional anesthesiology rotations also focus on a variety of treatment modalities such as multimodal approaches, including single and continuous PNB (inpatient and ambulatory) techniques.

During their 12-week acute pain rotations, fellows are involved in the care of patients on the Acute Pain Service, including being responsible for the management of regional techniques performed to enhance patient recovery as a part of a multimodal approach. Management of patients into the postoperative period in association with ERAS protocols was emphasized when appropriate. These rotations are also an opportunity for the fellow to improve their cognitive, psychomotor, and affective skills to safely and effectively provide acute pain management in surgical and non-surgical patients.

In FY18, fellows contributed to 26,592 consults and visits, including 8,643 pre-procedure consults and 17,949 postoperative visits performed by the Acute Interventional Perioperative Pain & Regional Anesthesiology Division. Under faculty supervision fellows also performed an average of 1,327 blocks for a total of 15,935 blocks in FY18. This included 9,527 extremity blocks (3,262 upper extremity and 6,265 lower extremity) and 6,397 truncal blocks. Each fellow on average performed 510 continuous nerve blocks.

**Regional Anesthesiology Fellow Post-graduation Plans**

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<thead>
<tr>
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<tbody>
<tr>
<td>Mazin Albert, DO</td>
<td>Academic - Allegheny Health Network - Forbes Hospital, Pittsburgh, PA</td>
</tr>
<tr>
<td>Rajamani Battula, MD</td>
<td>Private Practice - Florida</td>
</tr>
<tr>
<td>Jazelle Campbell, MD</td>
<td>Private practice in Hartford CT, Woodland anesthesia associates</td>
</tr>
<tr>
<td>Hector Casiano-Pagan, MD</td>
<td>Chronic Pain Fellowship - John H. Stroger Jr. Hospital of Cook County, Chicago, IL</td>
</tr>
<tr>
<td>D’Onior Felton, MD</td>
<td>Anesthesia Company LLC, in Annapolis MD</td>
</tr>
<tr>
<td>Karthik Hiremath, MD</td>
<td>Private Practice - Vassar Brothers Medical Centre, Poughkeepsie, NY</td>
</tr>
<tr>
<td>Nicole Hollis, DO</td>
<td>Academic - West Virginia University, Morgantown, WV</td>
</tr>
<tr>
<td>Andrew Hudson, MD</td>
<td>Private Practice - Upper Chesapeake Hospital</td>
</tr>
<tr>
<td>Archana Hudson, MD</td>
<td>Private Practice - St. Joseph’s Medical Centre</td>
</tr>
<tr>
<td>Niranjan Maganti, MD</td>
<td>Undecided at press time</td>
</tr>
<tr>
<td>Ata-ul Rahman, MD</td>
<td>Private Practice - U.S. Anesthesia Partners - Colorado</td>
</tr>
<tr>
<td>Wayne Wang, MD</td>
<td>Private Practice - Overlook Medical Centre, Summit, NJ</td>
</tr>
</tbody>
</table>

PITTSBURGH JOURNAL OF ANESTHESIOLOGY AND PERIOPERATIVE MEDICINE 61
On June 15, 2018, the UPMC Anesthesiology resident and fellow classes of 2018 celebrated their graduation at the University Club in Oakland, PA surrounded by their friends, family, colleagues, and mentors.

The following faculty were awarded honors for excellence in clinical teaching, as demonstrated by excellent evaluative feedback by trainees and their contributions to education, and were acknowledged during the ceremony:

- Ryan Ball, MD
- William Jones, MD
- Amy Kemp, MD
- K. Grace Lim, MD, MS
- Scot Muir, MD
- Daniel Pickle, MD
- Hulimangala Rakesh, MD
- Mahesh Sardesai, MD
- Brian Williams, MD, MBA

The following awards were also presented at the event:

- Ezeldeen Abuelkasem, MBBCCh, MSc: Mark H. Gilliland, MD Award for Best Clinical Resident, UPMC Department of Anesthesiology and Perioperative Medicine. This annual award honors the memory of a former chief resident in anesthesiology.
- Carl Daltner, MD: Dr. Leroy Harris Award for Excellence in Teaching. This award was chosen by the UPMC Anesthesiology residents.
- Eugene Raggi, MD: Award for Excellence in Teaching (Trainee to Trainee). The awardee of this honor is chosen by the by the UPMC Anesthesiology residents.
- Ezeldeen Abuelkasem, MBBCCh, MSc: Best Scholarly Resident Award in recognition of the Most Productive Resident Scholar, UPMC Department of Anesthesiology and Perioperative Medicine.
- Tetsuro Sakai, MD, PhD, MHA, FASA: The Dr. Peter M. Winter Award for Excellence in Medical Student Teaching, for his outstanding contributions to Medical Student Education, UPMC Department of Anesthesiology and Perioperative Medicine.
MEDICAL STUDENT PROGRAMS

The Department of Anesthesiology and Perioperative Medicine medical student programs are recognized nationally as among the best in the nation. Under the leadership of Dr. Michael Mangione, faculty members continued their enthusiastic participation in clinical teaching during the anesthesiology clerkship and in the electives offered by the department in academic year 2017-2018. The department maintained a strong presence throughout the four-year University of Pittsburgh School of Medicine (UPSOM) curriculum.

CLINICAL PROCEDURES COURSE

The Clinical Procedures Course is designed for second-year medical students just prior to the start of clinical rotations and Drs. Rita Patel and Ryan Romeo are the course directors. This four-week course consists of brief introductory lectures followed by “hands-on” sessions. Medical students studied the details of airway assessment and endotracheal intubation under the leadership of Drs. Dalby, Blasiolo, Doshi, & McIvor. They received a brief introduction to hemodynamic monitoring and interpretation of blood-gas reports in the session led by Dr. Ondecko Ligda. Students learned how to perform lumbar punctures with Dr. Thomas Chalifoux, nasogastric tube insertion with Dr. Peter Bulova (Associate Professor of Internal Medicine), and Foley catheter insertion during sessions with Dr. Sarah Hugar. Under the guidance of session leaders Drs. Catalin Ezaru and Robert Krohner, they utilized universal precautions and performed intravenous cannulation and venipuncture.

We are unique among anesthesiology departments because of our faculty’s extensive involvement in pre-clinical medical student education. In very few U.S. medical schools are pre-clinical courses directed by clinical department faculty members. Based on written evaluations from the medical students, the Clinical Procedures Course received an overall approval rating of 90%. Students said they valued the opportunity to learn these basic procedures prior to performing them on patients.

SURGERY AND PERIOPERATIVE CARE CLERKSHIP

The mandatory Surgery and Perioperative Care Clerkship for third year medical students consists of an eight-week course directed by Drs. Michael Mangione (anesthesiology segment) and Greg Watson (surgery segment). The surgery and anesthesiology portions of the course are fully integrated in terms of coordination, although the grades are generated separately.

The anesthesiology portion of the course is an intensive two-week introduction to the practice of perioperative medicine. This rotation is intended to develop knowledge, skills, and patient-management principles that are vital for all physicians. The course is structured around a detailed curriculum with a 10-day didactic and clinical program.

Students rotate through four on-campus sites (UPMC Presbyterian, UPMC Montefiore, UPMC Magee-Women’s Hospital, and VAPHS) and four community-based sites (UPMC Children’s Hospital of Pittsburgh, UPMC Mercy, UPMC Shadyside, and UPMC St. Margaret), where they receive extensive clinical experience. While completing the two-week anesthesiology portion of the clerkship, students also attend four required sessions at the Peter M. Winter Institute for Simulation Education and Research (WISER) under the direction of Dr. William McIvor and his faculty. This portion of the course continues to be very successful; in electronic evaluations, students described the
simulation sessions as “outstanding.” Students also spend one morning of the anesthesiology rotation at Western Psychiatric Institute and Clinic of UPMC. This experience allows students to receive concentrated exposure to bag-mask ventilation, a critical skill for future physicians. During this clerkship, department faculty members regularly present four didactic lectures: “Preoperative Evaluation,” “Cardiac Evaluation for Non-Cardiac Surgery,” “Cardiac Physiology,” and “Acute Pain Management.” A review session occurs at the end of the course and is conducted by members of the PGY-4 residency class. The anesthesiology residents are a key component to the department’s teaching efforts. Their effectiveness as educators has been rated at 88% over the last two years.

A Medical Student Clinical Coordinator at each site is responsible for the education of students assigned to that site. Coordinators follow a formal curriculum (“Ten-Day Program”) and assign students to various attending physicians to provide one-on-one teaching in the operating room and offer clinical performance feedback to the student, course director, and School of Medicine. Coordinators are also readily available to answer pertinent questions regarding subspecialties and to review clinical scenarios.

Thanks to the teaching efforts of the faculty, this course enjoyed another very successful year, as evidenced by excellent evaluations and feedback. Students continue to give excellent evaluations of the quality of the clerkship. Ninety percent of the medical students for the 2017-18 academic year rated the clerkship as outstanding or good. Ninety-nine percent of the students rated the overall teaching as good quality. The trend of excellent teaching by residents and fellows continued its upward ascent, with a 96% approval rating for the last academic year.

The following is a five-year summary of the evaluations completed by students regarding the required clerkship. Please note that students indicated they “Strongly Agree” or “Agree” with each category.

SUMMER PRECEPTORSHIP
The department offers a summer preceptorship each year to UPSOM students during their first and second year of medical school. The duration of the program is typically four consecutive weeks with a weekly stipend.

ELECTIVES
One month-long electives provide in-depth exposure to anesthesiology. Four electives are offered:

- **General Anesthesiology**, which provides advanced training in the clinical practice of anesthesiology in both the operative setting and through a specialized simulation curriculum. The elective is guided by a detailed curriculum emphasizing advanced problem-solving concepts and case studies. In addition, students are required to give a presentation during their rotation. This requirement, guided by the faculty, furthers students’ skills in performing critical literature analyses, making evidence-based recommendations, and presenting the material to their colleagues. At the VAPHS, for example, the senior medical student presentation is a staple of the Wednesday morning lecture series. Coordinators include the following faculty: Drs. Romeo, Hall-Burton, Montoya, Ezaru, Ondecko, Herlich, Monahan, and Hayanga. In addition to hosting UPSOM medical students, the anesthesiology elective is very popular with visiting medical students from other institutions, many of whom end up matching with our residency program. Twenty-four students participated in this elective.

- **Anesthesiology Research**, which provides opportunities for students to pursue scholarly activities in basic research in either a laboratory or clinical setting. Dr. James Ibinson serves as the main coordinator for the research elective.

- **Subspecialties in Anesthesiology**, which provide an opportunity for students to develop expertise in one or more of the anesthesiology subspecialties.
• Pain Medicine, coordinated by Dr. Scott Brancolini, provides exposure to acute and chronic pain patients. Medical students who learn basic principles of pain management will develop increased confidence in reducing their patients’ pain and will understand proper timing for consulting pain medicine specialists. Dr. Brancolini supervises students who rotate through this specific elective. Five students participated in this elective.

Due primarily to the enthusiastic involvement of the faculty, as evidenced by evaluations, these electives continue to be well-received.

FAER SUMMER RESEARCH FELLOWSHIP
The Department of Anesthesiology was one of 37 sites nationwide selected to host trainees as part of the 2017 Foundation for Anesthesia Education and Research (FAER) Medical Student Anesthesia Summer Research Fellowship (MSARF) program. This program was created to encourage talented medical students to consider careers in anesthesiology research and perioperative medicine and offers medical students an eight-week anesthesiology-related research experience. MSARF fellows can present research abstracts at the American Society of Anesthesiologists annual meeting. The department has hosted at least one student every summer since 2008 and a total of 19 students have participated in the fellowship. This year’s students were Austin Cusick (Ohio University Heritage College of Osteopathic Medicine), and Jeffery Johnson (Florida State University College of Medicine). Austin’s project, “Identification of an Imaging-based Biomarker for Pain” was sponsored by Dr. James Ibinson. Jeffery’s project “Determination of the Neural Correlates of Post-Operative Cognitive Dysfunction” and was also sponsored by Dr. James Ibinson.

SCHOLARLY PROJECTS
UPSOM students are required to undertake a mentored longitudinal scholarly activity beginning in their second year and concluding in their final year. There is broad latitude in the choice of topic with the restriction that it must be medicine- or healthcare-related. Students are to read and critically evaluate scientific and medical literature, present a research proposal and receive direct feedback from faculty and other students on that proposal, perform a research project under direct mentorship from an expert in that field, present the research project in both informal and formal collegial venues, discuss, troubleshoot, and critique the research, and present the research to their colleagues in their medical school class.

Several of our faculty members continued to serve as mentors for scholarly projects in academic year 2017-18.

<table>
<thead>
<tr>
<th>Mentor</th>
<th>Student</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grace Lim, MD, MS</td>
<td>Rachel Silverstein</td>
<td>Postpartum psychological distress after emergency team response during childbirth</td>
</tr>
<tr>
<td>William McIvor, MD, FASA</td>
<td>Nathaniel Blecher</td>
<td>Measuring performance in simulation as a function of time in the academic year</td>
</tr>
<tr>
<td>Steven Orebaugh, MD</td>
<td>Laura Nelson</td>
<td>A retrospective analysis of nerve block success in arthroscopic shoulder surgery patients taking opioid medications preoperatively</td>
</tr>
<tr>
<td>Kathirvel Subramaniam, MD, MPH, FASE</td>
<td>Tsang Wai Lok</td>
<td>Predictors of postoperative pain in patients undergoing major abdominal surgery with ERAS protocol</td>
</tr>
<tr>
<td>Kathirvel Subramaniam, MD, MPH, FASE</td>
<td>Zaid Safiullah</td>
<td>Role of intraoperative neurophysiologic monitoring in prevention of mortality and morbidity after cardiac surgery</td>
</tr>
<tr>
<td>Kathirvel Subramaniam, MD, MPH, FASE</td>
<td>Angela Hirsch</td>
<td>Correlation between Lidocaine levels and lidocaine toxicity in ERAS surgical population receiving intravenous lidocaine for postoperative analgesia</td>
</tr>
</tbody>
</table>
EDUCATION

MEDICAL STUDENT PROGRAMS

MICHAEL P. MANGIONE, MD, Director

Jonathan Waters, MD
Ethan Craig
Red blood cell salvage analysis from clotted blood

Brian Williams, MD
Mara-Rice Stubbs
Case Report: Postoperative Analgesia and Preserved Motor Function after Hip and Knee Replacement Surgeries, with Multimodal Perineural Analgesia

ANESTHESIOLOGY INTEREST GROUP
The Anesthesiology Interest Group (AIG) that was formed by two third-year University of Pittsburgh medical students in 2005 continues to thrive, with Dr. Mangione serving as Faculty Mentor. This group welcomes students from all four years of medical school who are interested in our specialty. Meeting topics have included the application process, residency programs, and the residency match. This year’s group was led by Milap Rakholia, class of 2018, and Matt Kocher, class of 2019. An increasing number of students have been accepted into the ASA Student Membership component. Departmental support was also provided about the AIG’s lunch and social meetings, which were well attended by both faculty and residents. Our faculty and residents continue to enthusiastically support the students’ efforts.

SPECIALTY NIGHT
Each spring, our department chair, vice chair for education, residency and medical student program directors, along with several faculty and residents, host a “Specialty Night” for University of Pittsburgh students in their final year of medical school. This proves to be an excellent forum for students interested in our specialty to learn about anesthesiology, as well as our residency program application process. The 2018 Specialty Night took place on April 25.

Eight UPSOM students (Class of 2018) matched into anesthesiology residencies, including some of the top programs in the country:

- Nadeige Chop, Johns Hopkins University, Baltimore, MD
- Jessica Hsu, University of Maryland Med Center, Baltimore, MD
- Johannes Kutten, University of Mass Med School, Worcester, MA
- Anh Vinh Nguyen, UPMC Medical Education, Pittsburgh, PA
- Milap Rakholia, Stanford University Progs, Stanford, CA
- Ling Tian, UCLA Medical Center, Los Angeles, CA

UPSOM MEDICAL STUDENTS IN THE MATCH, 2006-2018
Comprising 12 classes between 2006 and 2018, 104 medical students entered the anesthesiology match. A total of 99% (103/104) matched successfully. Over 30% of these medical students matched into programs ranked in the top 10 residency programs, 70% into residencies ranked into the top 20, and 80% into residencies ranked into the top 50, as ranked by US News and World Report. During this time frame, a quarter of the medical students matched into our own program.

ROBERT L. WILLENKIN AWARD
Each year at the medical student award banquet, one senior medical student is recognized as the Best Student in Anesthesiology and receives the Robert L. Willenkin award. The 2018 awardee was Chelsea Meenan. Dr. Willenkin came to the University of Pittsburgh in 1982 by way of Yale University and then the University of California at San Francisco. He served on the faculty from 1982 until retiring as Professor Emeritus in 1996. Dr. Willenkin was a local and national leader in anesthesiology education during his career. He served as Vice Chair for Education in the Pitt Department of Anesthesiology and presented more than 60 invited national lectures during his career and beyond. In 1984, he became one of the founding members of the Society for Education in
Anesthesia (SEA), an organization in which he continues to be active. In 1998, he received the Prestigious SEA-Duke University Award for Excellence and Innovation in Anesthesia Education.

HONORS AND SERVICE
In 2018, the Department of Anesthesiology awarded the Peter M. Winter Award for Excellence in Medical Student Teaching to Dr. Tetsuro Sakai, who was recognized for his outstanding contributions to the medical student program and high teaching evaluations from students. This award is named in honor of our former department chairman, Dr. Peter M. Winter, who successfully helped build our department into one of the nation’s largest academic departments of anesthesiology.

Dr. David G. Metro is the Chair of the UPSOM task force subcommittee for Liaison Committee on Medical Education (LCME) accreditation (member of the Promotions Committee and applicant interviewer. Dr. Rita M. Patel is a member of the UPSOM Clinical Procedures Course Design Committee and LCME Task Force Committee. Dr. William McIvor is a member of the Clinical Procedures Course Design Committee. Dr. Michael Mangione served on several UPSOM committees such as the Promotions Committee, Retention Committee, and LCME Task Force committee. Drs. Patricia Dalby served on the Admission Committee, Clinical Procedures Course Design Committee, and is an applicant interviewer. Dr. William Simmons served on the UPSOM Promotions Committee and the LCME Task Force Committee.

Faculty members Drs. Charles Boucek and Joseph Quinlan also served as UPSOM applicant interviewers. Drs. Brian Blasiole, Thomas Chalifoux, Catalin Ezaru, Robert Krohner, Kristin Ondecko Ligda, and Steven Orebaugh also served on the Clinical Procedures Course Design Committee.

EDUCATIONAL CREDIT UNITS (ECUs)
Faculty participated in various medical student activities, such as small group sessions and problem-based learning sessions in the first-year course “Introduction to Being a Physician.” Second year courses taught by our faculty include “Integrated Case Studies,” “Basic Science of Care,” and “Clinical Procedures.” Our faculty served as facilitators for mandatory simulator sessions taught to third and fourth year students during the Surgery & Perioperative Care Clerkship and the Anesthesiology Elective. Several faculty members participated in the lecture series conducted during the Surgery & Perioperative Care Clerkship.

The administrative activities category of the ECU report encompasses administrative responsibilities of those faculty members who serve as Medical Student Course Directors for Clinical Procedures, the Surgery & Perioperative Care Clerkship, and the various Anesthesiology Electives. Additional ECU categories include scholarly project mentoring, research elective mentoring, and advising activities. The University of Pittsburgh committee activities category of the ECU report includes participation in various committees such as the LCME (Liaison committee on medical education) Curriculum, Promotions and Retention Committees, as well as the Dean’s Applicant Interviewer and Ethics & Professionalism Task Force. Several of our faculty members served as Chair and members on each of these formal committees.

Our faculty’s teaching activities were also well represented in the graduate student ECU categories. Instructional activities included teaching small group sessions and lecturing in such courses as Neuropharmacology, Biology of Signal Transduction, and Cellular & Molecular Neuroscience. Faculty also participated in graduate student mentoring and advising activities. We received credit in additional ECU categories for graduate student teaching such as lab supervision and graduate program administrative committees.
The following abstract was presented at the International Anesthesia Research Society 2018 Annual Meeting and International Science Symposium: Improving Health Through Discovery and Education, April 28 - May 1, 2018, Chicago, Illinois.

CENTRAL CORD SYNDROME AFTER PROLONGED FIXATION IN HEAD PINS: A CASE REPORT
Jonah Abraham, Zulfaqar Alam

INTRODUCTION
Central cord syndrome following anesthesia is an uncommon but potentially life-altering complication. We present a case of a 69-year-old male who developed central cord syndrome due to previously asymptomatic meningioma after prolonged neck extension while under anesthesia for complete sphenethmoidectomy. A review of the literature (1-3) reveals that central cord syndrome is rare; however, the postoperative presentation and PACU management presented in this case present unique considerations for the anesthesiologist.

METHODS
This is a case report of a single patient in a tertiary care hospital with review of the medical record, including the intraoperative anesthesia records, operative notes, progress notes, and radiologic studies and reports pertaining to the case.

RESULTS
The patient was a 69-year-old male with recurrent frontal sinusitis and a large frontal mucocele. He had previously undergone resection of mucoceles that had subsequently recurred and had gradually progressed with occasional tenderness. His past medical history was significant for coronary artery disease, hypertension, and dyslipidemia and his surgical history included coronary artery stenting, lumbar laminectomies, cholecystectomy, and right total knee arthroplasty. At baseline, he had no noted neurologic symptomatology. Anesthesia was induced, and endotracheal intubation proceeded uneventfully. The patient was placed in Mayfield pins with slight head extension. The surgical procedure was performed via an endoscopic endonasal approach with bilateral sphenoidotomies, frontal sinusotomy, and drainage of a frontal mucocele. Total time that head pins were applied was five hours and eight minutes. Total OR fluid intake was 3,250 mL with 400 mL of blood loss and 700 mL of urine output. The patient was extubated to a simple face mask and upon arrival in the PACU, the patient was noted to have sustained hypoxemia with saturations ranging from 88-94% with increased work of breathing. Additionally, the patient complained of exquisite bilateral arm and shoulder pain with associated weakness and paresthesia. The patient was unable to lift his left arm at all, displaying proximal muscle weakness while handgrip and sensation remained intact. Differential diagnoses included positional neuropathy, fluid overload, and central cord syndrome. Initial interventions included albuterol and inhaled steroids and furosemide administration with 350mL output. A full point of care ultrasound evaluation was completed, revealing a normal transthoracic echocardiogram, mild atelectasis, and no evidence of hematoma at intravenous access sites. An urgent cervical spine MRI revealed a calcified dural-based mass along the right aspect of the spinal canal at the C3-C4 level consistent with a small meningioma (Figure 1). The patient was subsequently transferred to the neurosurgical intensive care unit in the setting of depressed diaphragmatic excursion due to the tumor location and continued hypoxemia with maintenance of a mean arterial pressure of greater than 80 mmHg. The patient’s postoperative course included undergoing C3-C5 laminectomies, complicated by meningitis from a surgical wound infection. The patient was discharged home neurologically intact 20 days after admission.

CONCLUSION
Central cord syndrome is more commonly associated with a traumatic event or due to underlying cervical spondylosis. However, prompt recognition of the condition and management by the anesthesiologist may significantly decrease the morbidity associated with this syndrome.

REFERENCES

FACTOR IX FROM PROTHROMBIN COMPLEX CONCENTRATE AUGMENTS LOW TISSUE FACTOR-TRIGGERED THROMBIN GENERATION – AN EXPLORATORY IN VITRO STUDY

Ezeldeen Abuelkasem, MBB Ch, MSc*, Shaheer Hasan, MHS†, Brittnie Williams, MD#, Reney Handerson, MD#, Michael A. Mazzeffi, MD, MPH ‡, Kenichi A Tanaka, MD, MSc§

*Resident, Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
†Research Assistant, #Assistant Professor, ‡Associate Professor, and §Professor, Department of Anesthesiology, University of Maryland School of Medicine, Baltimore, Maryland, USA

BACKGROUND

Dosing of prothrombin complex concentrate (PCC) is guided by tissue factor (TF)-triggered prothrombin time (PT). Because PT only reflects the onset of thrombin generation (TG) and is insensitive to the contributions of intrinsic pathways, including factor (F)IX, it may underestimate the thrombogenic potential of PCC.1 Activated FIX and FVIII make up the intrinsic tenase (FIXa-FVIIIa), which activates FX, propagating TG via an intrinsic pathway (Fig. 1).2 Therefore, we hypothesized that FIX contained in PCC could strongly enhance the total amount of TG, and elevated FVIII as well as hemodilution would augment such an effect.

METHODS

Pooled normal, FIX-deficient, and warfarin plasma were used to analyze the effects of FIX derived from PCC. PCC was evaluated for final concentrations at 0.2 and 0.4 international units per ml (IU ml-1) in FIX-deficient and normal plasma, and at 0.6 IU ml-1 in warfarin plasma under elevated FVIII (1.5 IU ml-1) and/or 40% dilution with saline. Ex vivo effects of PCC and FVIII addition were compared by measuring lag time, peak thrombin, and endogenous thrombin potential (ETP) in both its procoagulant (ETPp) and inhibitory (ETPi) phases using TG assay. TG parameters were compared across treatments groups using ANOVA, Friedman’s test, and Dunn’s multiple comparison test. A P value of P<.05 was considered statistically significant.

RESULTS

FIX-deficient plasma had lower peak TG and ETP than normal plasma, and the addition of PCC resulted in significant increases to peak TG and ETP. The combination of FVIII and PCC resulted in greater increases relative to each agent alone, restoring TG to normal ranges. After 40% dilution, adding PCC and/or FVIII to FIX-deficient plasma resulted in more extensive increases in peak-TG and ETP (Table 1, Fig. 2). In warfarin plasma, TG patterns were characterized by prolonged lag time, reduced peak and ETP values (Table 2). The addition of 1.5 IU ml-1 of FVIII did not result in any significant changes, but the addition of 0.6 IU ml-1 of PCC with or without FVIII restored lag time and enhanced peak and ETP values. Like normal and FIX-deficient plasma, adding PCC and FVIII after 40% dilution

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Table 1. Effects of FVIII and PCC addition in diluted normal and FIX-deficient plasma. Data is expressed in median and interquartile ranges.

| Treatment Conditions | TF I (IU.ml-1) | TF II (IU.ml-1) | FIX (IU.ml-1) | FVIII (IU.ml-1) | Dilution
|----------------------|----------------|----------------|---------------|----------------|---------|
| Normal plasma        | 2.00 ± 0.68    | 1.00 ± 0.46    | 10.0 ± 2.27   | 1.00 ± 0.25    | No dilution
| FIX-deficient plasma | 2.00 ± 0.68    | 1.00 ± 0.46    | 0.00 ± 0.00   | 1.00 ± 0.25    | No dilution

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Fig 1. Schematic illustration of hemostatic pathways and role of intrinsic tenase

Fig 2. Key parameters of thrombin generation assay. Lag time (minutes), peak thrombin (nM), and endogenous thrombin potential (ETP, nM X min); ETP is separated into two segments, representing the procoagulant phase (ETPp) before peak TG, and inhibitory phase (ETPi) after the peak. TG indicates thrombin generation.

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Table 2. Effects of FVIII and PCC addition in diluted normal and FIX-deficient plasma.

| Treatment Conditions | TF I (IU.ml-1) | TF II (IU.ml-1) | FIX (IU.ml-1) | FVIII (IU.ml-1) | Dilution
|----------------------|----------------|----------------|---------------|----------------|---------|
| Normal plasma        | 2.00 ± 0.68    | 1.00 ± 0.46    | 10.0 ± 2.27   | 1.00 ± 0.25    | No dilution
| FIX-deficient plasma | 2.00 ± 0.68    | 1.00 ± 0.46    | 0.00 ± 0.00   | 1.00 ± 0.25    | No dilution

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Fig 2. Key parameters of thrombin generation assay. Lag time (minutes), peak thrombin (nM), and endogenous thrombin potential (ETP, nM X min); ETP is separated into two segments, representing the procoagulant phase (ETPp) before peak TG, and inhibitory phase (ETPi) after the peak. TG indicates thrombin generation.
of warfarin plasma resulted in significantly higher peak and ETP values compared to the same intervention in undiluted warfarin plasma (Fig. 3).

**CONCLUSIONS**

FIX derived from PCC strongly enhances low TF-triggered TG in the presence of elevated FVIII activity. Hemodilution further enhances the procoagulant effects of FIX and FVIII, prolonging the inhibitory phase of TG.

**IMPLICATIONS**

Dosing of PCC according to PT underestimates the thrombogenic potentials of PCC because it does not account for intrinsic tenase or antithrombin activity. Thrombogenicity of PCC is further enhanced if the latter is used to treat dilutional coagulopathy, which is common perioperatively and particularly in patients with elevated FVIII levels (those who received FVIII-rich products or were on warfarin). Therefore, to increase safety, the perioperative PCC dosing scheme needs to improve beyond PT/INR and weight-based nomogram.

**REFERENCES**


The following abstract was presented as a poster at the 2018 Spring Annual Meeting of the Society of Education in Anesthesia, April 19 – 22, 2018, Louisville, KY.

**FINANCIAL INCENTIVE IN PLACE OF NON-CLINICAL TIME IMPROVES FACULTY INVOLVEMENT AND INCREASES RESIDENT DIDACTIC EVALUATION SCORES**

Douglas R. Adams, MD; David G. Metro, MD, FASA; Keith M. Vogt, MD, PhD

**INTRODUCTION**

An important component of anesthesiology residency training comes from organized didactics. However, these sessions frequently occur at times when clinical coverage by residents and presenting faculty members is required. This coverage comes as a financial burden to academic departments. Attending physicians at our institution formerly received one non-clinical day to prepare and present a didactic session to our residents. To both reduce cost and continue to recruit and motivate faculty to give high-quality lectures, our department began to incentivize attending physicians with a $500 stipend instead of a non-clinical day to present specific resident didactics. Our hypothesis is that with a financial incentive, more attendings would present didactics. Our secondary aim was to show that didactic quality would not suffer as a result.

**METHODS**

Residents routinely evaluate all didactic sessions, using a Likert scale of 1-5. Residents also answer “yes” or “no” to indicate whether the presenter should return. For this study, didactic evaluations for the 2015-2016 (non-clinical day) and 2016-2017 (financial stipend) academic years were collected and presenter names were de-identified. For each, the mean Likert score and percentage of positive responses for the lecturer returning were calculated. A chi-square was performed on the percentage of “yes” responses. The Likert data was transformed via squaring, as it was not normally distributed (left skew). An unpaired two-tailed t-test was performed on the transformed data.

**RESULTS**

Data summaries for the academic years are shown in Table 1. Positive responses to the presenter returning significantly increased (p < 0.0005) (Figure 1). Likert scores significantly increased from one year to the next (p < 0.0002) (Figure 2). A greater number of faculty participated in the didactic program, and evaluation scores significantly improved.

**DISCUSSION**

We present an alternative way of incentivizing teaching activities in academic anesthesiology departments. We have demonstrated that more faculty members participated in lectures, and lecture evaluation scores were significantly higher under the new incentive system. This change was also associated with a cost savings of $191,250. The total cost of 153 non-clinical days amounted to $267,750 ($1,750/day), while our stipend incentive program decreased the cost to $76,500 ($500/session).
The following abstract was presented at the Annual Pennsylvania Anesthesia Resident Research Conference, May 19, 2018, Drexel University, Philadelphia, PA.

UTILITY OF PECTORAL BLOCK FOR ANTERIOR RIB FRACTURES

SAFETY AND EFFECTIVENESS OF SUGammadex FOR SURGICAL PATIENTS WITH END STAGE RENAL DISEASE

Adams D, Phillips D, Quinlan JJ, Artman J, Sakai T
Department of Anesthesiology and Perioperative Medicine, UPMC

INTRODUCTION
Sugammadex use in patients with end stage renal disease (ESRD) is cautioned due to concerns regarding possible recurarization; thus far, little has been investigated. The aim of this study was to review the outcomes of surgical patients with ESRD who received sugammadex as a reversal agent.

METHODS
In this quality improvement study, all general anesthesia cases performed at a single institution for one year (4/1/16-4/1/17) were examined to identify patients who received sugammadex administered at the discretion of the anesthesia team. Preoperative renal function was checked and patients with ESRD (with renal replacement therapy) were identified. Patient demographic data, surgical procedures, time of endotracheal tube removal, and re-intubation or any respiratory complications within 48 hours postoperatively were investigated. The data are shown with number (%) or median (minimum - maximum).

RESULTS
Among 35,592 anesthesia cases, 871 patients (2.4%) received sugammadex, of which 94 cases (10.8%) had renal dysfunction (serum creatinine >1.4 mg/kg). Three cases were excluded because sugammadex was erroneously used for reversal of cisatracurium. Among 91 cases, 41 ESRD patients were identified (Figure 1). Thirteen cases (31.7%) underwent renal transplantation and 28 cases (68.3%) underwent non-renal transplant procedures. In the renal transplant group, sugammadex was the primary reversal agent in eight cases and was the rescue agent after neostigmine and glycopyrrolate for five. All patients were successfully extubated at the end of transplantation. Among the 28 patients in the non-renal transplant procedure group, sugammadex was the primary reversal agent in 21 cases (four cases needed additional dosage of sugammadex) and as the rescue agent after neostigmine and glycopyrrolate for seven. The dosage of sugammadex for each condition is detailed in Table 1. Of those that received sugammadex alone, there were three deferred extubations in the OR. Two re-intubations were required for airway protection only; one re-intubation in the sugammadex only group was due to bilateral epistaxis, and the other in the sugammadex as the rescuer group occurred one-day postoperatively due to status epilepticus (Table 1).

DISCUSSION
Sugammadex seems to be safe and effective in those with ESRD.

<table>
<thead>
<tr>
<th>Group</th>
<th>Reversal Type (Sug: mg/kg)</th>
<th>n</th>
<th>Deferred Extubation</th>
<th>Reintubation in 48 hrs.</th>
<th>RR Therapy in 48 hrs.</th>
<th>Surgical Duration (min)</th>
<th>Reversal to Extubation Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Sug</td>
<td>41</td>
<td>3 (7.3%)</td>
<td>2 (4.9%)</td>
<td>19 (46.3%)</td>
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<td>Kidney TX</td>
<td>Sug 3.1 (2.0 - 4.1)</td>
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<td>0</td>
<td>0</td>
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<td>9 (3 - 41)</td>
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<td></td>
<td>Neo + Sug 2.3 (2.2 - 3.1)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>239 (235 - 256)</td>
<td>19 (4 - 19)</td>
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<tr>
<td>Non-Kidney TX</td>
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<td>3a</td>
<td>1b</td>
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<td></td>
<td>Neo + Sug 2.0 (1.9 - 4.1)</td>
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<td>0</td>
<td>1c</td>
<td>6</td>
<td>104 (60 - 379)</td>
<td>18 (1 - 54)</td>
</tr>
<tr>
<td></td>
<td>Sug + Sug 3.1 (1.9 - 8.0)</td>
<td>4</td>
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<td>0</td>
<td>3</td>
<td>64 (28 - 137)</td>
<td>15 (2 - 27)</td>
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</tbody>
</table>

Table 1. Note: aone unplanned deferred extubation, one patient kept intubated was on ECMO and the final patient had a pre-existing tracheostomy; b due to bilateral epistaxis after an endoscopic sinus surgery; c due to status epilepticus; The data are shown as median (min - max). Abbreviations: n, number; RR, renal replacement; TX, transplantation; Sug, sugammadex; Neo, neostigmine.
The following abstract was an oral presentation at the Annual Pennsylvania Anesthesia Resident Research Conference, May 19, 2018, Drexel University, Philadelphia, PA and a poster presentation at the Annual Spring Meeting of the Society of Education in Anesthesia, Louisville, KY, April 19 – 22, 2018.

**RESIDENT PARTICIPATION IN A FIBEROPTIC BRONCHOSCOPY SIMULATION COURSE IS ASSOCIATED WITH INCREASED CONFIDENCE AND COMPETENCE**

Dewasurendra AM, Orebaugh S, McHugh S
Department of Anesthesiology and Perioperative Medicine, UPMC

**BACKGROUND**

Anesthesiologists must be familiar with the fiberoptic bronchoscope because it is a useful instrument in several settings. Proper placement of a double-lumen endotracheal tube, awake intubations, difficult airways, and diagnostic bronchoscopy are a few examples. At our institution, residents at the PGY-2, PGY-3, and PGY-4 levels are provided with a fiberoptic bronchoscopy course at our simulation center.

**METHODS**

Our fiberoptic bronchoscopy simulation course consists of pre-course didactics, a pre-class survey, a hands-on session with attending anesthesiologists, fiberoptic bronchoscopes, mannequins, and a post-class evaluation (Fig. 1 and Fig. 2). After study approval from our Institutional Review Board, we examined pre-class and post-class survey data from 369 residents (128 PGY-2, 127 PGY-3, 114 PGY-4) who took the course from 2011 to 2018. The pre-class survey included self-assessment questions asking users to rate their own competence (expert, competent, or need to improve) and confidence (very confident, confident, or not confident) regarding their fiberoptic bronchoscopy skills.

**RESULTS**

Subjects evaluated their own competence and confidence, their general feelings about simulation, overall course rating, and perceived effects of simulation on their confidence and practice. Users’ ratings of their own competence and confidence increased every subsequent year of training (Fig. 3 and Fig. 4). Only 9.5% of PGY-2 residents rated themselves as competent, compared to 79.7% of PGY-4 residents. Similarly, 78.9% of PGY-2 residents rated themselves as not confident, while 85.7% of PGY-4 residents rated themselves as confident. As the residents progressed through their training, subjects rated themselves as more comfortable with simulation and less embarrassed to use simulation in front of their peers. Using a nine-point Likert scale, residents of all years gave the course an overall high rating (8.2 out of 9) and planned to apply what they had learned (8.4 out of 9). In general, residents rated the simulation-style training as valuable and better than a standard lecture/workshop and indicated that it improved their confidence. These ratings remained stable over the course of the residency.

**DISCUSSION**

Fiberoptic bronchoscopy is a valuable piece of technology for anesthesiologists, though it may not be a commonly used tool. Simulation can be a practical and safe way to introduce new skills, techniques, and equipment to PGY-2, PGY-3, and PGY-4 residents.

**REFERENCES**

GENDER DIFFERENCES IN PERIOPERATIVE HORMONAL AND INFLAMMATORY STRESS RESPONSE DURING CARDIAC SURGERY: AN EXPLORATORY DATA ANALYSIS
Luke Doney, DO; Sofiane Lazar, MD; Kathirvel Subramaniam, MD

INTRODUCTION
The natural response to the stress of cardiac surgery and cardiopulmonary bypass (CPB) is well known. Included in this response is the elevation of inflammatory mediators including ACTH, growth hormone, cortisol, and interleukins [1]. Perioperative stress, hyperglycemia, and inflammation have been linked to an increased incidence of major adverse events and mortality in patients undergoing cardiac surgery [1, 2]. This abstract is an exploratory analysis examining gender differences in stress mediators during cardiac surgery. Data for this analysis was taken from a clinical trial at UPMC examining remifentanil and glycemic response during cardiac surgery (clinical trial# NCT02349152).

METHODS
A prospective, randomized clinical trial took place at UPMC after institutional ethical board review in patients undergoing cardiac surgery. Potential participants were screened by the cardiac surgeons and study coordinators and informed consent was obtained. Eligible participants were randomized to either the control (fentanyl IV bolus) or intervention (remifentanil infusion) group. Table 1 details the study inclusion and exclusion criteria. The blood glucose goal during the perioperative period was between 140-180 mg/dl. A standard insulin infusion protocol was followed.

Upon placement of the arterial line, desired lab values were obtained. These values were subsequently drawn 30 minutes into CPB, at the end of CPB, at the end of surgery, and eight hours post-operatively. Perioperative patient data was obtained from the electronic anesthesia record and the Society of Thoracic Surgeon’s database. Independent samples t-test (SPSS 12.0) was utilized for analysis of baseline characteristics and inflammatory mediators. Chi square test evaluated categorical variables. A value of p < 0.05 was determined to be statistically significant.

RESULTS
A total of 116 patients were enrolled in the study and 106 patients (72 men and 34 women) completed the study. Since this abstract focuses on an exploratory analysis of the relationship between gender and stress response, please refer to clinical trial #NCT02349152 for information on the primary outcome. Baseline patient characteristics are included in Table 2. BMI was significantly higher in men compared to women. An equal proportion of patients of both genders belonged to the remifentanil and control groups.

Cortisol levels at the end of surgery as well as initial growth hormone levels were significantly higher in men compared to women. ACTH (eight hours post-op), growth hormone (CPB-end, end of surgery, eight hours post-op) and TNF alpha (eight hours post-op) levels were significantly higher in women compared to men. See Table 3 for complete data analysis of hormonal and inflammatory mediators in men and women.
CONCLUSIONS
During the peri-operative period in patients undergoing cardiac surgery with CPB, it was found that men and women have significant differences in elevation of certain known mediators of the stress response (cortisol, ACTH, growth hormone, TNF alpha). Further research is required to evaluate gender discrepancies in the perioperative stress response and how they relate to outcomes after cardiac surgery.

REFERENCES

Table 3. Data analysis

<table>
<thead>
<tr>
<th>Hormonal/Inflammatory Mediators</th>
<th>Male (n=72) Mean (SD)</th>
<th>Female (n=34) Mean (SD)</th>
<th>p-value</th>
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<tr>
<td>Cortisol initial a-line (μg/dL)</td>
<td>11.7 (3.7)</td>
<td>12.3 (6.1)</td>
<td>0.590</td>
</tr>
<tr>
<td>CPB-30 minutes</td>
<td>17.6 (11.6)</td>
<td>13.7 (10.7)</td>
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<tr>
<td>CPB-end</td>
<td>19.8 (14.6)</td>
<td>14.6 (13.8)</td>
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<td>Surgery-end</td>
<td>21.3 (13.6)</td>
<td>14.9 (11.8)</td>
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</tr>
<tr>
<td>8 HR post-op</td>
<td>41.8 (15.8)</td>
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<td>0.862</td>
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<td>ACTH initial a-line (pg/mL)</td>
<td>15.8 (12.7)</td>
<td>12.0 (10.6)</td>
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<td>CPB-30 minutes</td>
<td>153.4 (348.0)</td>
<td>124.7 (339.1)</td>
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<tr>
<td>CPB-end</td>
<td>152.0 (382.1)</td>
<td>242.0 (613.7)</td>
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<td>Surgery-end</td>
<td>221.5 (559.2)</td>
<td>281.8 (924.0)</td>
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<tr>
<td>8 HR post-op</td>
<td>252.3 (475.3)</td>
<td>655.8 (1042.3)</td>
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<td>Growth Hormone initial a-line (pmol/L)</td>
<td>1661.5 (1762.5)</td>
<td>937.0 (999.5)</td>
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<td>CPB-30 minutes</td>
<td>2706.1 (2072.2)</td>
<td>2941.0 (2772.9)</td>
<td>0.632</td>
</tr>
<tr>
<td>CPB-end</td>
<td>2373.7 (2105.8)</td>
<td>3952.1 (3437.0)</td>
<td>0.005</td>
</tr>
<tr>
<td>Surgery-end</td>
<td>4476.3 (2754.7)</td>
<td>6715.0 (4134.1)</td>
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</tr>
<tr>
<td>8 HR post-op</td>
<td>3674.6 (2736.7)</td>
<td>5241.0 (3476.3)</td>
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<tr>
<td>IL-1B initial a-line (pg/mL)</td>
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<td>Surgery-end</td>
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<td>13.7 (4.9)</td>
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<td>8 HR post-op</td>
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<td>IL-6 initial a-line (pg/mL)</td>
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<td>CPB-30 minutes</td>
<td>110.6 (172.9)</td>
<td>106.9 (104.4)</td>
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<td>CPB-end</td>
<td>1158.9 (2307.4)</td>
<td>1980.5 (2576.8)</td>
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<tr>
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<td>1681.6 (3026.2)</td>
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<td>8 HR post-op</td>
<td>1443.7 (3071.9)</td>
<td>2020.9 (2698.7)</td>
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<tr>
<td>TNF-a initial a-line (pg/mL)</td>
<td>92.9 (37.2)</td>
<td>94.7 (46.3)</td>
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<td>CPB-30 minutes</td>
<td>114.0 (48.1)</td>
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<td>191.5 (159.9)</td>
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<td>8 HR post-op</td>
<td>104.1 (56.3)</td>
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<td>Glucagon initial a-line (pg/mL)</td>
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<td>103.7 (84.9)</td>
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<td>112.1 (105.1)</td>
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<tr>
<td>CPB-end</td>
<td>170.0 (193.3)</td>
<td>138.6 (135.5)</td>
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<td>Surgery-end</td>
<td>125.2 (87.6)</td>
<td>124.4 (111.9)</td>
<td>0.971</td>
</tr>
<tr>
<td>8 HR post-op</td>
<td>148.1 (125.7)</td>
<td>169.2 (203.9)</td>
<td>0.530</td>
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</tbody>
</table>
The following abstract was presented as a poster at the World Congress on Regional Anesthesia & Pain Medicine, April 19-21, 2018 in New York, NY and the Annual Pennsylvania Anesthesia Resident Research Conference, May 19, 2018, Drexel University, Philadelphia, PA

BILATERAL SERRATUS ANTERIOR PLANE CATHETERS FOR POST-OPERATIVE ANALGESIA AFTER DOUBLE LUNG TRANSPLANTATION
Samuel Goldstein, MD; Rajamani Battula MD; Nicholas Schott MD

INTRODUCTION
Double lung transplantation is a surgical procedure fraught with significant post-operative pain due to transverse sternotomy, better known as the “clamshell” incision, and multiple chest tubes. Anesthesiologists are frequently unable to achieve adequate pain control with a multimodal regimen including opioids and ketamine, causing significant discomfort and occasionally preventing successful post-operative extubation. When traditional neuraxial or deep plexus regional anesthesia techniques such as thoracic epidural or paravertebral catheter placement are unattainable due to inability to position patients secondary to severe pain or due to coagulation concerns, alternative therapies are required.

MATERIALS AND METHODS
Patients gave informed consent for the procedure. IRB approval was not required at our facility, but informed consent was validated for publication submission approval.

DISCUSSION
At UPMC, the acute pain service is consulted for post-operative pain management for double lung transplantation. We provide adequate analgesia, reducing chest wall discomfort and facilitating successful extubation by placing bilateral serratus anterior plane catheters with local anesthetic infusions and hourly boluses in the post-operative period. The procedure merely requires the patient to lay supine in bed and is well tolerated. Considering that the serratus anterior plane is neither a neuraxial nor deep plexus site, less stringent coagulopathy and medication requirements may be required, making this approach a viable alternative to traditional therapies.

REFERENCES
USE OF AN ERECTOR SPINAE PLANE (ESP) BLOCK FOR POST-OPERATIVE PAIN FOLLOWING SINGLE LUNG VATS IN AN ANTICOAGULATED PATIENT

Samuel Goldstein, MD; Nicholas Schott MD

INTRODUCTION
Although video-assisted thoroscopic surgery (VATS) has successfully reduced post-operative pain compared to thoracotomy for lung decortication, acute and chronic pain are common after this procedure. [1,2] Considering that VATS decortication is often performed in the setting of infection, regional anesthesia techniques are overlooked. Avoiding neuraxis is important in this situation, as an epidural abscess can be devastating. We report a complicated case when a young individual with anticipated perioperative pain was started on therapeutic heparin for a cavernous sinus thrombosis and was scheduled for a right VATS decortication, wedge resection, and chest tube placements.

MATERIALS AND METHODS
The patient gave informed consent for the procedure. IRB approval was not required at our facility, but informed consent was validated for publication submission approval.

RESULTS/CASE REPORT
A 19-year-old otherwise healthy female initially presented to an outside hospital with three days of URI and recent dental work. She quickly decompensated and was intubated and transferred to our facility with septic shock from infective U thrombophlebitis, new cavernous sinus thrombosis, bilateral pleural effusions, and blood cultures growing fusobacterium. After resuscitation, chest tube placement, heparinization, initiation of antibiotics, and transfer to the medical floor from the ICU, the patient had continued issues with loculated pleural effusions. VATS exploration was scheduled. Heparin was continued in the pre-op holding area. To minimize interventional risk, a unilateral erector spinae plane (ESP) block with catheter placement was performed in one pass pre-operatively. Lidocaine 0.25% at 12cc/hr. with hourly 3cc boluses was initiated. Her pre-operative pain score was 6/10. Her post-VATS pain scores were 2-4/10 in the ICU. Her 24-hour post-operative IV hydromorphone PCA consumption was 3.6mg. There was no peri-operative bleeding associated with the catheter, and the patient was satisfied with her pain control.

DISCUSSION
The ESP block is effective in controlling thoracic pain. [3] We decided that ESP would be adequate to cover the posterolateral region of the chest, encompassing the chest tube and surgical incision. It would not be appropriate to perform thoracic epidural or true paravertebral during therapeutic heparin infusion, for fear of epidural hematoma or seeding of an infection from the lung if pleura was violated. Paravertebral catheters are not effective after decortication, because once the parietal pleura is damaged, the anterolateral boundary of the paravertebral space is compromised. A paravertebral catheter is essentially intrathoracic after decortication, making it ineffective at covering the thoracic spinal nerves. Successful ESP block encompasses the dorsal and ventral rami of the thoracic spinal nerves in the plane between the erector spinae muscle and the transverse process, providing adequate analgesia to the chest wall. Without compromising the costo-transverse ligament / paravertebral plane, pulmonary infection should be contained while limiting bleeding risk from decreased needle trauma. Our patient’s therapeutic heparin infusion was acceptable, as a skilled regionalist requires only a single pass to perform this block and uses ultrasound for visualization, and the location is relatively far from the neuraxis and is superficial within a compressible space. The ESP block is a viable alternative to traditional regional techniques, as it safely and effectively provides thoracic analgesia.

REFERENCES
The following abstract was presented as a poster at the Spring Annual Meeting of the Society of Education in Anesthesia, April 19 – 22.

**FACULTY FEEDBACK INTERVENTION WITHIN THE EVALUATION SYSTEM OF THE CLINICAL PERFORMANCE OF ANESTHESIOLOGY RESIDENTS**

Melanie Hodge, MD; Doreen E. Soliman, MD

UPMC Children’s Hospital of Pittsburgh

**BACKGROUND**

In today’s world of clinical training, it is important to have a tool for objective evaluation of residents’ competence [1]. Faculty play an essential role in providing educational feedback for residents’ overall improvement [2]. Performance evaluations have significant limitations, such as faculty not having directly observed the residents, grading leniency, and needing more formative feedback [3]. The addition of a checklist for standardized feedback can provide a format that faculty can follow to assess specific elements of resident performance, such as areas of excellence, areas that require improvement, and areas that are of concern.

**NEEDS ASSESSMENT**

To ultimately improve a resident’s clinical care and performance, further development of feedback and intervention is needed. Direct observation and detailed critique of a resident’s clinical performance is imperative to enhance competency and establish expertise. Previous studies have concluded that assessment of a resident’s performance maintains a significant subjective influence [4]. Improving faculty feedback can allow for a less subjective, but more thorough and comprehensive evaluation.

**CURRICULUM DESIGN**

Feedback intervention with the use of a practical and user-friendly checklist may improve faculty’s overall evaluation skills and resident satisfaction with their performance feedback. This innovative checklist will serve as an instructional guide that can be utilized daily and will include specific topics, such as preoperative preparation, technical skills, clinical performance, medical knowledge, professionalism, and interpersonal skills. Workshops with real-life clinical scenarios will ensure adequate training in the utilization of the checklist.

Constructive criticism, provided in real time with the help of the checklist, may aid in competency levels and build appreciation and trust between faculty and residents.

**CURRICULUM EVALUATION**

The faculty involved in the pilot testing of the checklist will provide both oral and written feedback concerning the checklist efficacy. Online surveys sent to the residents will help in the further development and determination of the use of this innovative feedback tool.

Utilizing face-to-face interactions, this compact, laminated, and pocket-sized checklist is a resourceful feedback intervention with the potential to make a large impact in the standardization of resident evaluations.

**REFERENCES**


The following abstract was presented at the Society of Cardiovascular Anesthesiologists 40th Annual Meeting and Workshops, April 28-May 2, 2018, Phoenix, AZ.

THE EFFECT OF HIGH DOSE REMIFENTANIL INFUSION ON ACUTE POST-OPERATIVE PAIN AFTER CARDIAC SURGERY
Ibarra A, Subramaniam K

INTRODUCTION
Remifentanil is a short-acting synthetic opioid with a rapid onset and recovery time. Remifentanil has been effectively used for cardiac surgery with cardiopulmonary bypass (CPB). It has demonstrated to reduce the stress response during CPB by preventing the increase of cytokines and catecholamines.1,2 Despite its benefits, remifentanil has also been associated with increased acute and chronic post-operative pain.3 We aim to investigate whether remifentanil infusion increases pain and analgesic requirements after elective cardiac surgery.

METHODS
This study is a prospective, randomized, open label clinical trial. After approval from the Institutional Review Board, 116 patients undergoing open cardiac surgery with CPB were enrolled. Informed consent was obtained from the study candidates. Patients were randomized to either the fentanyl group (control) who received titrated doses of intermittent fentanyl boluses or the IV remifentanil infusion group (interventional) who received an infusion at 0.1-0.4 µg/Kg/minute in the pre- and post-CPB periods and 1 µg/Kg/min during CPB. Post-operative pain was assessed for 48 hours after surgery using a visual analog scale, as well as by total analgesic requirements in terms of morphine, oxycodone, acetaminophen, hydromorphone, ketorolac, and total morphine equivalent. Nonparametric tests were used to compare pain scores and amounts of analgesic medication received between the two groups. A P-value <0.05 was considered significant.

RESULTS
Data from 100 patients were included for this analysis. The interventional and control groups had 48 and 52 patients, respectively. Preoperative characteristics and operative parameters were comparable between the two groups. Pain scores were comparable between the groups except at hours 15 (p<0.006) and 17 (p<0.003) when the remifentanil group had higher pain scores in comparison to the fentanyl group (Figure 1). No statistical significance was found in terms of rescue analgesic requirements (Table 1). Complications extracted from the Society of Thoracic Surgeon’s Database did not differ between the two groups.

CONCLUSION
Intraoperative high dose remifentanil infusion did not significantly increase the requirement of postoperative rescue analgesics or increase postoperative complications. Reported pain scores were higher in the remifentanil group, a finding that will need further evaluation.

REFERENCES
MANDATORY ENVIRONMENTAL SAVINGS INITIATIVE (MESI):
COST COMPARISON OF ANESTHETIC TECHNIQUES IN A LARGE UNIVERSITY HOSPITAL SYSTEM

Evan E. Lebovitz, MD  Mark E. Hudson, MD, MBA  Sanford Littwin, MD
UPMC Department of Anesthesiology and Perioperative Medicine, Pittsburgh, PA

INTRODUCTION
Modern anesthesia faces demanding challenges to continue technological improvements, lower costs, and improve outcomes in our current healthcare environment. The practice of anesthesiology has monetary effects within the healthcare system, including preoperative testing, control of operating and recovery room usage, and consumption of large amounts of hospital supplies and services, which represent 3-5% of the total health care costs in the United States [1].

METHODS
In this study, we analyzed prices for medication and equipment purchased in the spring of 2017 for various hypothetical cases at our institution. In these cases, we utilized standardized equipment (Table 1), induction medications (Table 2), and analyzed various methods of maintenance anesthesia, including various inhaled agents and total intravenous anesthesia (Table 3). Cases utilizing neuromuscular blockade and reversal were also analyzed.

RESULTS
For our inguinal hernia repair on an 80-kg male, the total cost for a standard set up of non-reusable equipment was $57.07. Induction medications cost $29.50. Additional cost for neuromuscular blockade and reversal with rocuronium, neostigmine, and glycopyrrolate amounted to $94.78. Maintenance anesthesia varied significantly depending on the type (inhaled agents vs. TIVA) and on volatile agent used, e.g. isoflurane vs. sevoflurane. Our analysis revealed a 48% reduction in cost of medications utilized

<table>
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<th>CART EQUIPMENT</th>
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<td>Description</td>
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<td>PULSE OX SENSORS</td>
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<td>SKIN TEMPERATURE PROBES</td>
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<td>30 FR NASAL AIRWAY</td>
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<td>BLUE CAP</td>
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Table 1

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<td>Midazolam 1 mg/mL - 2 mL</td>
<td>$0.58</td>
<td>1</td>
<td>$0.58</td>
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<tr>
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<td>$2.29</td>
<td>1</td>
<td>$2.29</td>
</tr>
<tr>
<td>Rocuronium 10 mg/mL - 5 mL</td>
<td>$2.46</td>
<td>1</td>
<td>$2.46</td>
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<tr>
<td>Succinylcholine 20 mg/mL - 10 mL</td>
<td>$18.22</td>
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<td>$18.22</td>
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<tr>
<td>Ondansetron 2 mg/mL - 2 mL</td>
<td>$0.33</td>
<td>1</td>
<td>$0.33</td>
</tr>
</tbody>
</table>

Set Up Medications

Table 2.
throughout the case when comparing a two-hour case performed under sevoflurane with neuromuscular blockade and reversal compared to TIVA without neuromuscular blockade ($147.73 vs. $77.54).

**CONCLUSIONS**
We performed a cost analysis of equipment and medications utilized by anesthesia providers in the perioperative period. Anesthetic technique can dramatically alter the costs of providing care for similar patients undergoing the same type surgery. They can also alter other important variables such as time to recover and length of PACU stay. Pain and/or nausea/vomiting in the course of the PACU time also can be considered, but there were not part of the initial cost saving measures. Further studies should analyze the impact of these management decisions on patient safety, patient/provider willingness to change techniques, and overall perioperative care costs.

<table>
<thead>
<tr>
<th>2 hr case 80 kg, Sevoflurane + Reversal</th>
<th>2 hr case 80 kg, Sevoflurane + no NMB</th>
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<tr>
<td>$ Per Unit</td>
<td>Units</td>
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<tr>
<td>Cefazolin 1 gram</td>
<td>$0.84</td>
</tr>
<tr>
<td>Dexamethasone 10 mg/mL 1mL</td>
<td>$0.95</td>
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<tr>
<td>Dexmedetomidine 40 mcg/10mL</td>
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<tr>
<td>Epinephrine 100 mcg/10mL</td>
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<tr>
<td>Glycopyrrolate 0.2 mg/mL - 1 mL</td>
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</tr>
<tr>
<td>Sodium Chloride 0.9% - 1 L</td>
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</tr>
<tr>
<td>Ketamine 10 mg/mL - 20 mL</td>
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</tr>
<tr>
<td>Lidocaine 1% - 5 mL</td>
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<td>Midazolam 1 mg/mL - 2 mL</td>
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</tr>
<tr>
<td>Neostigmine 1 mg/mL - 10 mL</td>
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<tr>
<td>Phenytoin 800 mcg/mL</td>
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<tr>
<td>Succinylcholine 20 mg/mL - 5 mL</td>
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</tr>
<tr>
<td>Sevoflurane (per hr)</td>
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<tr>
<td><strong>Total cost for sevoflurane + NMB</strong></td>
<td><strong>$146.73</strong></td>
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<table>
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<tr>
<th>2 hr case 80 kg, TIVA, no NMB</th>
<th>2 hr case 80 kg, TIVA, no NMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ Per Unit</td>
<td>Units</td>
</tr>
<tr>
<td>Cefazolin 1 gram</td>
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<tr>
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<td>Sodium Chloride 0.9% - 1 L</td>
<td>$1.37</td>
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<tr>
<td>Ketamine 10 mg/mL - 20 mL</td>
<td>$11.21</td>
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<tr>
<td>Midazolam 1 mg/mL - 2 mL</td>
<td>$0.58</td>
</tr>
<tr>
<td>Ondansetron 2 mg/mL - 2 mL</td>
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<tr>
<td>Phenytoin 800 mcg/mL</td>
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<td>$2.29</td>
</tr>
<tr>
<td>Succinylcholine 20 mg/mL - 5 mL</td>
<td>$2.46</td>
</tr>
<tr>
<td>Sevoflurane (per hr)</td>
<td>$9.05</td>
</tr>
<tr>
<td><strong>Total cost for TIVA w/o NMB</strong></td>
<td><strong>$77.54</strong></td>
</tr>
</tbody>
</table>

| Table 3 |
A 56-year-old female with severe myasthenia gravis (MG) necessitating weekly plasmapheresis for the past seven years presented after a fall resulting in elbow dislocation, radial head fracture, and coronoid process fracture. She required open reduction of elbow dislocation, left radial head replacement, open reduction and internal fixation of the coronoid fracture, and repair of the ulnar collateral ligament. Her pertinent past medical history included insulin-dependent type 2 diabetes, peripheral diabetic neuropathy, chronic back pain, hypertension, morbid obesity (BMI 45), and COPD (2-4L home O2). Her home pain and myasthenia medications included baclofen 5 mg TID, gabapentin 1200 mg QAM/QPM, gabapentin 1800 mg QHS, oxycodone ER 30 mg Q12H, oxycodone 10 mg Q8H, prednisone 20 mg QAM, pyridostigmine 120 mg Q12H, and pyridostigmine 180 mg with lunch.

MG is a disorder caused by antibodies against the nicotinic acetylcholine receptor and associated proteins, leading to decreased receptor density and weakness. The likelihood of postoperative ventilatory support may be increased if the patient has disease lasting longer than six years, has previous respiratory problems or coexisting lung disease, takes a daily pyridostigmine dose greater than 750 mg, or has a preoperative forced vital capacity less than 2.9L. This is a case report of tourniquet release resulting in exacerbation of MG symptoms in a patient undergoing bilateral Achilles tendon release. The exacerbation of symptoms was thought to be due to lactate release following desufflation of bilateral lower extremity tourniquets inflated for 105 and 110 minutes.

On the day of surgery, a supraclavicular block was performed with an 18G, 9cm Tuohy needle by administering lidocaine 2% 20 mL perineurally. A 20G perineural catheter was placed. One hour later, the procedure started with tourniquet inflation. Lidocaine 2% 5mL was administered perineurally via the catheter. Anesthetic consisted of propofol infusion 25 50 mcg/kg/min and dexmedetomidine 40 mcg in multiple divided doses. The patient breathed 8L oxygen spontaneously by facemask with SpO2 92-98%. The surgery lasted two hours. After surgery, sensory and motor function of the operative extremity was evaluated in the PACU by the orthopedic surgery team and the following alterations were made to the patient’s home pain regimen: bupivacaine 0.0625% infused through the perineural catheter postoperatively to provide analgesia and limit opioid consumption. Ketamine IV was added to the postoperative pain regimen since it has been shown in various studies to decrease postoperative opioid consumption and reduce pain scores.

Regional anesthesia can be used in patients with MG to avoid intubation and the respiratory depressant effects of opioids. Exacerbation of MG symptoms has been reported following tourniquet release; therefore, anticipation of this possibility is necessary. Perineural lidocaine 2% can provide adequate anesthesia for upper extremity orthopedic surgery and allow for timely postoperative neurological assessment of the extremity. Ketamine is useful to improve pain control and limit opioid requirements in the perioperative period.

The following abstract was a poster presentation at the ASA Practice Management meeting, January 26-28, 2018, New Orleans, LA; at the Annual Pennsylvania Anesthesia Resident Research Conference, May 19, 2018, Drexel University, Philadelphia, PA; and at the 16th annual Safar Symposium/sixth annual Multi-Departmental Trainees’ Research Day, May 31-June 1, 2018 in Pittsburgh PA.

USING AN ANESTHESIOLOGY-TRAINED CHRONIC PAIN PHYSICIAN FOR PERIOPERATIVE INPATIENT AND OUTPATIENT PAIN MANAGEMENT AS PART OF THE PERIOPERATIVE SURGICAL HOME
Neal Shah, MD; Trent Emerick, MD, MBA

INTRODUCTION
In an era when increasing numbers of surgical procedures are being performed and in the current opioid epidemic, surgeons and anesthesiologists are working closer together to effectively manage post-operative pain. This is even a bigger challenge in patients with substance abuse problems, chronic pain, or high levels of oral morphine equivalent use. Sub-optimal acute pain management in surgery has been well documented to lead to various negative consequences, including increased morbidity, impaired physical function and quality of life, slowed recovery, prolonged opioid use during and after hospitalization, and increased cost of care due to prolonged stay. Clearly, patients with chronic pain often are concerned about their pain management throughout the perioperative period. Discussions surrounding pain management often dominate the surgeon’s surgical consultations, which makes it difficult for surgeons to conduct their own preoperative evaluation and discuss the specifics of the procedure. Analogous to a preoperative anesthesia assessment clinic, we have developed a novel approach with the Department of Neurosurgery to pre-operatively evaluate high risk and challenging chronic pain patients undergoing various neurosurgical procedures to develop a plan to manage postoperative pain.

METHODS
In conjunction with the Department of Neurosurgery, appropriate referral patients were identified in the neurosurgical clinics by physicians and physician assistants. No definitive criteria for referral were used; instead, chronic pain consultation referrals were left up to the discretion of the neurosurgical team. These patients would be evaluated in the chronic pain clinic pre-operatively and a plan for how to manage pain after the procedure would be determined. Once the patient was admitted for the surgical procedure, the chronic pain team would be consulted and would then enact the plan determined at the initial outpatient visit. On discharge, a pain plan would be given to the patient and further pain management would be guided by the patient’s primary care provider/chronic pain specialist or other physician managing the condition pre-operatively.

RESULTS
Since inception of the program in July 2017, a small cohort of patients (n=8) have undergone this novel approach of an outpatient pre-operative evaluation by a chronic pain specialist. Patients that were referred included those with a history of substance abuse on outpatient addiction maintenance therapy, patients with preoperative high oral morphine equivalent usage, and those who specifically requested a pain clinic consultation. Amongst these patients, almost all described feeling less anxious about their pain management throughout the perioperative period.

DISCUSSION
It is possible that this new approach to managing postoperative pain in select patient populations is effective in reducing anxiety and improving the satisfaction among this cohort of chronic pain patients. Patients have anecdotally mentioned a sense of comfort knowing that a plan to manage their pain was in place, which was outlined even before they were admitted to the hospital. Patients also expressed satisfaction with the continuity of seeing the same chronic pain team members post-operatively. Furthermore, this approach likely allowed the neurosurgical staff to focus specifically on the surgical tasks at hand and not perioperative acute-on-chronic pain management.

In an era when reimbursements are becoming tied to patient satisfaction, approaches such as this one can help hospitals improve their quality of care. Further implementation of such an approach in conjunction with other surgical departments can help improve quality of care in chronic pain patients undergoing a wide variety of surgical procedures. After this pilot program, the next likely step would be a larger-scale program involving statistical analysis of patient satisfaction, provider satisfaction, and perioperative outcome measures.
The following abstract was a poster presentation at the ASA Practice Management meeting, January 26-28, 2018, New Orleans, LA and won the FAER Resident Scholar Award for Best Resident Poster and received 3rd place amongst all posters presented at meeting. It was also an oral presentation at the Annual Pennsylvania Anesthesia Resident Research Conference, May 19, 2018, Drexel University, Philadelphia, PA and received the first place award in the original research category.

**UTILIZING A “VALUE” INCENTIVE TO RAPIDLY INTRODUCE EVIDENCE-BASED PRACTICE ACROSS A LARGE MULTIHOSPITAL HEALTH CARE SYSTEM**

Neal Shah, MD; Jamie Artman, CRNA, MSN; Sanford M. Littwin, MD; Mark Hudson MD, MBA

**INTRODUCTION**

For the past several years, evidence-based medicine has guided healthcare reform to improve quality of care while reducing cost. Implementation of evidence-based medicine is often not straightforward. Based on the literature, it takes an average of 17 years to develop and implement guidelines to change clinical practices. Efforts are often unsuccessful due to disincentives in the form of complexities to making notable changes to system practices. Common challenges include: requiring providers to change their routines, time and cost for implementation, and organizational culture that fosters usual and customary practice. The UPMC Department of Anesthesiology and Perioperative Medicine, a University Physicians Practice, rapidly introduced evidence-based practices across 11 separate departmental divisions spanning 18 surgical facilities utilizing a value-based incentive program.

**METHODS**

A “value” incentive was introduced, requiring identification and introduction of metrics aimed at improving patient quality and/or reducing expenses in care delivery. The evidence-based metrics of lung protective ventilation; intraoperative glucose monitoring and treatment; transfusion trigger; and albumin use were selected. For transfusion trigger and albumin use, projected direct savings from reduction in red blood cell and albumin use was calculated. To aid in achieving compliance, a modest incentive (<2.5% of total compensation) was paid to providers who succeeded in the defined metric goals. In fiscal year (FY) 2017 and FY 2018, thresholds for goal improvement were established for each six-month incentive period. Data was collected for the two months prior to introduction of the metrics and standardized education was provided to department members. Performance by division and by individual anesthesiologist was collected monthly and feedback was provided to department leadership.

**RESULTS**

As seen in Table 1, within six months there was a rapid increase in compliance to goal thresholds for each metric, which continued to increase over the subsequent six months. For albumin usage, all sites achieved the goal threshold of less than 7% of anesthetics within six months as well. While all metrics improved quality, the transfusion trigger and albumin usage provided a projected annual direct cost savings of $382,800 and $907,894, respectively.

**DISCUSSION**

Incentives have been used for decades to improve performance in many industries and more recently, healthcare. Previously, large academic institutions were able to implement evidence-based measures in 18 months by focusing on key areas of infrastructure, including leadership, information technology, education methods, and measurement of metric performance. In our institutional model, financial incentives provide an avenue to incorporate evidence-based medicine as a rapid change agent for best clinical practice in a large, complex, multi-site healthcare organization.
REFERENCES

1. Morris ZS, Wooding S, Grant J. (2011, December). The answer is 17 years, what is the question: understanding time lags in translational research.


The following abstract was presented as a poster at the Society of General Internal Medicine Annual Meeting, April 12, 2018 in Denver, CO.

**DYSURIA AND STERILE PYURIA IN A KIDNEY TRANSPLANT PATIENT: UREAPLASMA UREALYTICA URETHRITIS**

Siyi Shangguan¹, C. Tyler Smith²

¹Department of Medicine; ²Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh

**LEARNING OBJECTIVE #1**

Diagnose *Ureaplasma urealyticum* infection in immunosuppressed patients with dysuria and sterile pyuria.

**CASE**

A 37-year-old man who had undergone kidney transplantation nine years ago for IgA nephropathy on immunosuppression presented with one week of dysuria. He went to an urgent-care clinic after two days of symptoms, where a urinalysis was reportedly “dirty” and oral cefuroxime was started. Urine culture, gonorrhea, and chlamydia screening samples collected in the clinic were negative. He was admitted to our medicine department from the emergency department after he had no improvement in symptoms. His past medical history was notable for Banff 1A-1B acute cellular rejection and antibody mediated rejection (with mild interstitial fibrosis and tubular atrophy) three years ago. Vital signs, cardiopulmonary, and abdominal and genitourinary physical exams were normal. Bloodwork showed normal white blood cell (WBC) count, BUN 34mg/dl, and creatinine 2.2mg/dl (at baseline).

Urinalysis showed a cloudy appearance, 3+ urine blood, 3+ leukocyte esterase, negative nitrite, protein 100mg/dl, greater than 100 WBCs, few WBC clumps, red blood cells 2 to 3, and urine eosinophil (+). Repeat gonorrhea and chlamydia screening, urine culture, Trichomonas vaginalis RNA, and urine fungal culture remained negative. Transplant renal ultrasound revealed unremarkable graft kidney and bladder. He failed to improve after two days of empirical ceftriaxone.

The decision was made to trial doxycycline for atypical pathogen coverage. Additional microbiology workup included AFB culture, PCRs of BK virus, adenovirus, *Mycoplasma hominis*, *Ureaplasma urealyticum*, and *Ureaplasma parvum*. On the second day of doxycycline, the patient reported a tremendous improvement of dysuria and was discharged to complete a 10 day course. Later, his urine *Ureaplasma urealyticum* PCR came back positive, while other tests were finalized as negative. A post-discharge phone call confirmed complete resolution of his dysuria.

**IMPACT**

The differential of sterile pyuria in this patient is broad: urinary tract infection, transplant rejection, IgA nephropathy relapse, urolithiasis, neoplasm, interstitial cystitis, or interstitial nephritis secondary to cefuroxime. Benefits of empiric antibiotic administration outweighed the risks in an immunosuppressed patient with prominent dysuria symptoms, and atypical pathogens should be considered if first line empirical therapy fails.

**DISCUSSION**

*Ureaplasma urealyticum* is associated with urogenital tract conditions. Its precise pathogenic role remains unproven given its common genitourinary colonization in healthy asymptomatic adults and its difficult detection due to the fastidious growth requirements. Immunocompromised patients are predisposed to develop diseases. Ureaplasma should be considered in such populations presenting with non-gonococcal urethritis and/or sterile pyuria. Urine sample PCR is the diagnostic test of choice. The suggested treatment is doxycycline, while macrolides and fluoroquinolones are appropriate alternatives.
The following abstract was an oral and poster presentation at the International Anesthesia Research Society 2018 Annual Meeting and International Science Symposium: Improving Health Through Discovery and Education, April 28 – May 1, 2018, Chicago, Illinois and was a Kosaka Best of Abstract Top Finalist. It was also presented as a poster at the 16th annual Safar Symposium/sixth annual Multi-Departmental Trainees’ Research Day, May 31-June 1, 2018 in Pittsburgh PA and tied for Best Abstract in Anesthesiology Award.

MIDAZOLAM SEDATION DURING THE PERIODIC EXPERIENCE OF PAIN DECREASES FUNCTIONAL CONNECTIVITY BOTH WITHIN AND BETWEEN BRAIN SYSTEMS FOR PAIN PROCESSING AND MEMORY ENCODING

C. Tyler Smith, James W. Ibinson, Keith M. Vogt

INTRODUCTION
Functional connectivity (FC) examines temporal correlations between spatially remote neurophysiological events and is a powerful tool for exploring interactions between distinct brain structures, most recently using blood oxygen-level dependent (BOLD) functional connectivity MRI (fcMRI) [1]. Light sedation with midazolam has previously demonstrated intact FC within lower-level brain networks, while FC of higher-level networks was significantly disrupted [2]. This study investigated fcMRI changes in subjects performing a memory encoding task while periodically receiving painful stimulation, comparing saline and midazolam conditions. We expected decreased interaction between the brain systems for pain and memory under midazolam, reflected by decreased fcMRI between areas of the pain matrix [3] and medial temporal lobe memory structures. Memory structures of particular interest included the hippocampus and amygdala, as these are engaged by aversive stimuli and differentially modulated by anesthetics [4].

METHODS
This preliminary dataset included six healthy adults (three male), mean (SD) age 23.9 (3.4) years old. Whole brain BOLD fMRI images were acquired every one second. In a previously reported cognitive experiment [5], the subjects were played a list of words and classified each (e.g. alive or not). One-third of the words were followed by a one-second electrical stimulation to the left index finger that was predetermined by each subject to be painful at a level of 7/10. Midazolam was then administered via target-controlled infusion to a plasma effect site concentration of 10 ng/ml, and the experiment was repeated with a different word list. Analysis was performed using the Conn toolbox for SPM. Average seed time courses were averaged across anatomical regions of interest. Group average contrast maps, comparing the no-drug and midazolam conditions for brain connectivity during the combined experience of memory encoding and periodic pain processing, were calculated and thresholded using p < 0.001 (uncorrected).

RESULTS
Table 1 lists significant changes in functional connectivity, comparing saline to midazolam conditions. FC was decreased between the right parahippocampus and hippocampus, as well as between the anterior cingulate and right insula. There was also decreased FC from seed regions in the hippocampus, amygdala, and parahippocampus to multiple areas of the pain matrix. Bilateral insula FC was decreased to the right parahippocampus and hippocampus. Characteristic FC contrast maps are shown for seed regions in the hippocampus (Figure 1), amygdala (Figure 2), parahippocampus (Figure 3), and insula (Figure 4).

CONCLUSION
During performance of a memory encoding task with periodic pain stimulation, light sedation with midazolam altered fcMRI data. Connectivity was decreased within the medial temporal lobe memory system and within...
the pain matrix. FC also decreased between elements of the brain systems that encode memories and process pain. This suggests that even minimal sedation with midazolam may affect how memory is formed under painful conditions.

REFERENCES


The following abstract was presented at the Annual Pennsylvania Anesthesia Resident Research Conference, May 19, 2018, Drexel University, Philadelphia, PA

A 10-YEAR EXPERIENCE IN INTERNATIONAL MISSION ROTATIONS IN ANESTHESIOLOGY RESIDENCY
Sara Straesser, MD; David Metro, MD, FASA; Steven Orebaugh, MD
Department of Anesthesiology and Perioperative Medicine, UPMC

INTRODUCTION
Since 2008, the UPMC anesthesiology residency has offered a one-month pediatric/international ACGME-approved mission rotation to PGY-4 residents in partnership with Surgicorps International, who organizes the trips. One or two residents and one faculty member go on each trip. Costs, including travel, lodging, and medical malpractice, are funded by the department. Our primary aim is to report our experiences with the mission rotations.

METHODS
The rotation consists of an advanced pediatric anesthesiology rotation at UPMC Children’s Hospital of Pittsburgh for two to three weeks, followed by one to two weeks abroad on the mission. Records and de-identified resident evaluations from 2008 to 2018 were reviewed. The online evaluation form includes 10 questions, scored in a Likert-type scale from 1-9 (1=lowest and 9=highest), along with two open-ended response questions to address strengths and weaknesses of the rotation.

RESULTS
A total of 41 anesthesia residents and one fellow have travelled to six countries: Guatemala, Zambia, Vietnam, Bhutan, Ethiopia, and Columbia (Table 1). Typical surgical cases performed on the trips include general surgery, plastic surgery (with emphasis on pediatric cases), and gynecological surgery (Table 2). Twenty evaluations have been submitted since 2013. Overall, the residents rated the rotation highly (Table 3). Free text responses commenting on strengths of the rotation include: “one of the most valuable clinical experiences of residency”; “would recommend to all my fellow residents”; “makes this residency stand out”; “great experience – definitely life changing”; “amazing experience and was everything I hoped for – would do it again”; and “not only rewarding to help patients in need but also invaluable experience of working with limited resources.” Free text responses commenting on suggestions for improvement relate to improving the preparation process by providing more information prior to trip departure.

DISCUSSION
Resident experiences from this rotation are overwhelmingly positive. Many residents comment on how this experience has changed them and that they plan to do further mission work in the future. Offering the mission as an ACGME-approved rotation eases stress by providing credit towards training requirements, funding travel costs, ensuring safety while on the trip, and eliminating scheduling challenges.1

REFERENCES
INCIDENCE OF MEDICATION ERRORS IN PEDIATRIC ANESTHESIA: A RETROSPECTIVE OBSERVATIONAL STUDY FOR IDENTIFICATION OF A POSSIBLE INTERVENTIONAL TARGET
Sara Straesser, MD; Doreen Soliman, MD
UPMC Children’s Hospital of Pittsburgh

INTRODUCTION
Medication errors have been identified in anesthesia as a major source of preventable adverse events. The incidence of operations involving a medication error and/or adverse drug event has been reported to be as high as 44.7%. The incidence is likely higher in the pediatric population. Dosing error has been recognized as the most common reason for medication error in pediatric anesthesia. The aims of this abstract are 1) to explore the incidence and nature of medication errors and 2) to compare the incidence of errors between residents and other hands-on care providers.

METHODS
Retrospective quality improvement data was collected through the anesthesia electronic medical record (EMR) from 1/1/16-12/31/17. Cases indicating a medication error in the event summary of the EMR and those indicating free text error events possibly relating to medications were included. Types of medication, reasons for error, types of surgery, patient ages, and the seasonal change of the incidents were analyzed. The rates of the medication errors between residents and other hands-on care providers were compared.

RESULTS
Among 56,933 anesthesia cases performed, 18 medication errors (1: 3,162) were identified. The most common medication classes to be involved in medication error were opioids (five errors) and neuromuscular junction blockers (five errors). Dosing error was identified as the most common reason for medication error (Figure 1). Errors were reported to occur most commonly in ENT surgery (six of 18 errors). The most likely age group to be affected by medication errors was two- to six-year-olds. Medication errors occurred most frequently in July and August (Figure 2). Eleven of 18 medication errors (61%) involved residents. The incidence of medication errors among resident cases (1:1,114) was higher than that among other hands-on care providers (1:6,382) (odds ratio 5.73 [95% confidence interval 2.2-14.8], p<0.0001).

DISCUSSION
Our study indicates that medication errors in pediatric anesthesia care most often occurred as a form of overdosing and were mainly committed by anesthesia resident physicians. These results have prompted us to investigate whether a weight-based medication dosing reference card for residents rotating in pediatric anesthesia could decrease medication errors in the institution.

REFERENCES

ASSESSING RISK FACTORS FOR CHALLENGING PAIN CONTROL IN PATIENTS UNDERGOING MAJOR ABDOMINAL SURGERY WITH ENHANCED RECOVERY AFTER SURGERY PROGRAM

Tran LT, Lazar S, Doney L, Boisen M, Esper SA, Holder-Murray J, Subramaniam K

INTRODUCTION
Enhanced Recovery After Surgery (ERAS) protocols are employed for many surgical procedures (1-3). At UPMC, ERAS programs were implemented for patients undergoing major abdominal surgeries. This has led to improved pain control and reduced length of stay for many patients. Despite the positive impact of ERAS, there is a subset of patients with refractory pain that is difficult to control. In this study, we assessed the risk factors for challenging pain control. Identification of such risk factors would allow the development of more effective strategies to improve pain control in this patient population.

METHODS
This retrospective study was conducted after institutional ethical board review and approval. Patients who underwent general abdominal and colorectal surgeries with the ERAS protocol at UPMC Presbyterian and Montefiore hospitals between July 2015 and August 2017 were evaluated. Appendix A shows an example of a UPMC ERAS perioperative pain management protocol. In the post-operative period, routine use of intravenous patient control analgesia (IVPCA) with opioid is reserved for patients with pain refractory to acetaminophen, non-steroidal anti-inflammatory drugs, lidocaine, and oral oxycodone. For patients with poor pain control despite IVPCAs, the acute or chronic pain service is consulted.

An automated query of the electronic medical records generated a list of patients along with their demographic data and peri-operative medications. Manual extraction of data for pre-operative comorbidities, home medications, and post-operative pain management was performed. Univariate analysis was done to compare the pre-operative characteristics and intra-operative variables between patients with challenging pain management (group 1) versus others (group 2). Patients who required IVPCA and consultation with pain specialists are classified into the challenging pain management group (group 1). Characteristics with significant difference (P <0.1) between the two groups were entered into a multivariable logistic regression model to identify the independent factors associated with difficult pain management. SPSS 12.0 was utilized for statistical analysis and P < 0.05 was considered significant.

RESULTS
A total of 731 patients underwent major abdominal surgery with ERAS during the study period. Patients with poor adherence to protocol, post-operative mortality, re-intubation, and re-operation were excluded, leaving 693 patients. Baseline patient characteristics are shown in Table 1. Univariate analyses showed a significant difference (P <0.1) in the baseline age, body mass index, previous abdominal surgery, psychiatric illness, and tobacco use between the two groups; there was also a significant difference in home medications, including benzodiazepines, antidepressants, gabapentin, or pregabalin. Duration of surgery was significantly different between the two groups (Table 2).
Using the significant variables above in a multivariable regression model, the following were found to be independently associated with challenging pain management: younger age, lower BMI, history of psychiatric illness, pre-operative opioid intake, and duration of surgery.

CONCLUSION

In patients undergoing general abdominal and colorectal surgeries with ERAS, risk factors for challenging pain control include younger age, lower BMI, longer duration of surgery, history of psychiatric illness, and home opioid use.

REFERENCES

The following abstract was presented at the meeting of the Society for Pediatric Anesthesia and the American Academy of Pediatrics, March 23-25, 2018, Phoenix, AZ.

RED BLOOD CELL TRANSFUSION IN PEDIATRIC ORTHOTOPIC LIVER TRANSPLANTATION: AN EVALUATION OF 278 LIVER TRANSPLANTATIONS
Tran L, Mazariegos G, Davis P

INTRODUCTION
Liver transplantation in children is often associated with coagulopathy and significant blood loss. Available data is limited. In this retrospective study, we assessed transfusion practices in pediatric patients undergoing liver transplantation at a single institution over the course of nine years.

METHODS
Data was retrospectively collected from electronic medical records at UPMC Children’s Hospital of Pittsburgh. All patients who underwent liver transplantation from January 2008 to June 2017 were included.

RESULTS
From January 2008 to June 2017, 278 liver transplants were performed - 259 primary transplants, 15 second re-transplants, and four third re-transplants. The average age was 6.9 years old. Of 278 patients, 144 (51.8%) were female (Table 1). Biliary atresia, maple syrup urine disease, urea cycle defect, and liver tumor were the leading indications, accounting for 66 (23.7%), 45 (16.2%), 24 (8.6%), and 23 (8.3%) of transplants, respectively. A total of 76 (27.3%) cases did not require red blood cell transfusions (Figure 1). Among those transfused, 181 (89.6%) of the cases required less than 1 blood volume (BV). The median BV transfused among all cases was 0.21 (Q1 = 0, Q3 = 0.45). There is a trend toward higher volume transfusions among infants (median 0.46 BV) compared to children greater than 12 months of age (0.12 BV). By diagnosis, the group requiring the highest median volume transfusion were patients with TPN-related liver failure (3.41 BV) followed by patients undergoing repeat transplants (0.6 BV). Comparison of primary versus repeat transplants show a trend towards higher volume transfusions in third transplants (median 2.71 BV) compared to second transplants (0.43 BV) and primary transplants (0.18 BV).

DISCUSSION
In contrast to historically reported trends, evaluation of current transfusion practices reveals that most patients undergoing liver transplantation receive less than one blood volume of packed red blood cells. The transfusion requirements in this cohort of patients is markedly different from the average and range of blood volume transfusion requirements of 3.95 and 0.5-25 respectively, previously reported by Borland et al. in the first 50 patients reported from this institution (1). Our current study shows that more than one in four transplantations require no transfusion at all. Risk factors for greater transfusion need include younger age, TPN-related liver failure, and repeat transplantation.

REFERENCE
BURNOUT IN JUNIOR ANESTHESIOLOGY TRAINEES: EFFECT OF A MINDFULNESS INTERVENTION
Elizabeth Anne Ungerman, MD, MS; David G. Metro, MD, FASA; Tetsuro Sakai, MD, PhD, FASA; Phillip S. Adams, DO

INTRODUCTION
Physician burnout is an ongoing issue in anesthesiology and has been linked to poorer quality of care, patient dissatisfaction, and increasing healthcare costs. Physicians who implement more mindful behaviors provide better care for patients, are more productive, and have lower burnout rates. Our objective was to determine if a mindfulness course would improve anesthesiology resident burnout.

METHODS
Categorical anesthesiology interns (COURSE) underwent a mindfulness course comprised of a lecture, daily online activities for three weeks, and workshop. PGY-2 anesthesiology residents (CONTROL) had no prior mindfulness course. COURSE trainees at one-year follow up and CONTROL trainees (both groups six months into PGY-2 year) completed a survey measuring perceived ability to implement mindfulness as well as validated questionnaires regarding the main outcome burnout (i.e., exhaustion, depersonalization, and personal achievement).

Secondary outcomes of stress, depression, and sleep quality were also investigated. Pre/post group comparisons utilized Wilcoxon rank-sum testing and significant correlations were identified using Pearson’s correlation. Multivariable analysis was performed to identify possible predictors.

RESULTS
Fifteen (94%) COURSE trainees and 13 (81%) CONTROL trainees completed the survey/questionnaires and were included in the analysis. There were no significant differences in any of the three components of burnout, but COURSE trainees did show a trend toward lower depersonalization scores (7 [6-12] vs. 12 [10-15]; p=.078).

Combining all participants, there were significant correlations between ability to implement mindfulness and all three components of burnout (Fig. 1). Stepwise regression analysis combining all trainees showed the perceived ability to implement mindfulness to be an independent predictor of lower depersonalization scores (Coeff=-6.17, p<.001) and better sleep quality (Coeff=-1.26, p=.009).

DISCUSSION
Residents who participated in the mindfulness course did not show significantly better burnout scores. However, residents who perceived that they were able to implement more mindful practice showed better scores in all components of burnout. Perhaps a more longitudinal course or greater number of participants would produce more significant results. As stressors increase in residency training, it is imperative for programs to address burnout in their curriculum.
This abstract was presented at the 43rd annual meeting of the American Society of Regional Anesthesia and Pain Medicine, held in conjunction with the 2018 World Congress on Regional Anesthesia and Pain Medicine, April 19-21, 2018 in New York, NY.

EFFECT OF LOW VOLUME, ANALGESIC FEMORAL NERVE BLOCK ON SENSATION OF THE LATERAL FEMORAL CUTANEOUS NERVE AND THE SAPPHENOUS NERVE

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INTRODUCTION

It was formerly believed that a femoral nerve block (FNB) with a large volume of medication would also affect the lateral femoral cutaneous nerve (LFCN), resulting in a “three in one” block (1). However, recently, the trend has been to reduce nerve block volumes to reduce the chance of local anesthetic toxicity. As volumes have diminished and accuracy of placement has improved with ultrasound guidance, the effect on the LFCN may be less likely (2). We hypothesized that a FNB volume of 20 mL or less would not affect the LFCN.

METHODS

IRB approval was obtained and 30 patients undergoing anterior cruciate ligament (ACL) reconstruction at the UPMC Mercy South Side Outpatient Center gave consent to participate in an observational study. A standard FNB was performed under both ultrasound guidance and peripheral nerve block stimulator guidance. Twenty milliliters of bupivacaine 0.125% was injected either beneath or over top the femoral nerve. The effectiveness of the nerve block was assessed by testing motor and sensory function in the femoral nerve distribution. Concomitant evaluation of sensation was tested in the LFCN distribution and saphenous nerve distribution by both cold touch and pin-prick sensation. Sensory scores of 1, 2, or 3 (respectively no feeling, partial sensation, normal sensation) were recorded at 5, 10, 20, and 30 minutes following the nerve block.

RESULTS

Demographic information was comparable among all patients (Table 2). All 30 patients had an effective femoral nerve block within 30 minutes for both sensation and motor function. For the saphenous nerve distribution, all patients described no feeling or partial sensation within 30 minutes (90% no feeling for cold, 93.3% no feeling for sharp). None of the patients reported complete loss of sensation in 30 minutes for the LFCN distribution (83.3% normal sensation for cold, 83.3% normal sensation for sharp). No patients complained of knee pain after the surgery.

DISCUSSION

The volume of 20ml for an ultrasound-guided FNB provides motor and sensory blockade of the femoral nerve and adequate pain control post operatively. This volume of medication often numbs sensation of the saphenous nerve but does not significantly affect sensation in the LFCN distribution. This study could help guide providers performing FNBs when considering if a LFCN block is desirable (ex: treat tourniquet pain) at the cost of higher volumes of medication and thus likely higher risk of toxicity.

REFERENCES

INCIDENTAL FINDING OF SEVERE AORTIC ROOT DILATION AND AORTIC INSUFFICIENCY FROM A “LEFT TO LEFT” SHUNT AND LEFT SIDED VOLUME OVERLOAD FROM NUMEROUS AORTOPULMONARY COLLATERALS IN A CHILD WITH UNDIAGNOSED CONNECTIVE TISSUE DISORDER
Nicole Verdecchia, MD; Stacey Drant, MD; William S. Jones, MD; Khoa Nguyen, MD; Brian Blasiole, MD, PhD

INTRODUCTION
An 11-year-old male was incidentally found to have an aortic aneurysm with a severely dilated aortic root, severe aortic insufficiency, and extensive aortic to bronchial-pulmonary collateral vessels resulting in a “left to left” shunt. This case is unique because of the urgent management and anesthetic considerations required to address the aortic pathology and resultant valve insufficiency, but also due to the nature of how this child presented despite a known, strong family history of probable connective tissue disorder with resultant aortic pathology and arteriovenous malformations (AVMs).

CASE
An 11-year-old male who presented with a left wrist fracture from a football injury was found to have a pathologic diastolic murmur. Transthoracic echocardiogram revealed a severely dilated aortic root and dilated aortic annulus with severe aortic insufficiency. Chest CT showed a large ascending aortic aneurysm and a significantly dilated aortic root, as well as numerous aortopulmonary collaterals. He had an extensive family history with an autosomal dominant pattern of severe aortic dilation and aortic aneurysm requiring root replacement, and systemic artery to pulmonary collaterals and multiple additional systemic, pulmonary, and brain AVMs without definitive genetic diagnosis, but likely due to a probable unnamed connective tissue disorder now termed “Familial Multiple Organ Arterial Ectasia with Massive Hemoptysis” in a case report of his family.¹ Operative repair of the aortic root and ascending aortic aneurysm was indicated; however cardiac catheterization for coiling of the multiple aorto-pulmonary collateral vessels was required prior to cardiopulmonary bypass. MRI of the brain, chest, and abdomen was performed due to the striking family history of multiple AVMs and high probability of additional collateral vessels in this patient. The MRI found no intracranial AVM but confirmed aortic root dilation (Figure 1) and multiple collateral arteries arising from the descending aorta and giving rise to branches in the bilateral hilar region of the lungs, creating a left-to-left shunt estimated at 53% of the net ascending aortic flow. These vessels were coiled during cardiac catheterization to decrease the risk of bleeding during aortic root surgery. Subsequently, the patient underwent a valve-sparing aortic root replacement with 28 mm Hemashield graft and coronary re-implantation. Of note, the surgeon identified a contained dissection in the root. He had an unremarkable post-operative course and was discharged on POD#3.

DISCUSSION
The case described is remarkable due to the severity of aortic root dilation and aneurysm serendipitously found after sustaining a left wrist fracture. The child underwent urgent management including anesthesia for combined MRI and cardiac catheterization for coil embolization of collaterals and then a valve sparing aortic root replacement. This patient was at risk for sudden death from the dissection was well as worsening aortic regurgitation. While the patient will require frequent and close follow-up for his suspected connective tissue disorder, the differential diagnosis for the genetic cause of his disease remains broad. The anesthetic management for patients with aortic connective tissue disease includes consideration of bleeding tendency, risk of aortic rupture or dissection, and hemodynamic management of severe aortic insufficiency.

REFERENCE
This abstract was an original research poster presentation at the at the NYSORA Symposium on Regional Anesthesia, Pain & Perioperative Medicine, New York, NY, September 23-24, 2017. As a top scoring abstract, it was published in a supplement of the peer-reviewed journal Minerva Medica.

THE ABILITY OF ANESTHESIOLOGISTS TO DISTINGUISH CLOSELY ASSOCIATED NERVE ELEMENTS IN THE INTERSCALENE GROOVE
Nicole Verdecchia, Michael Kentor, Jim Ibinson, Steven Orebaugh

INTRODUCTION
In the interscalene groove, nerve roots and trunks are in close proximity and may not be visible as separate structures. This may increase the risk of insertion of the needle tip within the epineurium.

OBJECTIVES
To determine whether anesthesiologists can distinguish between nerve elements lying in close proximity on ultrasound images.

METHODS
Brachial plexus elements were harvested from four non-preserved cadavers and arranged in a water bath. Ultrasound images were taken of nerve roots and trunks lying one atop the other at the C5-C6 nerve root level and the superior and middle trunk level.

Three scenarios were created: separation of two nerve structures (either two nerve roots or two nerve trunks) by a 2 mm metallic spacer, two nerve structures in direct contact, and two nerve structures separated by a thin layer of fascial tissue. Volunteer anesthesiologists and residents viewed the images and were asked to denote whether they could distinguish the nerves as two separate structures.

In a second survey, eight images of two nerve roots in contact were mixed with eight images of one single nerve trunk and distributed to the same responders, who were asked to identify them as “two roots” or “one trunk.”

RESULTS
When a 2mm space was provided between nerve elements, most providers were able to distinguish the two structures on ultrasound imaging (Table 1). However, when the structures were touching, discrimination of separate structures was reduced (p<0.01).

In the second portion, incorrect responses ranged from 25-46%, with no significant differences between groups (Table 2).

CONCLUSIONS
When nerves are in close proximity in anatomic situations, it is not possible to consistently discriminate their borders, even for experienced providers, underscoring the importance of cautious needle insertion into anatomic situations where such arrangements prevail.
A CASE OF PERIOPERATIVE COCAINE-INDUCED TAKOTSUBO CARDIOMYOPATHY

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INTRODUCTION
Takotsubo cardiomyopathy (TC) is believed to be induced by catecholamine surge triggered by sympathetic excitation of the central nervous system that closely mimics acute coronary syndrome (ACS). As such, it frequently presents with chest pain, signs of ischemia on electrocardiogram (ECG), and elevated serum cardiac biomarkers. Coronary angiography is negative for ischemia, and transthoracic echocardiography (TTE) characteristically reveals apical ballooning. In contrast to ACS, TC is often reversible with full clinical recovery.

CASE PRESENTATION
A 47-year-old male was admitted for elective repair of facial fractures sustained during a second presumed syncopal episode a week prior. His history was notable for tobacco abuse, previous polysubstance abuse, hypertension, previous syncopal episode of unknown etiology, and peripheral arterial disease status post right iliofemoral thrombectomy. Recent syncopal evaluation was reportedly negative and had included TTE performed three months prior revealing normal ventricular and valvular function. After stable standard induction of anesthesia and intubation, the patient developed pulseless ventricular fibrillation arrest requiring 19 minutes of resuscitation until return of spontaneous circulation (ROSC). After ROSC, ST-depression in inferior leads was noted, and intraoperative transesophageal echocardiography identified a ventricular ejection fraction of 35% with inferior wall hypokinesis. Left heart catheterization was performed given concern for ACS; however, findings were significant for left ventricular apical akinesis with basal hypercontractility and only non-obstructive coronary artery disease. This was consistent with a diagnosis of TC. Within one week, the patient’s cardiac function returned to normal values. He was continued on his calcium channel blocker and angiotensin converting enzyme (ACE) inhibitor, and an automated implantable cardioverter-defibrillator was placed prior to being discharged to home neurologically intact. During this time period, he admitted to recent cocaine use and had a positive confirmatory urine toxicology screen.

DISCUSSION
A paucity of reports on stimulant-related TC exists in the literature. Cocaine acts as a sympathomimetic that blocks re-uptake of dopamine and norepinephrine, leading to overstimulation of alpha- and beta-adrenergic receptors. Cocaine use increases risk of stroke, myocardial infarction, and sudden cardiac death. Potential cardiovascular complications are deemed secondary to cocaine’s cardiac sodium channel blockade. Studies of cocaine-induced TC have described resolution of patient symptoms as well as ECG and TTE changes with use of beta-blockers and ACE inhibitors. This case is unique in that the patient did not present with chest pain or any other complaints in the preoperative period, but had a marked decrease in function consistent with TC compared to prior echocardiographic evaluation. This, along with possible arrhythmia related to cocaine intoxication itself, likely contributed to intraoperative cardiac arrest.

REFERENCES
This abstract was presented at the Society of Cardiovascular Anesthesiologists 40th Annual Meeting and Workshops, April 28-May 2, 2018, Phoenix, AZ.

AUDIT OF ANESTHESIOLOGY PERFORMED PERIOPERATIVE TRANSTHORACIC ECHOCARDIOGRAPHY
AT UNIVERSITY MEDICAL CENTER – A QUALITY IMPROVEMENT PROJECT
Liora Yehushua, MD; Michael L Boisen MD;
Dennis Phillips MD; Kathirvel Subramaniam, MD MPH

INTRODUCTION
Transthoracic echocardiography (TTE) has historically been the domain of cardiologists, but anesthesiologists nowadays have started using TTE at the patient’s bedside to diagnose the etiology of hemodynamic instability and guide interventions. A focused TTE examination is not meant to take the place of a cardiology-based comprehensive TTE service. Instead, it is meant to be a noninvasive tool for evaluation of perioperative clinical issues that may not be detectable by clinical examination or vital signs alone. Two important roles of perioperative TTE defined by the literature included “rescue” TTE, used to find the cause of hemodynamic instability or any other critical cardiorespiratory events and its use as a preoperative evaluation tool.

METHODS
Approval was obtained from our Hospital Quality improvement committee for this retrospective chart review. The Perioperative Echocardiography Service at UPMC Presbyterian was implemented in September 2016. Data were extracted for all TTE examinations done between September 2016 and August 2017. Information on relevant clinical history and change in management were also obtained. The Perioperative Echocardiography Service was run by a group of three cardiac anesthesiologists credentialed to perform focused and limited TTE for the perioperative period by the hospital credentialing committee. A departmental consult service was established and any patient in the operating room area requiring TTE (focused and limited) was referred to this service subject to the availability of these three faculty members. The service was provided with proper archiving of images and an anesthesia echocardiography consult note separately or as an addendum to preoperative evaluation notes.

RESULTS
This preliminary study acquired data on 74 patients who had TTE performed by anesthesiologists. TTE was used as a preoperative evaluation tool 36% of the time and for “rescue” in 64% of the cases. TTE was performed in the pre-operative holding area in 42% of the cases, in the operating room for 43% of patients, and post-operatively in 15% of patients. We categorized interventions by whether they were a step up or a step down in management. An example of a step up would be adding monitors that weren’t initially planned like an arterial line or PA catheter. A step down would be not giving volume or medications when the provider originally would have without the information gained from the TTE. No additional interventions were required 19% of the time. Step up in management happened 38% of the time and step down in management happened 22% of the time. Another 22% of cases had both step up and down actions.

CONCLUSIONS
We concluded that using limited or focused TTE in the perioperative period by well-trained anesthesiologists significantly alters patient management and the effect on patient prognosis should be studied in a prospective clinical trial.

REFERENCES
EXECUTIVE SUMMARY

The UPMC/University of Pittsburgh Department of Anesthesiology and Perioperative Medicine served 19 clinical sites in FY18:

**UPMC PRESBYTERIAN/MONTEFIORE**
UPMC Presbyterian is a Level I Regional Resource Trauma Center, as well as a renowned center for organ transplantation and a recognized leader in cardiology and cardiothoracic surgery, critical care medicine and trauma services, and neurosurgery. UPMC Montefiore is part of the UPMC Presbyterian system and specializes in ambulatory services and liver transplantation.

**UPMC CHILDREN’S HOSPITAL OF PITTSBURGH (CHP)** is devoted solely to the care of infants, children, and young adults and is one of the few hospitals in the nation to go completely paperless. CHP was again named in the 2017-2018 U.S. News & World Report’s Honor Roll of America’s Best Children's Hospitals.

**UPMC MAGEE-WOMEN’S HOSPITAL** is a world-class center for both women’s health and comprehensive medical-surgical care and a National Center of Excellence in Women’s Health, one of the first recognized by the U.S. Department of Health and Human Services. Their Neonatal Intensive Care Unit is the largest in Pennsylvania and the country.

**UPMC ST. MARGARET**, a 249-bed acute care and teaching hospital in Aspinwall, is a Magnet™ designated hospital. Magnet status is the highest international recognition for nursing excellence and leadership.

**UPMC SHADYSIDE** also holds Magnet™ status and is home to the Hillman Cancer Center, one of the nation’s largest and most advanced cancer research and patient care facilities.

**VETERANS AFFAIRS PITTSBURGH HEALTHCARE SYSTEM** serves as an acute care facility and major surgical tertiary care facility for veterans of the United States military.

**UPMC MCKEESPORT** is an acute care community hospital and an approved site for the Program of All-inclusive Care for the Elderly (PACE).

**UPMC MERCY** is Pittsburgh’s only Catholic hospital with specialized services, including Level I trauma and burn services, the neurosciences, physical medicine and rehabilitation, and women’s health.
UPMC MERCY SOUTH SIDE OUTPATIENT CENTER is an ambulatory surgical center that serves as a one-stop location for diagnostic and routine outpatient services such as x-rays, lab work, and same-day surgery.

UPMC PASSAVANT is a tertiary care center north of Pittsburgh with two campuses in McCandless and Cranberry Township (Butler County), focusing on specialties such as cancer, cardiac care, orthopedics, and spine surgery.

UPMC SOUTH SURGERY CENTER, located in Pittsburgh’s South Hills, accommodates outpatient procedures such as dental surgery, gastroenterology, general surgery, gynecology, neurosurgery, ophthalmology, orthopedics, otolaryngology, pediatrics, plastic surgery, podiatry, and urology.

UPMC EAST is a 300+ bed hospital with seven state-of-the-art operating rooms and 140 medical-surgical patient rooms equipped with specially designed SmartRoom software to help monitor, track, and document patient care.

UPMC BEDFORD MEMORIAL is an acute care general hospital in Everett, PA with units for telemetry services and medical, surgical, obstetrical, intensive, and coronary care. The hospital also operates a cardiac-pulmonary rehabilitation program and outpatient and ambulatory surgical units.

UPMC DIGESTIVE HEALTH & ENDOSCOPY CENTER is an outpatient endoscopy facility recognized for a high level of specialized care in gastroenterology, including screening and therapeutic colonoscopy, gastroscopy, and management of Gastroesophageal Reflux Disease and swallowing disturbances.

UPMC MONROEVILLE SURGERY CENTER offers the quality and experience of the region’s most skilled surgeons. The center offers outpatient procedures such as breast oncology, general and orthopedic surgery, and pain management.

UPMC HORIZON is a full-service academic community hospital with campuses in Greenville and the Shenango Valley. With a wide range of available surgical specialties, UPMC Horizon is the destination for world-class surgical care in the Mercer County region.

UPMC ALTOONA provides exceptional health care to Blair County, PA and surrounding areas. The 380-bed tertiary hospital offers an array of specialized programs and services, more than 200 years of health care experience, and nearly 3,000 employees as the largest employer in the county.

UPMC JAMESON is a full-service community hospital providing inpatient hospital care, surgical services, diagnostic imaging, emergency medicine, senior care, rehabilitation, and a variety of specialized health care services to the residents of Lawrence County, PA and its surrounding communities.

UPMC PALERMO (ISMETT) serves as a major transplantation center for Southern Italy and other countries in the Mediterranean region.
MAPS OF CLINICAL LOCATIONS

PITTSBURGH METRO AREA

EUROPE
Overview
UPMC Presbyterian/Montefiore is the largest quaternary care hospital in the UPMC Health System and Western Pennsylvania. It remains the department’s core hospital in terms of clinical activity, resident education, and clinical research.

The Department of Anesthesiology and Perioperative Medicine’s UPMC Presbyterian clinical site is larger than many entire academic departments found elsewhere in the country. It is comprised of 48 faculty members who work in 45 operating rooms (ORs) and 14 non-OR anesthetizing locations. The site is staffed by almost 100 full-time-equivalent Certified Registered Nurse Anesthetists (CRNAs). Up to 15 residents and 10 student nurse anesthetists (SRNAs) rotate at UPMC Presbyterian at any one time. Three Certified Registered Nurse Practitioners (CRNPs) provide care as well at the Preoperative Evaluation Center, which conducts pre-anesthesia consultations and evaluations.

Patient Care and Clinical Activities
Presbyterian anesthesiologists supervised a grand total of 36,485 anesthetics in FY18. This was a small decrease of 1,384 cases (3.7%) from the previous fiscal year. Services were provided in the Presbyterian and Montefiore ORs, the gastroenterology lab (where up to six anesthesia teams work each day), the bronchoscopy suite, the electroconvulsive therapy suite (at UPMC Western Psychiatric Institute and Clinic [WPIC]), the electrophysiology lab, the cardiac catheterization lab, gamma knife, interventional radiology, and two MRI locations.

Education and Training
Anesthesiology services at UPMC Presbyterian are highly subspecialty-oriented. Many of the advanced subspecialty resident rotations in anesthesiology (liver transplantation, cardiac, thoracic, and neuroanesthesiology) are based here. In addition, many novice residents and SRNAs perform their first cases at UPMC Presbyterian. The UPMC Presbyterian faculty is very active in medical student and resident education; they not only teach in the OR, but also deliver lectures, coordinate problem-based learning discussions (PBLDs), design and implement rotation curricula, serve on medical student and resident education committees, interview resident applicants, and teach at the Peter M. Winter Institute for Simulation Education and Research (WISER). Several teaching conferences are held specifically for trainees rotating at UPMC Presbyterian on Wednesday mornings. Monthly Quality Improvement conferences provided by a select group of faculty members are held and PBLDs are conducted monthly at UPMC Presbyterian. Subspecialty services also hold monthly conferences on topics in their subspecialty areas (e.g., neuroanesthesiology, cardiac, hepatic transplantation, and regional anesthesiology).
Overview
The UPMC Presbyterian Neurosurgical Anesthesiology service provided anesthetic care for over 4,400 neurosurgical procedures during FY18. Procedures included expanded endonasal approaches to skull base pathologies, craniotomies for tumor, retromastoid craniectomy for microvascular decompression of various cranial nerves, stimulator device insertion, and spinal surgery. Two separate Neurosurgical Intensive Care Units at UPMC Presbyterian have continued to facilitate innovative approaches to the acute care of patients with cerebrovascular pathology, neurotrauma, and other acute injuries.

Patient Care & Clinical Activities
Presby Neuroanesthesiology is highly involved with the anesthetic management of patients at the Center for Neurointerventional and Neuroendovascular Therapy (CNNET), led now by Dr. Brian Jankowitz. A second full bi-plane angiography suite will open late this year to help CNNET meet their growing clinical demand and allow patients more opportunities for treatment with novel therapies related to cerebral vascular aneurysms, arterio-venous malformations, tumors, and dural and cavernous sinus fistulae; treatment of refractory epistaxis, sclerotherapy, stroke thrombolysis and thrombectomy, dural sinus thrombolysis, and thrombectomy; temporary balloon occlusion testing with blood flow evaluation; petrosal sinus sampling; carotid, vertebral artery, subclavian artery, and intracranial arterial stenting; vessel sacrifice; WADA testing; and routine angiography.

The Center for Minimally Invasive and Cranial Base Surgery, led by Drs. Paul Gardner and Carl Snyderman (Otolaryngology), continues to attract unique patients from across the globe. Pioneering cutting-edge endoscopic minimally invasive craniotomy techniques, the team has performed hundreds of procedures in the past fiscal year, earning national and international recognition.

The complex spine service regularly engages in exceedingly challenging interventions, and we are instituting new protocols for pain control and resuscitation to optimize patient care. The Epilepsy and Movement Disorders program is one of the busiest in the country and is participating in many innovative clinical trials, including stem cell placement. We frequently provide care to patients of Dr. Mark Richardson (Neurosurgery) during real-time magnetic resonance imaging (MRI)-guided procedures.

The remaining clinical caseload includes care for traumatic intracranial injuries, evacuations of intracranial hemorrhages, placement of spinal cord stimulators and ventriculoperitoneal shunts, and various stereotactic procedures such as computed tomography or MRI-guided stereotactic surgery with three-dimensional localization.

Education & Training
The division’s didactic program currently consists of a monthly subspecialty conference, intraoperative teaching, and a new electronic curriculum. In addition, the residents have lectured at all levels on neuroanesthesiology topics and in small group learning sessions.
Patient Care and Clinical Activities

Anesthesiologists in the UPMC Presbyterian/Montefiore Division of Transplantation Anesthesiology (TA) are responsible for the care of patients undergoing liver, intestinal, multivisceral, kidney, pancreas, and composite tissue allograph (CTA) transplantation. In addition, TA provides anesthesiology care and work-up for patients undergoing major hepatic resections.

The primary responsibilities of TA include preoperative assessment of transplant candidates, participation in candidate selection, intraoperative management, and postoperative visits. Preoperative consultation of transplant candidates is the main strength of the service. As true consultants, anesthesiologists provide hepatologists and surgeons with valuable information on extrahepatic organ function. All candidates are evaluated at the Thomas E. Starzl Transplantation Outpatient Clinic or as inpatients at UPMC. As division chief, Dr. Planinsic reviews all the preoperative testing of candidates, concentrating on cardiovascular risk, and makes recommendations to the transplant surgery division if further testing or intervention is required.

Anesthetic management of hepatic, intestinal, multivisceral, kidney, pancreatic, and CTA transplantation requires both highly sophisticated monitoring and tight control of physiologic variables. An anesthesiologist carries out this management with the assistance of trainees, CRNAs, and clinical technicians. For hemodynamic monitoring, TA staff members routinely determine right ventricular ejection fraction, right ventricular end-diastolic volume, and mixed-venous oxygen saturation using a pulmonary artery catheter. Two-dimensional transesophageal echocardiography also plays an important role in determining and optimizing cardiac contractility and preload.

During FY18, 303 adult total solid organ abdominal transplants were performed at UPMC Presbyterian/Montefiore. These included 177 kidney (114 deceased-donor and 63 living-donor), 111 liver (54 deceased-donor and 57 living-donor), one intestine/multivisceral, and 14 pancreas and pancreas-kidney transplants.

Education and Training

Education in the UPMC Presbyterian/Montefiore TA service is comprised of a mandatory rotation (four weeks) for postgraduate year (PGY)-3 trainees and an elective rotation (three to nine months) for PGY-4 and PGY-5 trainees. Teaching objectives vary with the level of training. PGY-3 residents are expected to carry out anesthesia for liver transplantation with supervision and apply clinical skills learned during this rotation to other high-risk patients undergoing major surgery. PGY-4 trainees should comprehend the complex pathophysiology of patients with hepatic dysfunction and perform anesthetic care with minimal supervision. PGY-5 trainees should be able to perform anesthetic care independently and prepare themselves to become a consultant and/or a director of a liver TA program.

Residents beginning their rotation have the additional benefit of training at the Peter M. Winter Institute for Simulation, Education, and Research (WISER) in a course titled “Anesthesia for Liver Transplantation,” initially developed by Drs. Aggarwal, Boucek, and Planinsic. This course has been well reviewed by the residents and is offered at the beginning of the rotation and again upon completion of their OR experience with the UPMC Presbyterian/Montefiore TA division.

Research

TA members participate in diverse academic activities. During FY18, the TA faculty was very productive and participated in numerous meetings and symposiums, presenting their work related to organ transplantation.
Overview
The UPMC Children’s Hospital of Pittsburgh (CHP) anesthesiology clinical division comprises 30 faculty members, 13 FTE CRNAs, and eight CRNPs (4.5 FTE) who provide both anesthesiology and surgical perioperative care. The main CHP Hospital is one of the first fully-digital hospitals in the nation and sits on a 10-acre, environmentally sustainable campus at a new site in the Lawrenceville neighborhood of Pittsburgh. In addition to the Lawrenceville Campus, CHP also has an outpatient surgical center in Wexford (CHP North). The Wexford surgical center was specifically designed for family-centered care for surgical patients. Anesthesiology services are provided every day of the week, as well as one Saturday a month. CHP pediatric anesthesiologists and CRNAs are responsible for all perianesthetic care at Wexford. Dr. Slava Martyn serves as medical director of the satellite.

Patient Care and Clinical Activities
In FY18, the division provided anesthesiology services for a total of 27,969 procedures, a slight increase (47 cases) from the prior year (27,922). Of the total number of procedures, 8,022 were carried out at CHP North and 19,947 were carried out at the main hospital.

The CHP perioperative pain control service continued to serve a large number of patients under the guidance of Dr. Mihaela Visoiu. The acute pain anesthesiologists provide service at both the Lawrenceville and Wexford locations. Other CHP acute pain faculty members include Drs. Denise Hall-Burton, Alex Praslick, Plinio Silva, Nisha Kandiah, and Franklyn P. Cladis. The use of patient-controlled analgesia, epidural narcotics, epidural local anesthetics, pediatric caudal anesthetics, and regional blocks is now routine. It has become increasingly common to provide paravertebral, extremity, transabdominal, and rectus sheath blocks either with or without catheters. In addition, thoracic epidurals for postoperative analgesia in older patients and threaded caudal catheters in infants are used for thoracic and upper abdominal surgeries. Almost all regional blocks are performed under ultrasound guidance with or without nerve stimulation. The CHP acute pain service has improved patient care and provides resident and fellow training opportunities. Presently, two fellows are assigned to the acute pain service on a daily basis. In FY18, 2,163 pediatric regional blocks were performed in 1,360 patients.

Inpatient chronic pain patients are covered by our consult service that included Drs. Cladis and Ayse Genc, as well as chronic pain nurse practitioners Cathy Campese and Rachael Lauer. The CHP chronic pain program incorporates a multidisciplinary approach to patient care and involves the services of behavioral health, physical therapy, and physical medicine and rehabilitation. The CHP chronic pain outpatient clinic treats patients at the Lawrenceville campus, CHP North, and the new CHP campus in Bridgeville.

Other specialty anesthesiology service divisions at CHP include abdominal organ transplantation, radiology, and cardiology, headed by Drs. Daniela Damian, Brian Blasiole, and Patrick Callahan, respectively. The abdominal organ transplantation anesthesiologists also provide transplant anesthesia for pediatric patients undergoing liver transplantation at the University of Virginia and the Florida hospital in Orlando Florida.

The pediatric cardiac anesthesia service provides care for patients undergoing open heart procedures and patients undergoing diagnostic and/or interventional procedures in the cardiac catheterization lab. In FY18, 280 bypass cases and 522 closed procedures were performed. In the catheterization lab, anesthesia services were provided for 779 procedures.

The pediatric anesthesiology radiology service covers off-site locations that involve MRI, invasive radiology, PET scan, CT, nuclear medicine, and radiation therapy. In FY18, anesthesia services were provided for 3,932 procedures.
The newest division added to CHP Anesthesiology is the pediatric sedation service. Dr. Blasiole leads this division, which includes one full time pediatrician and one full time pediatric intensivist, as well as 2.5 FTE of allied health personnel.

**Education and Training**
Under faculty supervision, CHP pediatric anesthesiology fellows prepared and presented teaching activities including mini-lectures, core lectures, and case conferences. Anesthesiology residents spend three months at CHP during their third postgraduate year (PGY-3) for clinical training. Additional time in pediatric anesthesiology can be elected during the PGY-4 year. Dr. Doreen Soliman oversees the resident training program and Dr. Denise Hall-Burton directs the medical student clerkships at CHP. Faculty members actively participated in medical student courses, including introduction to medicine (a first-year course), clinical problem-based learning (second-year), clinical skills (third-year), and various anesthesiology clerkships for third- and fourth-year students. The pediatric anesthesiology education programs continued to provide special training for Critical Care Medicine fellows, pediatric dentists, emergency medical residents, and nurse anesthesia students rotating through the service. In addition, faculty members participated in an oral board preparation course for senior residents (PGY-3 and PGY-4).

In addition to the anesthesiology residency program, an ACGME-approved combined anesthesiology/pediatric residency has begun. This five-year program accepts one resident per year. The Program Director is Dr. Peter Davis and the Associate Program Directors are Drs. Erica Sivak and Kathryn (Karisa) Walker. Program applicants go through a separate match as fourth-year medical students.

Further information on the pediatric medical student and residency programs and the pediatric anesthesiology fellowship is available in the education section of this report.

**Research**
Research efforts at CHP focus on pediatric anesthetic pharmacology, respiratory physiology, and outcomes-based protocols. Clinical trials are also conducted and are an active research component at CHP. More details can be found in the research section of this report.
ACUTE INTERVENTIONAL PEDIATRIC PAIN SERVICE

The Acute Pediatric Interventional Pain Service at UPMC Children’s Hospital of Pittsburgh (CHP) is responsible for the care of pediatric patients (0 days - 26 years old) undergoing various surgical procedures and requiring postoperative pain control management. The group includes six pediatric regional anesthesiologists: Drs. Mihaela Visoiu, Denise Hall Burton, Nishanthi Kandiah, Alexander Praslick, Plinio Silva, and Franklyn Cladis, as well as two acute pediatric pain nurses, Anne Stevens and Annette Sellhorst. The CHP acute pain group’s goal is to find optimal, individualized therapeutic regimens that not only decrease pain scores and opioid consumption, but outlast postoperative pain, improve quality of care, increase patient and family satisfaction with pain control, and reduce healthcare costs.

Pediatric perioperative pain control is challenging and requires both advanced regional anesthesia techniques such as neuraxial and peripheral nerve blocks, single injections and catheters, and an understanding of neonatal and pediatric anatomy, physiology, and pharmacology. Ultrasound-guided truncal blocks (paravertebral, rectus sheath, transversus abdominis, quadratus lumborum, pectoralis, and serratus nerve blocks) represent the largest part of the peripheral nerve blocks performed at CHP. In addition, the service performs upper extremity and lower extremity nerve blocks (cervical, brachial, and lumbar plexus; sciatic, femoral, adductor canal, and saphenous); during FY18 they sent home more than 209 patients with continuous peripheral nerve blocks and On-Q pumps. Pediatric pain attendings provide anesthesia and sole postoperative pain care at the North Surgical Center in Wexford for orthopedic and general surgical procedures (93 patients, 148 blocks). Anesthesiologists at CHP work with a new regional anesthesiology and pediatric fellow every month and train fellows to be expert consultants in all aspects of pediatric regional anesthesia and acute pain management. In FY18, the acute pain service completed 2,474 blocks (92% peripheral nerve blocks, 8% neuraxial, 30% catheters), on 1,466 patients as follows: 2% neonates, 7% in the one-12 months old group, 29% in the one-10 years old group, and 52% in children older than 10 years old.

TRANSPLANTATION ANESTHESIOLOGY

Anesthesiologists in the Division of Transplantation Anesthesiology (TA) at UPMC Children’s Hospital of Pittsburgh (CHP) are responsible for the care of pediatric patients undergoing liver, intestinal, multivisceral, kidney, pancreas, and composite tissue allograph (CTA) transplantation. Additionally, these anesthesiologists, as part of the multidisciplinary CHP transplantation team, continue to provide consultation for the joint CHP – University of Virginia pediatric liver transplantation program. In 2018, they also started a new collaboration with Florida Hospital for Children; the collaboration has already resulted in three completed pediatric liver transplants.

Anesthetic management for pediatric transplant patients requires both highly sophisticated monitoring and tight control of physiologic variables. An anesthesiologist may provide sole care of these patients or work in an anesthesia care team model with fellows, CRNAs, and/or residents while assisted by anesthesia technicians.

During FY18, both living donor and cadaveric donor transplants were performed. The CHP TA faculty included Drs. Phillip Adams, Brian Blasiole, Franklyn Cladis, Daniela Damian, Peter Davis, W. Scott Jones, Anne Kamarchik, Gregory McHugh, David Rymer, and Mihaela Visoiu. Forty-four pediatric transplants were completed by CHP TA faculty in FY18. Of these cases, seven were kidney, seven were living-donor kidney, 14 were liver, 11 were living-donor liver, and five were small bowel
Anesthesiology and sedation services for off-site locations at UPMC Children’s Hospital of Pittsburgh (CHP) continue to grow and serve the children of Pittsburgh and beyond. The department provides anesthesia and sedation for children in interventional radiology, magnetic resonance imaging (MRI), computed tomography, nuclear medicine, positron emission tomography, radiation oncology, and hematology-oncology. Due to the unique restrictions and challenges that accompany safe administration of anesthesia for children in these out-of-the operating suite locations, a dedicated group of anesthesiologists that includes Drs. Brian Blasiole, Patrick Callahan, Daniela Damian, Anne Kamarchik, Nisha Kandiah, Khoa Nguyen, Greg McHugh, Cristina Roosen, and Scott Jones specifically provide care in this area. This group of physicians coordinates other care for these medically complex children after radiologic imaging procedures, including lumbar punctures, dental and ophthalmologic exams, and transthoracic echocardiograms, commonly under one anesthetic, and transport patients to the OR for other invasive procedures. The number of MRI cases performed under general anesthesia in FY18 were 2,590, an increase of 867 cases compared to the prior year. The number of interventional radiology cases requiring general anesthesia was 1,825 in FY18, a decrease of 318 cases compared to the previous year.

The Sedation Service physicians at UPMC Children’s Hospital continue to expand services to not only provide sedation in the out-of-OR locations, but also serve as consultants in guiding the appropriate care for imaging and other procedures using approaches that range from distraction techniques, anxiolysis, sedation, and general anesthesia. Most sedations are performed for MR exams and diagnostic and therapeutic procedures for hematology-oncology patients. Compared to FY17, sedation encounters in FY18 increased to 2,682.
Overview
The UPMC Magee-Womens Hospital (MWH) anesthesiology clinical site comprises 20 faculty members, 33 CRNAs, and one full-time Certified Registered Nurse Practitioner (CRNP) who provide care within the operating and delivery suites, in the pre-anesthesia evaluation and testing center, and in off-site locations such as Radiation Oncology, MRI, and Invasive Radiology. The division also provides emergency management in conjunction with members of the Department of Critical Care Medicine for all cardio-respiratory arrests (Condition A), as well as in conjunction with our obstetricians for all maternal emergencies (Condition O). MWH anesthesiologists’ primary focus is providing in-house, 24-hour anesthesia coverage in two primary anesthetizing locations: the WomanCare Birth Center (WCBC) and the main Surgical Services Center.

Patient Care and Clinical Activities
MWH anesthesiologists provide state-of-the-art anesthesia and obstetric care to their patients. Most services are provided in the WCBC. Additional procedures performed on the unit include combined cesarean/abdominal hysterectomy, external cephalic version, percutaneous umbilical blood sampling, manual placental extraction, urogenital laceration repair, and postpartum tubal ligation. Fetal surgery continues to increase as the hospital focuses more resources on this activity. Fifty-four fetal procedures were managed during FY18.

Beyond the birthing suite, MWH provided anesthetic management for 14,672 cases in the Surgical Services Center in FY18, a 30 case decrease from FY17. The FY18 site total (including deliveries and off-site cases) was 23,391 cases. The Surgical Services Center consists of 14 general operating rooms, a cystoscopy suite, and two minor procedure rooms. Of these, four state-of-the-art minimally invasive suites were used to accommodate a growing variety of minimally-invasive surgical procedures.

One CRNP is available Monday through Thursday in the pre-anesthesia evaluation and testing center for pre-anesthesia consultations and evaluations. In FY18, approximately 40% of surgical patients were evaluated preoperatively in the center.

Education and Training
MWH is a primary educational site for medical students, nurse anesthesia students (SRNAs), residents, and fellows from programs within the University of Pittsburgh and UPMC. The division provides both obstetrical anesthesiology and general anesthesiology rotations. In addition, anesthesia residents from other programs in the city rotate through the division for subspecialty obstetrical anesthesiology training. All residents, under the direction of Dr. Rob Krohner, attend daily didactic lectures covering topics in obstetric and gynecologic anesthesiology. Mock ABA oral examinations given by the faculty to each resident are an important aspect of the educational experience. Continuous quality improvement and formal case-discussion conferences are also held each week. With close faculty assistance, residents attend monthly journal clubs that review recent literature in obstetrical anesthesiology. Informal case-management discussions related to obstetrical anesthesiology complement the didactic program. A list of these topics is kept in a database and is repeated during each resident rotation. All residents rotating through obstetrical anesthesiology become certified in neonatal resuscitation by Dr. Ryan Romeo.

Dr. Krohner, Ms. Dani Meholic, RN, CRNA, and Valerie Pomerantz, RN, CRNA coordinate the SRNA program at MWH. These students rotate through both the labor and delivery and general operating suites.
The Division of Obstetric (OB) Anesthesiology at UPMC Magee-Womens Hospital (MWH) provides comprehensive anesthetic and perioperative services to the region’s highest- and lowest-risk pregnancies. The mission is to: 1) provide safe, compassionate, and cutting-edge clinical care to pregnant patients by leveraging a multidisciplinary team approach; 2) educate the next generation of clinicians and leaders in OB anesthesiology; and 3) advance new knowledge, discoveries, and innovation in OB anesthesiology. MWH is a tertiary referral center that serves a diverse perinatal population from a wide geographic distribution, spanning Pennsylvania, New York, Ohio, and West Virginia.

**Clinical Service**

**Peripartum Care**

Clinical management of routine and medically complex OB patients is the foundation of the division’s work. In FY18, MWH saw a total of 8,643 deliveries. In addition to managing labor analgesia and surgical anesthesia for 6,045 vaginal and 2,598 cesarean deliveries, in FY18 the division provided services for in- and ex-utero fetal surgeries, non-OB surgery during pregnancy, immediate post-vaginal delivery postpartum tubal ligations, peripartum management of postpartum hemorrhage, scheduled and unscheduled cesarean hysterectomies for morbidly adherent placentation (placenta accreta), and external cephalic versions (Figures 1 and 2). Fetal surgeries encompassed percutaneous umbilical blood sampling, fetoscopic laser photocoagulation, radiofrequency ablation of twin reversed arterial perfusion (TRAP) sequence, and fetal shunt procedures with radiographic guidance. In FY18, 43.2% of operative cases requiring the division’s services were categorized as unscheduled or emergent, reflecting the referral-based and unpredictable nature of clinical work. The division performed 30.2% of deliveries via cesarean section, below the national average and reflective of the high quality of services provided.

**Perinatal Health Optimization**

Perioperative consultations were provided to 139 women in FY18. Complex medical histories encompassed myriad conditions: congenital and acquired cardiopulmonary conditions, neurological or spine disorders, and complex airway history. Multidisciplinary complex care coordination and planning was undertaken, including monthly sessions reviewing all 109 prenatal women with acquired and congenital heart disease and other high-risk pregnancy conditions. A patient education opportunity called Meet the Anesthesiologist continued, where patients learn about the most up-to-date pain relief methods for childbirth and have questions about labor analgesia options answered personally.

Dr. Ryan Romeo supervises the anesthesiology clerkship for third-year medical students during their surgery and perioperative care rotation. In addition, many fourth-year medical students opt to take a one-month elective to further expand their knowledge of anesthesia.

MWH serves as the principal site for the department’s clinical fellowship in obstetric anesthesiology, directed by Dr. Patricia Dalby. The Accreditation Council for Graduate Medical Education (ACGME) re-accredited the program in January of 2016 until 2022. Lectures and research opportunities for the fellows encompass areas which are not normally part of the residency program. For instance, fellows rotate through maternal fetal medicine as well as the neonatal ICU. Elective rotations include a women’s neurology as well as a rotation in blood banking is available. We believe that this is highly unique to MWH.

**Research**

Research efforts by MWH faculty in both obstetric and general anesthesiology led to the publication of several manuscripts and case reports and the presentation of numerous abstracts. Additional MWH anesthesiology faculty accomplishments include a published book, several published book chapters, and invited lectures and presentations. For further information, see the publications section of this report.
Peripartum Safety
Several system safety enhancements were advanced and supported by the division in FY18. A hospital-wide simulation session for cardiac arrest in pregnancy was assembled in partnership with the Departments of Obstetrics and Gynecology (OB/GYN), Critical Care Medicine, Emergency Medicine, and Nursing. These efforts continued with “First Five Minutes” training for birth center staff in common and uncommon emergency scenarios. Systematic improvements for postpartum hemorrhage continued, including enhanced processes for serious event debriefing with both team members and with patients. Other highlights of safety initiatives included implementation of a formalized communication system that engages the OB anesthesiology service to review every patient’s candidacy for safe transfer to the postpartum unit; enhanced emergency code team response through implementation of a button-to-provider alert system; and protocolized external cephalic version procedures. The division continued consistent and seamless work with nurses, obstetricians, and other professionals to coordinate the care of routine and complex OB patients. These multidisciplinary efforts culminated in 2018 in an application for MWH to be designated as a Society for Obstetric Anesthesia and Perinatology (SOAP) Center of Excellence in Obstetric Anesthesia Care (designation decision pending).

Education and Teaching
The division is proud to educate learners from diverse backgrounds in advanced OB anesthesia clinical practice. In FY18, they served as the primary OB anesthesia clinical site for 36 student nurse anesthetists, four dental anesthesia residents, 54 anesthesiology residents (PGY 2-4), and 15 regional anesthesiology fellows. Although no OB anesthesiology fellows were enrolled in the 2017-2018 academic year, the program maintains positions for two fellows annually. The division also supports elective time for medical students and OB/GYN residents and fellows. In FY18, 15 regional anesthesiology fellows began rotating through the service to acquire neuraxial anesthesia skills, and the service started a programmatic approach to support nurse anesthetist professional development in acquiring safe neuraxial anesthesia skills. In 2017, the nurse anesthesia program began its MSN to DNP degree programs, with many students selecting OB anesthesia projects. Two faculty members were recognized with teaching awards by UPMC Medical Education, and one of the division’s OB anesthesia tier anesthetists was recognized for Excellence in Teaching by the University of Pittsburgh School of Nursing.

Research
The division continued its tradition of active research on important OB anesthesia topics inFY18. They published and represented at national and international meetings (20 peer-reviewed publications, 11 abstracts, conference leadership positions, committee membership and leadership, and speaker engagements), including at the SOAP and International Anesthesia Research Society meetings. Division members participated in the inaugural international Magee-Womens Research Institute Research Summit (“Magee Summit”) from Oct. 8-10, 2018, in Pittsburgh, Pennsylvania, which convened innovators from around the world to tackle key issues influenced by the early stages in life. A full listing of research output from the division is included elsewhere in this report. Highlights of OB anesthesia research achievements in FY18 include current funded/unfunded projects either led or contributed to by division members, including:

- Building Interdisciplinary Research Careers in Womens Health (NIH/NICHD, $517,430)
- Ketamine for Postpartum Pain and Recovery (CTSI/Foundation, $75,000)
- Effect of a Patient Education Strategy on Resident Self-Efficacy and Maternal Outcomes (The EDUCATE Study) (SEA/Foundation, $10,000)
- Reducing the Impact of Pain on Perinatal Depression (CTSI/Foundation, $50,000)
- Quantifying Genetic Variation in Postpartum Women for Pain and Depression (Institute for Precision Medicine/Foundation, $)
- Quadratus Lumborum Block for Post-Cesarean Delivery Pain
- Tranexamic Acid for the Prevention of Obstetrical Hemorrhage after Cesarean (NIH/NICHD)
Overview
The UPMC Shadyside Anesthesiology Division consists of 20 faculty members and 52 CRNAs. The division provides adult anesthesiology services for a 22-room main operating suite and a six-room ambulatory surgery center, as well as coverage for two gastrointestinal labs, two electrophysiology labs, and invasive radiology.

Patient Care & Clinical Activities
During FY18, clinical anesthesiology services were performed for 19,688 cases at UPMC Shadyside. Our caseload spans the full range of adult surgical procedures, including major thoracic, cardiovascular, orthopedic, urologic, gynecologic, oncologic, neurosurgery, and general surgery, as well as outpatient orthopedic, plastic, dental, gynecologic, and general surgery. The division provides subspecialty care in cardiac anesthesiology and regional anesthesiology with subspecialty-trained and credentialed faculty.

UPMC Shadyside was recently designated as an “Aortic Center” and is the regional referral center for complex cases involving the aortic valve and aorta. The cardiac anesthesiology team headed by Dr. Rama Joshi consists of Drs. Bryant Bunting, Brent Cain, Michael Ingram, Steve McHugh, Mahesh Sardesai, Jill Suffield, and Sudhakar Yenem. It provides 24/7 coverage for cardiac surgical cases. All are board-certified in transesophageal echocardiography.

The Regional Anesthesia and Acute Pain team at Shadyside is led by Dr. Rita Merman. She along with the other members of the team, which includes Drs. Bruce Ben-David, Brandon Chinn, Jacques Chelly, Shiv Goel, Sharad Khetarpal, Carl Rest, Anna Uskova, and Sudhakar Yenem, offer 24-hour postoperative pain management for the majority of our orthopedic, thoracic, and urologic patients.

UPMC Shadyside Anesthesiology also provides 24-hour in-house coverage for emergency surgical cases and emergency airway management.

Education & Training
The division provides educational opportunities for its staff and faculty, as well as to a diverse set of students from other departments. Teaching activities include weekly case presentations, where faculty members prepare and present lectures. UPMC Shadyside Anesthesiology faculty members actively participate in the medical student anesthesiology rotation organized and administered by Dr. Shiv Goel. Dr. Daniel Sabo directs the UPMC Shadyside internal medicine residency rotation in anesthesiology. UPMC Shadyside is a designated primary instruction site for the University of Pittsburgh School of Nursing’s Nurse Anesthesia program. Our CRNAs and faculty anesthesiologists actively participate in the education and training of these students. Airway management training is also provided for paramedic students from the Center for Emergency Medicine. Department faculty members also participate in the didactic educational program. Dr. Robert Boretsky is the Medical Director for the UPMC Shadyside School of Perfusion.

Research
UPMC Shadyside has become a major center for clinical research, generating publications in acute pain management, surgical outcomes, OR management, and economics.
The Division of Cardiac Anesthesiology & Perioperative Medicine at UPMC Shadyside provides a unique environment for patients undergoing cardiac and major vascular surgery. The service provides perioperative echocardiography services for patients in the operating suite and cardiothoracic intensive care unit, as well as anesthesia for traditional and minimally invasive valve replacements and aortic repairs in elective and emergent settings. The division’s faculty are all board-certified anesthesiologists with advanced training in perioperative transesophageal echocardiography. The team comprises Drs. Rama Joshi, Brent Cain, Bryant Bunting, Michael Ingram, Stephen McHugh, and Jill Suffield. In July 2019, Drs. Daniel Mandell and Elizabeth Unger will join the division.

UPMC Shadyside is the leading aortic center in the region, managing aortic surgery patients from Eastern Ohio, West Virginia, and Western Pennsylvania. In the past year, more than 150 cases were emergent. In calendar year 2018, the division managed 1,512 cases.

The Shadyside Division of Cardiac Anesthesiology & Perioperative Medicine faculty members are dedicated to teaching echocardiographic imaging techniques and interpretation to cardiac anesthesiology fellows and anesthesiology residents. They are also involved in teaching medical and perfusion students and student nurse anesthetists. The faculty’s diverse patient population, case diversity, and strong academic credentials provide trainees with an excellent educational experience.

RAMA M. JOSHI, MBBS, MPM
Director
Overview
Veterans Affairs Pittsburgh Healthcare System (VAPHS) Anesthesiology is staffed by 12.5 physician full-time equivalents, a mix of VA and University of Pittsburgh employees. Additionally, CRNAs provide care to veteran patients in a team care model. The department provides clinical care for veterans in a 12-room operating suite, three gastrointestinal (GI) labs, a cardiac electrophysiology (EP) suite, a fully integrated vascular angiography suite, a preoperative evaluation clinic, and a multi-disciplinary pain clinic. The staff is involved in a wide range of administrative, educational, research, and quality assurance activities at both the VAPHS and the University of Pittsburgh School of Medicine (UPSOM).

Patient Care and Clinical Activities
Clinical service volume for FY18 saw continuation of the trend of increasing case volumes. A total of 7,563 OR cases were completed, a slight increase from the year prior, including over 100 solid organ transplants. Off-site anesthesiology coverage continued to expand as the number of GI lab cases increased from 3,285 to 3,973, a 21% increase. The number for EP Lab cases, interventional radiology, pulmonary, MRI, and other off-site cases totaled 816, a 9% increase from the prior year.

Pain management services again saw increases in patient load for FY18. A total of 1,379 new consults (an almost 14% increase) and 1,300 follow-up encounters (an over 13% increase) were completed. The total number of pain procedures for FY18 was 3,001, an almost 11% increase from the prior fiscal year. In addition, 1,045 interventional procedures (16% increase) were completed. Chiropractic and acupuncture services were expanded and VAPHS pain providers began performing interventional procedures at the Altoona VA and instituted a video clinic to better serve veterans at remote sites. Dr. Mangione continued as Chair of the VAPHS Pain Committee and Co-chair of the Veterans Integrated Service Networks (VISN) 4 Pain Committee and Opioid Safety Initiative.

Education and Training
During FY18, both third- and fourth-year medical students rotated through VAPHS under the direction of Dr. Catalin Ezaru. The rotation continues to be highly successful and highly-rated. Dr. Mangione continues to serve as an educational leader in the University of Pittsburgh Department of Anesthesiology and Perioperative Medicine, where he serves as Director of Medical Student Programs, and at the UPSOM, where he serves as Clerkship Director for anesthesiology courses. He also serves on a variety of UPSOM committees and is a member of the Academy of Master Educators.

The VAPHS Anesthesiology Division continues to provide clinical experience for residents of all levels, with a total of 32 different residents rotating during the year with a particularly strong interest from the senior class. Residents also continued to participate in liver transplantation anesthesia and chronic pain management as part of their general rotations. Evaluations of both the rotations and the individual faculty members remained consistently excellent. The VA continued to be a key location for PGY-4 residents looking for experience in staff-staffing at a junior attending level. Dr. Todd Oravitz continues to coordinate the resident rotations, as well as the 20-day introductory program. VAPHS anesthesiologists also provide clinical training for SRNAs, dental residents, and anesthesia technology students. Teaching activities include weekly teaching conferences and lectures for UPSOM medical students and residents, as well as various programs for hospital employees. Dr. James Ibinson continues to educate and mentor graduate students at the University of Pittsburgh.

Dr. John Williams served on a variety of national and local committees, including the American Medical Association (AMA) Council for Medical Education and as a delegate to the AMA from the Pennsylvania Medical Society and from UPMC to the AMA Integrated Physician Practice Section.

Research and Scholarly activity
In FY18, faculty members were active in terms of scholarly activity, authoring seven peer-reviewed publications and several abstracts/poster presentations, invited presentations, and letters to the editor. Dr. Brian Williams’ $1.9 million US Department of Defense grant, “Four-drug Nerve Block versus Plain Local Anesthetic for Knee and Hip Arthroplasty Analgesia in Veterans,” continued recruiting patients and performed an initial data analysis. Drs. Ibinson and Mangione are co-investigators on this grant.
UPMC MERCY

Overview
UPMC Mercy is a 488-bed tertiary care hospital in the uptown district of Pittsburgh. UPMC Mercy has a rich history, from its beginning as the first permanent hospital in Pittsburgh and the first Mercy hospital in the world to its current role as a provider of faith-based care to its patient population, including the underserved in our region. The hospital remains the only Catholic hospital in the region, providing specialized services such as women’s health, neurological, cardiac, and orthopedic care; in addition, it serves as a Neuroradiology Stroke Intervention Center, Level 1 Adult Trauma Center, an American Burn Association-verified Adult Burn Center, and a Pediatric Burn Center. The hospital has been a focal point for student and resident teaching for the University of Pittsburgh Schools of Medicine, Dental Medicine, and Nursing for many years and continues to provide educational experiences for our residents in multiple specialties, including acute pain management, general surgery, and neuro-, cardiothoracic, regional, and obstetric anesthesiology.

The UPMC Mercy anesthesiology faculty consists of approximately 16.3 clinical full-time equivalent (FTE) anesthesiologists and 40 CRNA FTEs who cover 16 inpatient operating rooms (ORs), six outpatient ORs, an obstetrical suite with two cesarean-section rooms, a busy endoscopy suite, interventional neuroradiology suite, MRI, hydrotherapy unit for burn care, and electrophysiology suite. A pre-anesthesia evaluation (PEC) center is staffed by two CRNPs. The case selection includes all but solid organ transplants. Highlights include voice, airway-modification, robotic, thoracic, trauma, orthopedic, vascular, obstetric, and complex maxillofacial surgeries. Burn care is a focal point at UPMC Mercy for both children and adults. UPMC Mercy’s Level I trauma service has a team dedicated to the care of parturients who suffer either blunt or penetrating trauma.

Patient Care and Clinical Activities
In FY18, UPMC Mercy clinicians supervised 18,328 cases. The endoscopy, electrophysiology, and radiology suites played a greater role in total anesthetic activities, which parallels a local and national trend, with nearly 20% of our prime time (7a – 5pm) coverage provided to these areas.

Education and Training
The teaching component of the UPMC Mercy anesthesiology site consists of rotating residents, fellows, and SRNAs, as well as off-service residents and students from the emergency medicine, surgery, and transitional year programs. Trainees from podiatric medicine and EMT programs and medical students from the University of Pittsburgh spend time on the service. Hospital lectures include site Grand Rounds, Journal Club, Quarterly Morbidity and Mortality conferences, and monthly staff meetings. There are also weekly medical student/resident conferences, where fourth-year medical students benefit from weekly one to one tutorials. Most weekly departmental conferences have been certified for CME credits, as well as CEU credits for CRNAs.

CALIN GORUN-GORUNESCU, MD
Interim Chief Anesthesiologist
Overview
UPMC St. Margaret bridges the gap between community anesthesiology practice and tertiary care center. Efforts are focused on patient care in the operating rooms and GI suites of both the main hospital and Harmar Ambulatory Center. The UPMC St. Margaret anesthesiology clinical site comprises nine full-time physicians and 42 CRNAs. In September 2014, UPMC St. Margaret again achieved ANCC Magnet Recognition® status, the highest international recognition for nursing excellence and leadership granted by the American Nurses Credentialing Center. The anesthesiology division was very active in the magnet designation process and recertification efforts.

Patient Care and Clinical Activities
The UPMC St. Margaret and Harmar Ambulatory Center Anesthesiology Division have maintained a growing perioperative environment for the past six years at a time when the local population continues to decline. In FY18, anesthetics were provided for 19,826 cases; 16,409 cases were completed at the main hospital and 3,417 at the Harmar site. Anesthetics were provided at 21 sites at UPMC St. Margaret and the Harmar Ambulatory Center; these sites included 13 hospital and five ambulatory OR rooms, three GI rooms, and one remote location site, including a cardiology lab and invasive radiology suite. A large variety of surgical procedures were performed at St. Margaret, including orthopedic (spine, total joint, sports, and foot and ankle); general; thoracic; urologic; gynecological; vascular; ophthalmologic; plastic; and ear, nose, and throat surgery. Minimally invasive surgeries for knee and hip replacements were routinely performed here, and regional anesthesia with nerve blocks and post-operative pain control were used for orthopedic and general surgery cases. The combination of the two sites encompasses a large ultrasound-based regional anesthesiology and perioperative pain control program and manages the largest of UPMC’s outpatient peripheral nerve block catheter programs. In addition, the UPMC St. Margaret Anesthesiology Division is an integral member of the hospital’s geriatric fracture program.

Education and Training
In calendar year 2017, UPMC St. Margaret was a rotation site for anesthesiology residents, medical students, SRNAs, dental anesthesiology residents, and pain (acute and chronic) and critical care fellows. The hospital was also a popular rotation site for senior residents in the advanced clinical track focusing on perioperative pain management and operating room management. The faculty also provided an educational experience for other UPMC facility members in the practice of ultrasound-based regional anesthesiology. In addition, UPMC St. Margaret anesthesiologists participated in didactic sessions for the hospital medical staff and family practice residents. The group at UPMC St. Margaret has become increasingly involved in clinical research, participating in several industry-supported projects.
FY18 was UPMC East’s sixth full year of service after opening on July 2, 2012. Located in the heart of Monroeville, UPMC East is a full-service community hospital providing patient-centered care. It is a 156-bed facility – 120 medical-surgical beds; 16 ICU beds; 19 rehab beds – and houses seven operating rooms with 31 pre-op/PACU bays, two endoscopy rooms, and two integrated interventional procedural and catheterization labs. The Chief Anesthesiologist at UPMC East is Michael Kentor, MD, and the Chief CRNA is Cindy McGettigan. The faculty at East consists of Drs. Monica Bolland, Kimberly Cantees, Tara Knizner, Michael Kentor, Scot Muir, Steven Orebaugh, Rita Toshok, and Charles Law, who shares his time with UPMC Passavant. In July 2017, Drs. Doug Bentley and Louis Nitsos joined the faculty as full-time FTEs and we shared the services of Dr. Bryce Bernard with UPMC Mercy.

Our surgical volume covers a wide spectrum of surgical specialties, including general surgery, orthopedics, podiatry, plastics, ENT, urology, neurosurgery (consisting mainly of spinal procedures), and thoracic, gynecology, and vascular surgery. The case load at UPMC East steadily increased over the year, resulting in 10,339 cases in FY18, an over 10% increase from the prior fiscal year. In addition, we have a very active inpatient/outpatient GI lab that uses anesthesia services on almost all of their cases. Our volume of anesthesia cases in the GI lab increased by over 12%, going from 4,796 to 5,381 cases. Requests for anesthesia services in the interventional procedure suites also continue to grow. In addition, the number of peripheral nerve blocks for post-operative pain performed at UPMC East increased from 617 the previous fiscal year to 1,009 blocks in FY18.

UPMC MONROEVILLE SURGERY CENTER

MICHAEL L. KENTOR, MD
Director

The UPMC Monroeville Surgery Center is now in its 26th year of operation and became part of UPP (under the umbrella of Department of Anesthesiology) on July 1, 2015. It was one of the very first free standing outpatient surgery centers in western Pennsylvania. Since opening, over 100,000 anesthetics have been administered. In FY18, the center provided anesthesiology services for 4,927 cases, a decrease of 9% from the prior fiscal year. We performed 894 GI cases, reflecting a 37% decrease from the prior fiscal year. The surgery center is housed on the first and second floors of a four-story building at 125 Daugherty Drive, Monroeville.

A variety of surgical procedures, as well as a large chronic pain service were provided at the surgery center. Surgical specialties included ophthalmology, orthopedics, urology, and general surgery. Specialized areas within these groups include hand, glaucoma, and breast surgery.

Changes continued in FY18. Effective June 30, 2018, through consolidation of services throughout UPMC, the Monroeville Surgery Center ceased operation. Cases have been absorbed by UPMC East and McKeesport campuses.
Overview
FY18 was UPMC Mercy Southside Outpatient Center’s ninth and final year of service after its conversion from an inpatient facility to an ambulatory surgical center. The orthopedic sports medicine and ophthalmology services remained the primary source of surgical cases, along with a lesser number of podiatry cases and an occasional ENT case. Off-site provision of anesthesia for GI cases continued as well. Eighty percent (80%) of the nurse anesthetists in our division shared time between Mercy Southside and other institutions, mainly UPMC Mercy and the UPMC South Surgery Center in Bethel Park, as well as UPMC East. Until its closure, Mercy Southside continued to serve as the primary core site for resident peripheral nerve block training, with two residents rotating there each month, each of whom typically provides 50 to 80 nerve blocks.

Patient Care and Clinical Activities
Although there was a significant decrease in surgical/procedural cases in the years following the metamorphosis of Mercy Southside into an ambulatory facility, the increasing volume of the sports/orthopedic service, as well as the integration of the ophthalmology department into this site, resulted in restoration of the case numbers. Nonetheless, financial considerations dictated closure of the site, which was shuttered in August of 2018. Through the time of its continued operation, the UPMC Mercy South Side Anesthesiology Division continued to provide high-quality ambulatory services to these patients using multi-modal analgesia, aggressive prophylaxis against postoperative nausea and vomiting, and regional anesthesia (when practical) to mitigate against postoperative pain. The total number of cases performed at the center, including off-site GI cases, was 5,094 during FY18 (a slight increase from FY17).
Overview
UPMC McKeesport is a 222-bed community hospital serving patients along the Monongahela Valley. Currently, the division is staffed by one full time MD anesthesiologist and four full time, two part time, and two casual CRNAs.

In FY18, UPMC McKeesport provided anesthesia for 3,563 cases. OR cases accounted for 2,046 of those and 1,517 were off-site procedures. In addition, anesthesiologists performed 163 acute pain regional blocks for immediate post-operative pain control and provided blocks for chronic pain patients. Seventy-seven consultations were conducted and 26 subsequent epidural steroid injections were performed.

Clinical Activities
Typical of a community hospital, the surgical procedures performed at UPMC McKeesport include major non-cardiac vascular surgery, lumbar laminectomies, spinal fusions, total joint replacements/orthopedic cases, abdominal surgery, gynecologic surgery, urologic, ENT, ophthalmologic, plastic surgery, and minimally invasive chronic pain procedures. Anesthesiology services are also provided at non-OR sites for GI, cardiac catheterization and pacemaker, bronchoscopy, radiologic, and radiation oncology procedures. The division provides back-up support for Emergency Department physicians, intensivists, and hospitalists in managing patients with difficult airways.

UPMC McKeesport Anesthesiology has been instrumental in creating difficult airway carts in strategic locations within the hospital and has established protocols for preoperative recognition and identification of surgical patients with obstructive sleep apnea, as well as the perioperative management of these patients.

Periodic evaluation and assessments are done to ascertain compliance with Surgical Care Improvement Project (SCIP) initiatives, central line-associated bloodstream infection (CLABS) preventive measures, indicators for Physician Quality Reporting Initiatives (PQRI), and patient safety measures.

Teaching Activities
Teaching activities at UPMC McKeensport include teaching airway management to non-anesthesiology-trained chronic pain fellows and internal medicine and family practice residents, as well as EMT students. Residents in both disciplines also receive training and gain experience with insertion of invasive lines. UPMC McKeensport anesthesiologists and CRNAs are committed to the clinical teaching and training of student nurse anesthetists.

Morbidity and mortality conferences, journal club meetings, and appropriate clinical updates are conducted regularly. The perioperative team undergoes a yearly mock fire drill with participation from the hospital’s safety officer. A malignant hyperthermia update and review is conducted annually. Updates on anesthesia awareness are conducted on a biennial basis.
Overview
As UPMC’s tertiary care center north of Pittsburgh, UPMC Passavant is a 434-bed, state-of-the-art hospital offering world-class medical care at campuses in McCandless and Cranberry. Our staff and physicians, dedicated to quality and innovation, provide exceptional service, including all the capabilities of an academic medical center, by utilizing cutting-edge technology in a patient- and family-centered atmosphere.

UPMC Passavant–McCandless is a 399-bed campus that attracts patients from around the region and the country for advanced cardiovascular, cancer, neurosurgical, gastrointestinal, and colorectal care. The hospital’s new seven-story pavilion, the first Leadership in Energy and Environmental Design (LEED)-certified hospital addition in the North Hills, has enhanced the ability of UPMC–McCandless to provide specialized medical and surgical treatment while improving the patient and family experience. Located in the new pavilion, UPMC Cancer Center at UPMC Passavant provides high-quality, comprehensive cancer care to residents in Pittsburgh’s northern communities.

UPMC Passavant’s 35-bed campus in Cranberry Township includes an expanded Emergency Department; a Comprehensive Breast Center; a complete diagnostic services department, including CT scan, MRI, ultrasound, general and cardiac nuclear medicine, and echocardiography; and outpatient surgical services.

The 132-acre McCandless campus boasts 21 operating rooms, six GI procedure rooms, and a large cancer center. The smaller Cranberry campus has six operating rooms/procedure rooms.

Patient Care and Clinical Activities
The UPMC Passavant Anesthesiology Division consists of 35 credentialed physicians and 103 credentialed CRNAs, translating to an approximate 14.5 OR FTE physician/43 FTE CRNA complement. The division supports the hospitals’ surgical volume and numerous outside-the-OR cases, including the EP lab, six GI procedure rooms, and a minimally invasive image-guided procedures suite. In FY18, UPMC Passavant anesthesiologists treated 24,785 cases at both the McCandless and Cranberry locations.

Anesthetizing locations may run as high as 30 daily between both campuses. All surgical subspecialties are represented, with the exception of transplant and complex pediatric surgery. The hospitals’ neurosurgical program performs both spinal and intracranial procedures. UPMC Passavant has a multispecialty robotic surgery service line.

A UPMC Passavant division of the Acute Interventional Perioperative Pain Service (AIPPS) operates under the leadership of Dr. Charles Luke. AIPPS provides comprehensive postoperative pain management for appropriately selected patients.

Under the leadership of Drs. Ryan Ball, Stephen Esper, and colorectal surgeon Jennifer Holder-Murray, UPMC Passavant implemented a comprehensive Enhanced Recovery After Surgery (ERAS) Program positively impacting colorectal length of stay and perioperative complications. Expansion of the program to additional service lines beyond colorectal is currently underway.

Education and Training
Three anesthesiology fellowship programs (acute pain/regional anesthesiology, pain medicine, and cardiac anesthesiology) are active at UPMC Passavant. The hospital is a rotation site for senior anesthesiology residents and University of Pittsburgh and La Roche College anesthesia MSN students.
Overview
UPMC Bedford Memorial is a 49-bed, acute care general hospital located in Bedford County, Pennsylvania. The hospital has units for medical, surgical, intensive care, coronary care, and telemetry services, and offers a variety of diagnostic capabilities, including CT, MRI, and the region’s only digital mammography with 3D tomosynthesis. The hospital also operates a cardiac-pulmonary rehabilitation program, an outpatient procedure unit, and an ambulatory surgical unit. The emergency facilities include 24-hour, in-house coverage by Emergency Medicine physicians, a licensed heliport for emergency transport, and trauma center affiliation. The UPMC Bedford anesthesiology division consists of two physicians and five CRNAs who provide both anesthesia and surgical perioperative care.

Patient Care and Clinical Activities
In FY18, 4,000 cases were performed. The total number of cases comprised 545 inpatient OR procedures, 2,057 outpatient OR procedures, 131 inpatient GI procedures, and 1,267 outpatient GI procedures.

In 2014, the UPMC Bedford anesthesiology division was instrumental in the design and installation of a new GI lab/endoscopy suite on the hospital’s second floor. The number of endoscopies involving anesthesia have nearly doubled since its inception.

Education and Training
UPMC Bedford Memorial Hospital and its medical staff have committed to teaching residents from UPMC St. Margaret; medical students from Philadelphia College of Osteopathic Medicine, Lake Erie College of Osteopathic Medicine, West Virginia College of Osteopathic Medicine, and physician assistant students from St. Francis University and the UPMC Physician Assistant Program. Students can rotate through the anesthesiology, surgery, emergency medicine, radiology, pathology, and family medicine services.
Overview
During FY18, the Mediterranean Institute for Transplantation & Advanced Specialized Therapies/Instituto Mediterraneo per i Trapianti e Terapie ad alta Specializzazione (ISMETT) continued to build on the success of past years, which would not have been possible without the input, hard work, and dedication of all the members of the ISMETT Department of Anesthesiology and Critical Care Medicine as well as the ICU, OR, and Post-anesthesia Care Unit (PACU) nursing staff.

Clinical Activities and Patient Care
ISMETT’s clinical responsibilities are quite diverse and include OR anesthesia, 24-hour ICU staffing, and coverage of all invasive procedures in Radiology, the cardiac catheterization lab, the gastrointestinal clinical laboratory, and the PACU.

We have been working since the summer of 2015 to expand our facility. We added six more ICU beds for a total of 20 beds, and an additional operating room, which is a cardiac hybrid OR. These acquisitions were in addition to the almost 40% bed increase that we gained with the acquisition of the building behind ours. Thanks to Prof. Jean de Ville’s work, the pediatric transplant program increased, served by our specialty anesthesia team led by M. Piazza.

Thanks to the hybrid OR, we expanded our mini invasive interventional cardiology program, performing TAVI, MitraClip, atrial septum defect closures, and other procedures on a regular basis. The National Extracorporeal Membrane Oxygenation Network (ECMO Net) was maintained to centralize all patients with severe acute respiratory distress syndrome (ARDS) not responding to standard treatment. From October 2009 to present, an ECMO team has been dedicated to managing non-responsive severe ARDS emergencies. Since its beginning, ISMETT has coordinated and performed more than 100 rescue actions, mainly relying upon airborne helicopter transportation provided with the support of the regional medical emergency service.

During FY18, ISMETT’s Department of Anesthesiology and Critical Care Medicine treated a total of 2,231 cases. One hundred and sixty (160) transplants were carried out, including 50 cadaveric kidney transplants, 9 living donor kidney transplants, 67 cadaveric liver transplants, 14 living donor liver transplants, 8 lung transplants, 8 heart transplants, 1 combined kidney-liver transplant, 2 combined kidney pancreas transplant and one combined kidney heart transplant. Additionally, UPMC Palermo treated 869 ICU admissions, 612 cardiothoracic surgeries, 167 thoracic surgeries, 414 abdominal surgeries, and 9 ventricular assist device surgeries. ISMETT continued to receive patient referrals for both adult and pediatric complex surgeries and ICU treatments.

Education and Training
Drs. Arcadipane and Burgio delivered lectures on heart, lung, and liver transplantation anesthesia and critical care medicine at the University of Palermo School of Anesthesiology. Many anesthesiologists lectured at national and international meetings. Dr. Arcadipane attended the annual meetings of the Italian Society of Anaesthesiology and Intensive Care Medicine (SIAARTI) and EuroELSO in May 2018. He has also committed to lectures at many Italian congresses on ECMO issues over a three-year period (2015-2018). Dr. Arcadipane was elected as coordinator of the SIAARTI Study Group for Cardiothoracic and Vascular Anesthesia.

In FY18, ISMETT continued to host students and anesthesia residents who wish to spend part of their elective time in Palermo. Residents from other Italian medical schools have also participated in ISMETT ICU and OR rotations. We also conducted an elective anesthesia rotation and hosted residents and students from different universities and
countries. ISMETT hosted visiting residents from UPMC in Pittsburgh (Drs. Lindsay Stolling, Alex Dressler, Kathleen Coy, Diana De Andreade), as well as Giorgia Cocorullo, Silvia Peralta, Marco Tomasino, Zelia Milazzo, Giovanni Misseri, Claudia Paleologo, Riccardo Pugliesi, Marinella Calia, Iacopo Tramarin, and Giovanni D’Amico from the University of Palermo; Gaetano Palumbo and Roberta Nicoletti from the University of Catania; Gaetano Pavone from the University of Bari, and Loshe Alina from Amburg.

We continued to increase the number of courses offered to external customers by our Renato Fiandaca Simulation Center, sponsored by the Fiandaca Foundation. Our simulation center renewed its American Heart Association license and conducted about 108 courses and trained more than 967 participants.

**UPMC SOUTH SURGERY CENTER**

**Overview**

UPMC South Surgery Center is a freestanding ambulatory surgery center located in the South Hills of Pittsburgh. The Center is administratively a part of UPMC Presbyterian-Shadyside Hospital. A full range of outpatient surgical services is provided in a convenient patient-centered environment. Four operating suites are available, as well as full GI screening capabilities. The South Hills campus also offers a full range of medical and surgical services, as well as diagnostic imaging, laboratory, and physical therapy and rehabilitation services.

**Patient Care and Clinical Activities**

The anesthesiology division at UPMC South Surgery consists of a group of board-certified physicians and credentialed CRNAs who also work at the main UPMC hospitals in the city of Pittsburgh. Fellowship-trained physicians belonging to the Acute Interventional Perioperative Pain Service are present on a regular basis to provide peripheral nerve blocks and ambulatory pain catheters on appropriate patients.

South Surgery Center was the first UPMC site to become enrolled in the Society for Ambulatory Anesthesia Clinical Outcomes Registry (SCOR) in 2012. This project was designed to assist anesthesiologists to track their own outcomes, compare with national benchmarks, and meet regulatory requirements. Effective December 2014, management of the registry was transitioning to the Anesthesia Quality Institute (AQI) and will become the new ambulatory module under the National Anesthesia Clinical Outcomes Registry (NACOR). The NACOR has been designated as a Qualified Clinical Data Registry by the Centers for Medicare and Medicaid Services for Physician Quality Reporting System (PQRS) reporting. With millions of cases and growing, AQI’s clinical data provides an evidence-based rationale that informs treatment choices and helps control treatment costs. This information is used by the anesthesiologists at South Surgery Center to provide state of the art anesthesia care for our patients.

In FY18, South Surgery Center provided anesthesiology services for 2,474 cases.
Overview
The UPMC Altoona Anesthesiology Department provides anesthesia services 24 hours a day for all scheduled and unscheduled cases. Altoona is staffed with 11 anesthesiologists and 32 CRNAs; an anesthesiologist and a CRNA remain in-house 24 hours a day, with backup on-call personnel available. All on-call physicians and CRNAs can be physically present in the hospital within a reasonable time frame after being called in. Anesthesia providers at the Surgery Center are scheduled to complete the elective schedule as needed. The provider is present until the last patient of the day leaves the building.

UPMC Altoona provides anesthesia to inpatients and outpatients undergoing surgery and other procedures in multiple locations. The department covers 13 operating rooms with various off-site locations: the post-anesthesia care units; the anesthesia holding room; the critical care units, the emergency department, the endoscopy suites, obstetrics (OB) (two operating rooms); labor, delivery, recovery and postpartum rooms; radiation and radiation oncology; the electrophysiology (EP), gastrointestinal (GI), bronchoscopy, and catheterization labs; interventional radiology and neurointerventional labs; magnetic resonance imaging (MRI)/computed tomography; and the six room, on-campus Surgery Center.

Patient Care and Clinical Activities
UPMC Altoona became part of UPP (under the umbrella of the Department of Anesthesiology and Perioperative Medicine) on January 1, 2017. In FY18, UPMC Altoona anesthesiology provided care for 20,351 surgical cases and approximately 16,996 patients, including 3,332 patients at the Surgery Center and 3,939 patients in the endoscopy suite.

The anesthesia caseload consisted of general surgery, cardiac surgery, bronchoscopy, orthopedics, trauma, neurosurgery, urology, GI, EP, interventional neurolab, interventional radiology, otolaryngology, electroconvulsive therapy, transesophageal echocardiography, cardioversions, patent foramen ovale repairs, enhanced recovery after surgery, healthy pediatrics, and OB and MRI procedures. In 2019, UPMC Altoona will begin performing transcatheter aortic valve replacement and WATCHMAN™ procedures.

Education and Training
UPMC Altoona Anesthesiology provides education for CRNAs from the University of Pittsburgh and the Excela nurse anesthesia programs. They also teach basic skills in anesthesia to family practice residents and STAT MedEvac and respiratory therapy airway management skills. The department provides moderate sedation education for medical staff. Altoona Anesthesiology holds weekly meetings that include educational sessions, morbidity and mortality review, business discussions, and departmental updates.
Overview
UPMC Horizon became part of UPP (under the umbrella of the Department of Anesthesiology and Perioperative Medicine) on January 1, 2016. On September 1, 2017, the group merged with the existing anesthesia group and Horizon Anesthesiology regionalized with UPMC Jameson. The UPMC Horizon/Jameson Anesthesiology Division consists of 10 faculty members and 22 CRNAs. The division provides anesthesia services at three sites (Greenville, Shenango Valley, and Jameson campuses), covering 16 main operating rooms, a C-section room in the labor and delivery unit, six ambulatory rooms in which GI and urology cases are performed, and a cath lab. Each anesthesiologist performs their own regional procedures at all sites.

Patient Care and Clinical Activities
During FY18, clinical anesthesiology services provided care for 8,746 surgical cases at UPMC Horizon and 5,923 cases at UPMC Jameson, totaling 14,669 cases. The caseload primarily includes outpatient adult surgical procedures, including orthopedic, urologic, gynecologic, ENT, bariatric, and general surgery. Regional anesthesia services have been expanding to provide the most up-to-date care for the orthopedic surgery patients. There are also a small number of pediatric ENT cases. In addition, UPMC Horizon is one of the only local hospitals to provide obstetric care. Approximately 1,000 patient deliveries, with 70-75% receiving epidurals, were managed at Horizon in FY18.

Education and Training
The Department of Anesthesiology and Perioperative Medicine provides education opportunities telecast between Horizon and Jameson. Biweekly meetings include morbidity and mortality conferences, educational sessions, and business discussions. Horizon/Jameson anesthesiologists have the opportunity to teach medical students and surgery residents who rotate through the operating room. Student nurse anesthetists from the Pitt CRNA school spend month long rotations learning regional techniques as well as participating in OB and pediatric cases. In addition, airway management training is provided for STAT MedEvac paramedics who spend time in the division.
The UPMC Pain Medicine Division, comprising 10 faculty members, is a multidisciplinary clinical, teaching, and research endeavor spread over eight clinic locations: UPMC St. Margaret, Centre Commons in East Liberty, Oakland campus, Monroeville, UPMC Passavant, UPMC Mercy, UPMC Horizon, and UPMC Children’s Hospital of Pittsburgh. Both outpatient and inpatient hospital treatment services are provided at each of these locations. The program is committed to the evaluation and treatment of the entire range of pain, disability, and rehabilitation problems, from infancy to old age, including end of life care. It offers an interdisciplinary team approach that includes dedicated professionals from various specialties including anesthesiology, neurology, psychiatry, nursing, occupational therapy, physical therapy, and psychology.

The treatment teams develop and coordinate individual treatment plans to: reduce pain and suffering whenever possible and assist patients in coping with any remaining discomfort; reduce disability to restore a more normal, meaningful, and satisfying life; reduce emotional distress caused by chronic pain; reduce dependency on drugs and on the healthcare system; and facilitate, as appropriate, the patient’s return to gainful employment and usual household and leisure activities.

Patient Care and Clinical Activities
During FY18, Department of Anesthesiology and Perioperative Medicine Pain Medicine physicians completed 45,415 outpatient visits in over 17,000 unique patients, with a comparable number of inpatient visits as well. Interventional modalities are carried out at all eight locations, including somatic and sympathetic nerve blockade, neurolytic blocks, placement of intrathecal pumps and neurostimulators, joint injections, and pharmacotherapy.

Unique and valuable assets of UPMC Pain Medicine are the Intensive Pain Rehabilitation and Fibromyalgia Rehabilitation Programs at Centre Commons in Shadyside, which provide effective therapies for conditions not requiring invasive procedures. Rehabilitative programs and services offered at Centre Commons include physical conditioning exercises, cardiovascular conditioning, coping skills training, work hardening, job-site evaluation, family counseling, relaxation therapy, stress management, biofeedback, self-hypnosis, gait and postural training, physical-capacity evaluation, work simulation, psychological counseling, and nutritional and sleep counseling.

In keeping with its mission, the UPMC Pain Medicine Program treats the entire spectrum of pain conditions, including persistent post-surgical pain, chronic back pain, complex regional pain syndrome (reflex sympathetic dystrophy), fibromyalgia, cancer pain, musculoskeletal injuries, headaches, post-herpetic neuralgia (shingles), and cumulative trauma syndromes.

Two years ago, the division created a treatment outcomes tracking registry, modifying software from the Collaborative Health Outcomes Information Registry (CHOIR). At every visit, every patient reports a range of outcomes based on the NIH PROMIS system. This information is available to each provider instantaneously at the point of care to guide treatment decisions. In addition, the data is maintained on a server and merged with electronic medical record data from the former EPIC registry with suitable rigor to perform comparative effectiveness research and quality improvement projects. After two months of roll-out, we have collected over 50,000 surveys from 24,000 unique patients.

Research
The division has a robust clinical and translational research program in chronic pain (in collaboration with faculty from the Pittsburgh Center for Pain Research), funded by a variety of federal and industry grants. Details of this work and the growth of the program can be found in the description of Dr. Wasan’s research in this report. In addition, division faculty
are actively engaged in mentoring other pain clinical researchers in the department. Several of these trainees have obtained independent funding.

**Education and Training**
The Division of Pain Medicine offers a one-year pain medicine fellowship that is fully accredited by the Accreditation Council of Graduate Medical Education (ACGME). The program was recently re-accredited for the maximum five-year timeframe with no citations and with commendation. This is the third time the program has received this honor. UPMC has one of the largest clinical pain medicine fellowships in the country, graduating eight fellows per year. In addition, our department is one of few in the country with two NIH T32 programs in pain medicine, which train basic scientists and physicians over a two-year period in conducting basic, clinical, or translational research. The Pain Medicine Division works directly with the directors of the T32 programs to offer additional research training to the clinical pain medicine fellows if desired. We are one of the very few pain medicine divisions in the country with this physician-scientist training track.

Fellows rotate through the outpatient services at UPMC St. Margaret, Centre Commons, Oakland campus, Monroeville, and UPMC Passavant and provide inpatient consultation at UPMC St. Margaret, UPMC Shadyside, UPMC Mercy, UPMC Western Psychiatric Hospital, UPMC Passavant, UPMC Cranberry, UPMC Montefiore, and UPMC Presbyterian.

**AIPPS**

**Overview**
The mission of the Regional Anesthesiology and Acute Interventional Perioperative Pain Service (AIPPS) is the coordination and standardization of perioperative pain management for patients undergoing surgery at UPMC. AIPPS offers 24-hour perioperative pain management for orthopedic, thoracic, and urologic patients requiring peripheral and paravertebral nerve blocks. FY18 was marked by several changes in AIPPS, most notably the appointment of Dr. Charles Luke as Director, effective January 1, 2018.

**Patient Care and Clinical Activities**
In FY18, Drs. Beverly Pearce-Smith, Rita Merman, and Vlad Shick remained AIPPS sites chiefs for UPMC Presbyterian, Shadyside, and Mercy, respectively. Together, these leaders oversee the largest acute pain service in the country. In FY18, Dr. Charles Lin was appointed Chair of the AIPPS Standardization Committee, Dr. David Glover was appointed the division’s Quality Improvement (QI) Director and educational rotation site director for UPMC Passavant, and Dr. Sandy Littman became the point person for UPMC Presbyterian Orthopedic Trauma. Finally, Orthopedic Sports Medicine moved from UPMC Mercy South Side Outpatient Center to UPMC Montefiore in the summer, where Dr. Steven Orebaugh will oversee this new service line. The division continued to strengthen and form partnerships with surgical subspecialty services, ERAS, and UPMC Pain Medicine (the Department of Anesthesiology and Perioperative Medicine Chronic Pain division).

In FY18, AIPPS managed 35,878 cases. AIPPS improved operational efficiencies, leading to operating margin expansion and profitability for the division. Total revenues for FY18 were $4.9 million. The total number of blocks performed in FY18 was 23,663, including 13,092 blocks performed using an ultrasound-guided approach.

**Teaching Activities**
FY18 was remarkable for the accreditation of the Regional Anesthesiology and Acute Pain Medicine Fellowship by the ACGME for 15 fellows on September 21, 2017, effective January 1, 2018, under the directorship of Dr. Jacques E. Chelly. The program now represents the largest accredited fellowship at UPMC and the largest accredited regional anesthesiology/acute pain fellowship in the nation. The fellowship education team was completed by the appointment of
DEPARTMENT OF ANESTHESIOLOGY AND PERIOPERATIVE MEDICINE

Clinic Divisions

The UPMC Department of Anesthesiology and Perioperative Medicine provides a comprehensive perioperative clinical echocardiography service and supports a very active echocardiography education program for trainees. Intraoperative transesophageal echocardiography (TEE) for cardiovascular surgery and thoracic organ transplants is provided by 20 cardiac anesthesiologists (16 of them certified by the National Board of Echocardiography (NBE) in Advanced Perioperative TEE). Intraoperative TEE is also provided for electrophysiology procedures (e.g. WATCHMAN™ device insertion) and procedures in hybrid operating rooms (laser lead extractions, transcatheter aortic valve replacements). In FY18, department faculty performed 1,930 comprehensive diagnostic perioperative echocardiographic studies within the UPMC health system.

A perinatal transthoracic echocardiography (TTE) consult service was established in 2016 and performed more than 100 TTE examinations in FY18 for preoperative risk stratification and intra- and post-operative hemodynamic evaluation. Preoperative TTE identified significant findings in 63% of patients, which altered patient management. Plans are to extend the perioperative TTE service to patients in the Center for Presurgical Care for preoperative evaluation and optimization in FY19 and to other UPMC hospitals in Allegheny county.

Scholarly Activities

Over 30% of the AIPPS Division faculty, including Drs. Ben-David, Chelly, Khetarpal, King, Lin, Luke, Schott, Monahan, Orebaugh, Pearce-Smith, and Williams, presented at and/or participated in workshops at local, national, and international meetings. These meetings included the 9th International Auriculotherapy Symposium in Singapore, August 10-12, 2017, the 71st National Congress of the SIAARTI, October 18-21, 2017 in Rimini, Italy, the annual meeting of the American Society of Anesthesiology (ASA) in October 2017, the UPMC Update in Regional Anesthesia, Pain, and Intensive Care at Nemacolin Woodlands Resort on April 28-29, 2018, and the ASRA/World Congress of Regional Anesthesia, New York, NY on April 18-22, 2018.

In FY18, members of the AIPPS Division published 19 peer-reviewed and review articles. Dr. Chelly also served as a reviewer for the Swiss National Science Foundation and was awarded a $30,000 grant from the Shadyside Hospital Foundation to study the role of the BRIDGE device in preventing perioperative pain in patients undergoing major abdominal surgery. Other active research projects included “A Randomized Controlled Trial of Regional versus General Anesthesia to Promote Independence after Hip Fracture (the REGAIN Trial).” One fellow presented a poster at the annual ASA meeting and fellows presented six posters at the 2018 ASRA meeting/World Congress of Regional Anesthesia.

KATHIRVEL SUBRAMANIAM, MD, MPH, FASE
Director
The perioperative echocardiography rotation continues to provide residents and adult cardiothoracic anesthesiology fellows excellent opportunities to learn basic TEE and point of care ultrasound (POCUS). In addition to hands on training in the operating room, they are provided with web-based resources, one-on-one simulation training at WISER, lectures and problem-based discussions on topics related to echocardiography, and review of echocardiography exams at the digital echocardiography laboratory with expert faculty. The aim is to prepare trainees for NBE certification in echocardiography. In 2018, 12 residents took the NBE basic TEE examination and all of them passed and qualified for basic TEE certification. Residents on their PACU rotation during their PGY-2 year receive supervised focused cardiac ultrasound (FOCUS) training. In FY18, most residents completed 25 FOCUS examinations during their rotation.

The UPMC Department of Anesthesiology and Perioperative Medicine, in conjunction with the UPMC Center for Continuing Medical Education, held the second biennial “Boot Camp for Basic TEE Boards and Focused Cardiac Ultrasound Workshop” at the Herberman Conference Center at UPMC Shadyside on Saturday, June 9, 2018 (Drs. Kathirvel Subramaniam & Michael Boisen were the Course Directors). The response to this educational event was robust. Sixty-seven medical specialists registered for the conference, including anesthesiologists, fellows, and residents from other states (Maryland, Delaware, West Virginia, Ohio, New York, DC, Missouri, and Massachusetts).

Beginning in FY18, a digital echocardiography laboratory (Syngodynamics, Siemens HealthCare, MA) is utilized to archive all echocardiographic studies from UPMC Shadyside and Presbyterian. This lab is a cloud system for storage of all echocardiographic images from both hospitals and is used for clinical review of images for patient care, education of trainees, quality improvement, and research.

Several research projects are being conducted on perioperative echocardiography involving faculty, adult cardiac anesthesiology fellows, and residents. Dr. Daniel Mandell, an adult cardiothoracic anesthesiology fellow, received an educational seed grant for his project “Evaluation of Anesthesiology Resident Competence and Clinical Impact of a Structured Point-of-Care Ultrasound Training Program,” mentored by Drs. Subramaniam and Boisen. Dr. Ezeldeen Abuelkasem, a faculty member in the Department of Anesthesiology and Perioperative Medicine, is involved in two research projects evaluating the effect of myocardial deformation imaging on patient outcomes in cardiac surgical patients. We are also evaluating the impact of basic TEE education for senior residents on their practice in a study involving residents graduating over the past five years.

In FY18, many faculty and fellow earned accolades related to the perioperative echocardiography division. Two faculty members, Drs. Ryan Ball and Kathirvel Subramaniam were appointed Fellows of the American Society of Echocardiography by the American Society of Echocardiography (ASE). Adult cardiothoracic anesthesiology fellow Diana DeAndrade, MD received a $1,000 travel grant to attend the ASE Annual Meeting on June 22-26, 2018 in Nashville, TN. Dr. Subramaniam was invited as a Visiting Professor to teach POCUS to residents at St Louis University. He was also invited to present the lecture “Ultrasound for Anesthesiologists - Sixth Sense” at the Anaesthetist Society meeting held in Chennai, India. Dr. Subramaniam also organized a workshop on POCUS at the same meeting. He was invited to present his experience organizing the POCUS service at UPMC Presbyterian at a meeting involving the ASE’s POCUS Taskforce B. Finally, Dr. Subramaniam was invited to speak about the role of echocardiography in thoracic transplantation at the Korean Society of Anesthesia 2018 conference (“KoreAnesthesia 2018”) to be held November 7-11, 2018 in Seoul, South Korea.

**Digital Echocardiography Laboratory**

A digital echocardiography laboratory is utilized for archiving all echocardiographic studies as part of a quality improvement program, allowing the education of residents and fellows in research studies related to echocardiography.
Patient Care and Clinical Activities
The Cardiotoracic Anesthesiology Division is comprised of 30 faculty members who are experts in their subspecialty. The division encompasses four hospital locations: UPMC Presbyterian, UPMC Shadyside, UPMC Passavant, and the Veterans Affairs Pittsburgh Healthcare System. Surgical procedures span the full spectrum of adult cardiothoracic practice: coronary artery bypass graft surgery (including minimally invasive coronary artery bypass and off-pump coronary artery bypass), conventional cardiac valve replacement and repair, transcatheter mitral valve (MitraClip) repair, atrial fibrillation ablation (MAZE) surgery, left atrial appendage exclusion procedures (Watchman; Amulet), thoracic aorta repair/reconstruction (conventional and endovascular approach), pulmonary thromboendarterectomy, repair of ventricular and atrial septal defects, and removal of cardiac tumors/myxomas, transcatheter aortic valve replacements (TAVRs), NeoCHORD® mitral valve repair, pulmonary resection (conventional, robotic, and minimally invasive approaches), pneumonectomy, minimally invasive and robotic esophagectomy, complex endoscopy procedures (flexible/rigid bronchoscopy, esophagoscopy), tracheal resection, and minimally invasive procedures for digestive disorders. During FY18, the division provided anesthesia for 2,301 open heart surgeries, 64 structural heart cardiology procedures, 276 TAVRs, 19 endovascular thoracic aneurysm repairs, and 5,078 thoracic surgery procedures (data from the Veterans Affairs Pittsburgh Healthcare System not included in these numbers).

UPMC Presbyterian is recognized as a world leader in heart, lung, and heart-double lung transplants and is the designated site in the UPMC healthcare system for these procedures. UPMC Presbyterian is also the primary site for the surgical treatment of patients with end-stage heart failure. A variety of mechanical ventricular assist devices are used as a bridge to transplantation or for “destination” therapy (HeartMate 3®, Impella® (Abiomed), and HeartWare®). Extracorporeal membrane oxygenation support (ECMO) is also used to support patients with compromised myocardial and pulmonary function. During FY18, the division managed anesthesia for 37 cardiac transplants, 67 double-lung transplants, 17 single-lung transplants, 50 ventricular assist devices, and 28 ECMO insertions.

Education and Training
The Division of Cardiothoracic Anesthesiology offers world-class opportunities for both basic and advanced training in adult cardiothoracic anesthesiology. Most post-graduate year (PGY)-3 residents receive their initial exposure to cardiac anesthesiology at UPMC Presbyterian. PGY-4 residents are offered a three-month elective in advanced adult cardiac anesthesiology. Adult Cardiothoracic Anesthesiology (ACTA) Fellows (PGY-5) have the opportunity to receive advanced training in the subspecialty beyond the PGY-4 year in an ACGME-accredited program, inclusive of: emergency and elective surgery, TEE, perfusion/ventricular assist device theory and operation, management of patients with electrophysiologic cardiac disturbances requiring ablation therapy or implantation of automated implantable cardioverter-defibrillators/pacemakers, management of patients for minimally invasive implantable cardiac devices in the cardiac catheterization lab, cardiothoracic critical care medicine, and heart/lung transplantation. Fellows who successfully complete the training program are eligible to take the Advanced PTEeXAM administered by the National Board of Echocardiography. Residents and fellows receive course goals and objectives at the beginning of their clinical rotation along with a list of required reading material. Didactic programs are separate for residents and fellows and consist of intraoperative clinical teaching, lectures, and PBLDs based on topics related to cardiothoracic anesthesiology. In addition, fellows attend weekly TEE reviews and a lecture series that is moderated by the cardiac anesthesiology faculty. A mock oral exam is administered to each resident at the conclusion of the clinical rotation and to each fellow on a semiannual basis. UPMC Presbyterian hosts IDECs with the Division of Cardiology and the Departments of Critical Care Medicine and Cardiothoracic Surgery that follows an interactive evidence-based medicine format. ACTA fellows present topics of interest that are moderated by the interdepartmental faculty. A combined cardiothoracic anesthesiology faculty/fellow conference is held quarterly and includes case presentations, morbidity and mortality discussions, journal club, and quality improvement topics.
AMBULATORY ANESTHESIOLOGY

The Ambulatory Anesthesiology division was created in 2009 to integrate research-based patient care principles for same-day surgery into a formal clinical entity. The division’s foundation is the development of new recovery criteria, the “WAKE Score,” which outlines recovery parameters after ambulatory surgery and/or moderate sedation. The WAKE Score, authored by Drs. Brian Williams and Michael Kentor, not only predicts safe bypass of the “Phase 1 Recovery Unit” (post-anesthesia care unit [PACU]), but also predicts successful same-day discharge (i.e., no unplanned hospital admission). In August 2010, the WAKE Score was rolled out for daily clinical use en route to becoming the official recovery criteria for UPMC. This important initiative for standardizing recovery criteria system-wide is a Joint Commission-driven patient care directive, and this rollout involved top-level teamwork with many departments and committees.

The Director of Ambulatory Anesthesiology is Brian A. Williams, MD, MBA, a 1995 alumnus of the Pitt Anesthesiology Residency Program and a 1996 alumnus of the Katz Graduate School of Business and our Department’s Charles Schertz Memorial Research Fellowship. After leading the UPMC rollout of the WAKE Score in 2009-2010, Dr. Williams relocated to the VA Pittsburgh Healthcare System (VAPHS) as the inaugural Director of Ambulatory Anesthesiology, Regional Anesthesiology/Acute Pain Medicine, and Preoperative Optimization. By 2011, the WAKE Score became recovery policy at the VAPHS and the resident teaching curriculum promulgated the novel concept of “design the anesthetic to meet the WAKE Score criteria for PACU bypass.” This included initiating a new regional anesthesiology program, as well as active teaching curriculum in multimodal analgesia (MMA), multimodal antiemesis (MMAE), multimodal perineural anesthesia-analgesia (MMPNA), and multimodal total intravenous anesthesia-analgesia (MMTIVA). MMTIVA at the VAPHS continues to evolve as an important component of their evolving “Enhanced Recovery after Anesthesia and Surgery” (ERAS) program. Meanwhile, in February 2016, the national VA office (under the leadership of former Secretary of the Department of Veterans Affairs, Dr. David Shulkin) announced that the WAKE Score was chosen as a “Gold Status” initiative. Dr. Williams was named “Gold Status Fellow for the Promising Practices Consortium Diffusion of Excellence” program. Dr. Shulkin is also an alumnus of the UPMC Internal Medicine Residency Program. The book chapter “Design the Anesthetic to Meet the WAKE Score” is now published in Dr. Shulkin’s book Best Care Everywhere – by VA Professionals Across the Nation (U.S. Department of Veterans Affairs, June 2017, P96877, IB 10-1009).

Several important research advances in ambulatory anesthesiology (originating from the University of Pittsburgh School of Medicine Department of Anesthesiology and Perioperative Medicine) occurred during FY17-18. Most of these are related to the MMPNA concept described above with nerve blocks. Underwritten by funding from the Department of Defense (2010-2019) and the NIH (2008-2010), Dr. Williams’ teams developed novel four-drug nerve blocks comprised of either local anesthetic or preservative-free midazolam with the combination of clonidine-buprenorphine-dexamethasone. These four-drug combinations were shown to be non-toxic in vitro and in vivo at the concentrations studied. The team also reported (in retrospective reviews of prospective clinical pathways) on the block duration and rebound pain encountered after these block effects dissipated. These reports were published in the peer-reviewed journals Regional Anesthesia and Pain Medicine (2011-2014) and Pain Medicine (2015-2017). This preliminary work led to a new Department of Defense clinical trials grant (2015-2019) comparing plain bupivacaine with the four-drug combination (as single-injection nerve blocks) for patients undergoing primary knee or hip arthroplasty. As of this writing, 70 study patients have completed their joint replacement surgery study protocol.
In July 2015, in conjunction with the Department of Surgery and Jennifer M. Holder-Murray, MD, FACS, as well as Michael Boisen, MD and Kathirvel Subramaniam, MD, MPH, FASE, and with the help of project manager Katie Meister and nurse educator Steve Foos, UPMC launched its Enhanced Recovery after Surgery program, commonly referred to as ERAS. The program is designed to reduce patients’ stress response to surgery, support their physiologic function, and accelerate their return to normal daily function. ERAS protocols encompass a multimodal approach to surgical care. Major components of these protocols include limiting fasting prior to surgery, intraoperative goal-directed fluid therapy, and adequate pain control while minimizing opioid use, early ambulation, early postoperative enteral nutrition, and nausea/vomiting prophylaxis. ERAS protocols are designed to reduce surgical stress and maintain post-operative physiological function, reduce rates of complications, facilitate faster recovery through early ambulation and feeding (thus reducing length of hospital stay), and improve patient/family satisfaction.

Thus far, ERAS has been established at UPMC seven hospitals and on 15 service lines. The program’s success has been demonstrated by reducing length of hospital stay by two to three days, reducing patient-controlled analgesia use from >95% to approximately 16% after complex abdominal surgery, and improving same day patient discharge for minimally invasive gynecology and urogynecology surgeries. Success is achieved through evidence-based pathways utilized throughout the entire perioperative period, including in the preoperative outpatient setting.

Prior to surgery, ERAS patients receive patient education, including encouragement to abstain from drinking alcohol or using tobacco products for one month prior to surgery and to obtain good nutrition with a high protein and carbohydrate-rich diet for one week pre-op; engage in a pre-op walking program (30 min/day until day of surgery); eat a regular diet until midnight the night before surgery (unless a bowel prep is required); and drink clear liquids up until three hours prior to surgery. Patients are screened for malnutrition with supplements for seven to 10 days preoperatively if needed and for post-op nausea/vomiting risk with prophylaxis. The ERAS protocols reinforce the need for patient engagement.

Since its inception, ERAS has won the UPMC Quality & Safety Fair 1st Place Award in Innovation (“ERAS” – Nursing Unit 10 North), the UPMC Presbyterian Service Excellence Award, the UPMC Shadyside Service Excellence Award and UPMC Passavant, MAGNET Status.

**CENTER FOR PERIOPERATIVE CARE**

**STEPHEN A. ESPER, MD, MBA, Director**

In the current healthcare landscape, identifying and reducing mortal and morbid surgical risks is important for patients, families, providers, and healthcare systems. Patients identified as “high risk” based on their underlying physical status and co-existing medical conditions are associated with considerable morbidity and mortality and low-value care, accounting for more than 30% of ICU admissions, 70% of post-operative deaths, and 90% of the care provided during hospitalization. “Prehabilitation” of high-risk patients prior to surgery has been shown to help reduce hospital length of stay, hospital acquired conditions, and readmission rates, translating into better quality care, higher patient satisfaction, and cost savings.

The Center for Perioperative Care (CPC), a team-based, multidisciplinary prehabilitation clinic, identifies and screens high-risk patients prior to non-emergency surgery. The CPC accepts all patients under consideration for these surgical procedures and tailors the surgical experience to each patient’s specific needs at no additional cost to either the patient or the health system. This “surgical pause” provides the opportunity to mitigate risk and optimize patients’ health.
before surgery to improve outcomes or refer patients to safer non-surgical approaches if warranted. Anesthesiologists specializing in perioperative medicine facilitate the multidisciplinary CPC team, which includes the surgeon, primary care provider, and specialists working with the patient in a shared-decision-making approach. The first CPC clinic opened in June of 2016 at UPMC Shadyside; a second CPC site opened at UPMC Presbyterian in August of 2017. On April 1, 2019, UPMC Presbyterian’s Preoperative Evaluation Center (PEC) and CPC services were integrated into a single service.

Patients seen in the CPC are assessed using a validated and accepted Risk Analysis Index tool developed by the CPC team to identify those at high-risk for poor surgical outcomes (see Arya S et al. Recalibration and External Validation of the Risk Analysis Index: A Surgical Frailty Assessment Tool. Ann Surg. 2019 Mar 19). The team’s comprehensive system addresses patients’ anesthetic and medical concerns, nutritional status, physical and cardiopulmonary therapy, weight loss, chronic pain assessment, and tobacco, drug, and alcohol cessation and provides mental health therapy and social work support services. At-risk patients are provided with a supportive “Surgery Coach” specifically trained in surgical preparation who mentors patients, readying them for their surgical experience.

Thus far, the two CPC sites have screened more than 1,000 patients. In a subset of that cohort (n=132) evaluated between February and September 2018, 25% decided to pursue non-surgical therapy; 55% had their health optimized with prehabilitation prior to surgery; and 20% proceeded to surgery without delay. A snapshot of 24 patients referred from orthopedic surgical clinics showed a 32-pound average weight loss per patient. Analyses suggests that CPC consultation is associated with an approximately one-day reduction in postoperative length of hospital stay when compared to frailty, procedure, and comorbidity-matched controls. Furthermore, initial data indicates overwhelmingly positive responses from both patients and surgeons regarding CPC experiences.

Plans are for the CPC to continue to expand to additional UPMC hospitals, leveraging telemedicine to deliver services to outpatients distant from urban centers. The team is already in the process of launching multiple additional clinics at other UPMC hospital sites, with a goal to expand to these new sites by 2020.

CRNAS

The Certified Registered Nurse Anesthetist (CRNA) professional staff met all patient care delivery needs in FY18 with 392 CRNA full-time equivalents. We continue to recruit strong candidates as the Department of Anesthesiology and Perioperative Medicine expands services to UPMC facilities beyond Allegheny County. The CRNA leadership team works closely with physician colleagues to efficiently cover all service lines. Team-focused anesthesia care ensures the best possible outcomes for all our patients.

Professional development is valued and supported. CRNAs actively participate in quality improvement projects at all levels through committee work. Clinical skills are sharpened at the Peter M. Winter Institute for Simulation Education and Research. Many CRNAs are now engaging in doctoral-level studies at various local universities with the goal of improving safety and quality.

We continue our relationship with the University of Pittsburgh’s Nurse Anesthesia Program, which is currently tied for #4 with three other institutions ranked by U.S. News and World Report. All CRNAs participate in clinical instruction; 37 nurse anesthetists will graduate from the program in 2018. Mentoring programs are utilized to transition trainees into their new roles and promote a positive learning environment.

FY 2018 was full of professional growth, recognition, and philanthropic events. The CRNA staff organized and participated in numerous community outreach programs. Many of our CRNAS were recognized for their commitment to patient safety, quality, and professionalism.
FY18 was a productive year for basic science research in the Department of Anesthesiology and Perioperative Medicine. We received a total of $4,284,263 in extramural grants, $3,469,678 of which was from the National Institutes of Health (NIH) and other federal sources. Three of our investigators (Drs. Yan Xu, Gregg Homanics, and Pei Tang) were among the top 105 NIH-funded investigators in anesthesiology, each bringing in from $419,599 to $1,243,704 in total NIH grant funding in 2017.

The academic activities in the department resulted in 127 peer-reviewed publications in FY18. Please see the publications section of this report for a detailed list of publications.

Significant studies published during FY18 include the following:


Opioids are the gold-standard treatment for severe pain. However, potentially life-threatening side effects decrease the safety and effectiveness of these compounds. The addiction liability of these drugs has led to the current epidemic of opioid abuse in the US. Extensive research efforts have focused on trying to dissociate the analgesic properties of opioids from their undesirable side effects. Splice variants of the mu opioid receptor (MOR), which mediates opioid actions, have unique pharmacological properties and anatomic distributions that make them attractive candidates for therapeutic pain relief. In another article published in the same issue of JCI, Xu et al. showed that specific C-terminal regions of the MOR can modulate side effects without altering analgesia. This discovery greatly improves our understanding of opioid side effects and suggests intriguing therapeutic approaches that could improve both the safety and long-term effectiveness of opioids.


Alcohol use is responsible for about 4% of all deaths worldwide. A portion of this increased incidence of all-cause mortality is due to head and neck cancers. In addition to personal exposure to alcohol, parental or even grandparental behaviors may influence the methylation of genes which can influence the expression of genes involved in tumor promotion (oncogenes) or suppression. The authors hypothesized that cross-generational effects of alcohol exposure could alter DNA methylation and expression of the HRAS oncogene and TP53 tumor suppressor gene that drive cancer development. The authors found that parental behaviors before conception appear to have cross-generational effects on the methylation of genes involved in the development of a variety of cancers. The present study found significant decreases in methylation of CpG sites within the HRAS oncogene along with significant increases in methylation of CpG sites within the TP53 tumor suppressor gene in the offspring of parents with alcohol dependence. Public health awareness of the influence that parental preconception behaviors have on offspring needs to be added to those targeting prenatal behaviors of the mother.
Ketamine inhibits pentameric ligand-gated ion channels (pLGICs), including the bacterial pLGIC from Gloeobacter violaceus (GLIC). The crystal structure of GLIC shows R-ketamine bound to an extracellular intersubunit cavity. Here, we performed molecular dynamics simulations of GLIC in the absence and presence of R- or S-ketamine. No stable binding of S-ketamine in the original cavity was observed in the simulations, largely due to its unfavorable access to residue D154, which provides important electrostatic interactions to stabilize R-ketamine binding. Contrary to the symmetric binding shown in the crystal structure, R-ketamine moved away from some of the binding sites and was bound to GLIC asymmetrically at the end of simulations. The asymmetric binding is consistent with the experimentally measured negative cooperativity of ketamine binding to GLIC. In the presence of R-ketamine, all subunits showed changes in structure and dynamics, irrespective of binding stability; the extracellular intersubunit cavity expanded and intersubunit electrostatic interactions involved in channel activation were altered. R-ketamine binding promoted a conformational shift toward closed GLIC. Conformational changes near the ketamine-binding site were propagated to the interface between the extracellular and transmembrane domains, and further to the pore-lining TM2 through two pathways: pre-TM1 and the β1-β2 loop. Both signaling pathways have been predicted previously using the perturbation-based Markovian transmission model. The study provides a structural and dynamics basis for the inhibitory modulation of ketamine on pLGICs.


Although a direct link has long been suspected between systemic immune responses and neuronal injuries after stroke, it is unclear which immune cells play an important role. A question remains as to whether the blood brain barrier (BBB) is transiently disrupted after circulatory arrest to allow peripheral immune cells to enter brain parenchyma. Here, the authors developed a clinically relevant cardiac arrest and resuscitation model in mice to investigate the BBB integrity using noninvasive magnetic resonance imaging. Changes in immune signals in the brain and periphery were assayed by immunohistochemistry and flow cytometry. Quantitative variance maps from T1-weighted difference images before and after blood-pool contrast clearance revealed BBB disruptions immediately after resuscitation and one day after reperfusion. Time profiles of hippocampal CA1 neuronal injuries correlated with the morphological changes of microglia activation. Cytotoxic T cells, CD11b+CD11c+ dendritic cells, and CD11b+CD45+hi monocytes and macrophages were significantly increased in the brain three days after cardiac arrest and resuscitation, suggesting direct infiltration of these cells following the BBB disruption. Importantly, these immune cell changes were coupled with a parallel increase in the same subset of immune cell populations in the bone marrow and blood. We conclude that neurovascular breakdown during the initial reperfusion phase contributes to the systemic immune cell invasion and subsequent neuropathogenesis affecting the long-term outcome after cardiac arrest and resuscitation.


Multiple sclerosis (MS) is an autoimmune-inflammatory neurodegenerative disease often accompanied by debilitating neuropathic pain. Disease-modifying agents slow down the progression of MS and prevent relapses, yet it remains unclear if they yield analgesia. The authors explored the analgesic potential of fingolimod (FTY720), an agonist and/or functional antagonist at the sphingosine-1-phosphate receptor 1 (S1PR1), because it reduces hyperalgesia in models of peripheral inflammatory and neuropathic pain. They used a myelin oligodendrocyte...
glycoprotein 35 to 55 (MOG35-55) mouse model of experimental autoimmune encephalomyelitis, modified to avoid frank paralysis, and thus, allow for assessment of withdrawal behaviors to somatosensory stimuli. Daily intraperitoneal fingolimod reduced behavioral signs of central neuropathic pain (mechanical and cold hypersensitivity) in a dose-dependent and reversible manner. Both autoimmune encephalomyelitis and fingolimod changed hyperalgesia before modifying motor function, suggesting that pain-related effects and clinical neurological deficits were modulated independently. Fingolimod also reduced cellular markers of central sensitization of neurons in the dorsal horn of the spinal cord: glutamate-evoked Ca signaling and stimulus-evoked phospho-extracellular signal-related kinase ERK (pERK) expression, as well as upregulation of astrocytes (GFAP) and macrophage/microglia (Iba1) immunoreactivity. The antihyperalgesic effects of fingolimod were prevented or reversed by the S1PR1 antagonist W146 (1 mg/kg daily, i.p.) and could be mimicked by either repeated or single injection of the S1PR1-selective agonist SEW2871. Fingolimod did not change spinal membrane S1PR1 content, arguing against a functional antagonist mechanism. The investigators concluded that fingolimod behaves as an S1PR1 agonist to reduce pain in MS by reversing central sensitization of spinal nociceptive neurons.

The department continues to place a major focus on research training, fostering research activity among the next generation of anesthesiology investigators and physician scientists. The Director of Resident Research and the Junior Chief Resident for Research facilitate resident research and scholarly activities, and the department offers research opportunities to University of Pittsburgh medical students throughout the year, matching students with anesthesiology faculty for their scholarly projects. Our department was one of 36 in the nation selected to serve as a host site for the 2018 Foundation for Anesthesia Education and Research (FAER) Medical Student Anesthesia Research Fellowship program. Our department is one of only 16 anesthesiology departments in the nation that have NIH T32 training grants. One of our department’s T32 grants is funded by the National Institute for General Medical Sciences mainly for training physician scientists in anesthesiology and pain medicine and the other is funded by the National Institute of Neurological Disorders and Stroke to train pre- and postdoctoral basic scientists in pain mechanisms (see the “Research Fellowships” section for more information).
MAHAJAN LAB

Biomedical Science Tower, BSTW 1401

LAB MEMBERS

Aman Mahajan, MD, PhD, MBA, PI
AKimberly Howard-Quijano, MD, MS, Associate Professor
Siamak Salavatian, PhD, Research Assistant Professor
Fei Gao, Lab Manager
Yuki Kuwabara, MD, Post-doctoral Scholar

OVERVIEW

The Mahajan Lab’s primary research focus is spinal neural modulation of cardiac electrophysiology and the assessment of cardiac function in heart failure.

PROJECTS

The Role of the Spinal Cord in Regulating Myocardial Sympathoexcitation

The spinal cord serves as the main nexus point for neural regulation of cardiac sympathetics. Myocardial ischemia activates local afferent sympathetic nerve endings in the ischemic myocardium that synapse in the thoracic spinal cord with a complex neural circuit, resulting in reflex efferent. While nociceptive pathways have been studied, evidence suggests that the spinal neural network involved in cardiovascular sympathetic responses differ from those involved in nociception. However, the network interactions and organization of the specific neural circuits involved in myocardial ischemia are unknown. These network connections combined with descending projections from the higher centers ultimately control sympathetic preganglionic neuron output in the interomediolateral cell column. The goal of this project is to investigate the spinal cord network that regulates the myocardial sympathoexcitation.

Spinal Neuraxial Modulation Therapies in Ischemic Heart Disease

Treatment for patients with chronic myocardial infarction and heart failure, including beta-blockers and neuraxial modulation, achieve therapeutic success largely through sympatholytic pathways. The Mahajan Lab recently showed that neuromodulation therapies directed at the spinal cord, including thoracic epidural anesthesia and spinal cord stimulation, decrease cardiac sympathoexcitation and reduce ventricular arrhythmias during acute ischemia, thus providing novel avenues for therapeutic intervention in prevention of sudden cardiac death. Recently, dorsal root ganglion stimulation has been advocated as an effective approach to modulate the afferent neural inputs to the spinal cord, providing a more selective therapeutic approach. The aim of this project is to assess the efficacy of spinal neuroaxial neuromodulation therapies and investigate how neuromodulation therapies regulate cardiospinal neural circuits and control cardiac sympathoexcitation, specifically during acute myocardial stress in chronic ischemic heart disease.
**BASIC RESEARCH**

**PUBLICATIONS**


**CURRENT FUNDING**

NIH/NHLBI, 1R01HL136836, 7/1/2018-6/30/2022, Spinal Neuraxial Modulation of Ventricular Excitability - Mechanisms and Therapeutics

- Program Director/PI: Aman Mahajan MD, PhD
- Co-PIs: Kalyanam Shivkumar MD, PhD; Jeffrey L. Ardell, PhD
- Co-Is: Kimberly Howard-Quijano MD, MS; Bradley Taylor, PhD

NIH/NHLBI, 1K08HL135418, 7/1/2018-6/30/2023, Spinal Neuraxial Modulation of Ventricular Arrhythmias – Mechanisms and Treatment

- PI: Kimberly Howard-Quijano MD, MS
- Primary Mentor: Aman Mahajan MD, PhD, Co-Mentors: K Shivkumar MD, PhD Bradley Taylor, PhD
OVERVIEW

The Homanics Lab is interested in understanding the effects of alcohol on the body so that safe, effective treatments for alcohol use disorder can be developed.

PROJECTS

Epigenetic Effects of Alcohol
Epigenetic processes are molecular pathways that control gene expression. It has been long recognized that alcohol induces changes in gene expression in hundreds of genes in the brain and these neuroadaptations are thought to underlie the development of tolerance, dependence, and addiction to alcohol. We are currently investigating the effects of alcohol on epigenetic processes such as DNA methylation, histone modifications, and regulatory RNAs. We are especially interested in the possibility that alcohol-induced changes in epigenetic processes can be inherited across generations and impact alcohol drinking behavior in offspring derived from alcohol-abusing parents and grandparents.

Role of Long Noncoding RNA (IncRNA) in Alcohol Action
This project will test the hypothesis that individual IncRNAs are key regulators of alcohol drinking. We are currently in the midst of a revolution in our understanding of RNA function. Emerging results indicate that there is a plethora of RNAs produced that do not encode proteins, but instead serve important gene regulatory functions. A particularly interesting class of noncoding RNAs that are highly regulated by exposure to alcohol are IncRNAs. To define the contribution of IncRNAs to alcohol action, we are currently creating genetically engineered rodents that harbor mutations in IncRNA genes. Such animals will subsequently be studied for alterations in alcohol drinking and behavioral sensitivity to alcohol.

Exosome Research
This project investigates the hypothesis that exosomes can be harnessed as effective brain noncoding RNA/drug delivery vehicles to modulate alcohol drinking. Exosomes are nanometer-sized (~30-120 nm) liposome-like particles secreted by all cell types. Exosomes are thought to function as paracrine and exocrine communication systems via cell-to-cell transfer of exosome contents, including lipid, RNA, DNA, and protein. We are investigating the use of exosomes as delivery vehicles for noncoding RNA agonist/antagonists, for anti-inflammatory drugs, and for gene editing reagents. Exosomal cargo is being selectively delivered to the brain by intranasal instillation.

Production of Genetically Engineered Animals
This project uses state of the art molecular techniques to create precisely engineered animals that harbor gain of function or loss of function mutations in genes thought to be important for the behavioral effects of alcohol. This project
serves numerous investigators that are part of a large, multi-institutional international alcohol research consortium, the Integrative Neuroscience Initiative on Alcoholism-Neuroimmune. Animals are also being created to model neurological disorders such as Alzheimer’s Disease.

**PUBLICATIONS**


**CURRENT FUNDING**

- R37 AA14022-21 (Homanics): Ethanol Mechanisms in GABAA-R Gene Targeted Mice, 05/01/2015 – 04/30/2020, NIH/NIAAA
- U01 AA020889-06 (Homanics): Role of noncoding RNA in alcohol action, 02/20/2017 – 01/31/2022, NIH/NIAAA
OVERVIEW

Dr. Tang’s laboratory has focused on two related research areas. One is to determine the structures and dynamics of neurotransmitter-gated ion channels, which play a central role in neuron signaling and are targets of therapeutics. Another is to understand channel protein interactions with low-affinity drugs, particularly general anesthetics and alcohols. Various biophysical tools, including high-resolution nuclear magnetic resonance (NMR) spectroscopy and X-ray crystallography, as well as large-scale molecular dynamic simulations, have been utilized to tackle various biomedical and neuroscience questions.

PROJECTS

Structural basis of neurosteroid anesthetic action on GABAA receptors

Type A γ-aminobutyric acid receptors (GABAARs) are inhibitory pentameric ligand-gated ion channels in the brain. Many anesthetics and neurosteroids act through binding to the GABAAR transmembrane domain (TMD), but the structural basis of their actions is not well understood and no resting-state GABAAR structure has been determined. Here, we report crystal structures of apo and the neurosteroid anesthetic alphaxalone-bound desensitized chimeric α1GABAAR (ELIC-α1GABAAR). The chimera retains the functional and pharmacological properties of GABAARs, including potentiation, activation, and desensitization by alphaxalone. The apo-state structure reveals an unconventional activation gate at the intracellular end of the pore. The desensitized structure illustrates molecular determinants for alphaxalone binding to an inter-subunit TMD site. These structures suggest a plausible signaling pathway from alphaxalone binding at the bottom of the TMD to the channel gate in the pore-lining TM2 through the TM1–TM2 linker. The study provides a framework to discover new GABAAR modulators with therapeutic potential.

Recent progress on the molecular pharmacology of propofol

The precise mechanism by which propofol enhances GABAergic transmission remains unclear, but much progress has been made regarding the underlying structural and dynamic mechanisms. Furthermore, it is now clear that propofol has additional molecular targets, many of which are functionally influenced at concentrations achieved clinically. Focusing primarily on molecular targets, this brief review attempts to summarize some of this recent progress while pointing out knowledge gaps and controversies. It is not intended to be comprehensive, but rather to stimulate further thought, discussion, and study on the mechanisms by which propofol produces its pleiotropic effects.
PUBLICATIONS


CURRENT FUNDING

Principal Investigator, 1R01DA046939-01, NIH/NIDA, Alpha7 Nicotinic Receptor: Structures and Coupling with Intracellular Proteins, 07/15/18-04/30/23

Principal Investigator, R01GM056257-17, NIH/NIGMS, Anesthetic Sites in Transmembrane Peptides by NMR, 05/01/98–01/31/19

Principal Investigator, TG-MCB050030N, NSF XSEDE, Structural Studies and Drug Discovery on α7-Nicotinic Acetylcholine Receptors, 04/01/16–06/31/18

Co-Principal Investigator, MCB1613007, NSF, Paramagnetic Metal Ion Based ESR Distance Methods for Measuring Ion-Channel Conformation in Cells and in vitro, 08/01/16–07/31/20

Co-Investigator (Yan Xu, PI), R01GM49202-22, NIH/NIGMS, Developing Receptor Therapeutics to Treat Chronic Pain, 04/10/15-01/31/19

Co-Investigator (Yan Xu, PI), R01GM114851-04, NIH/NIGMS Injury Mechanisms and Systemic Immune Responses after Cerebral Global Ischemia, 09/01/14-07/31/18

Co-Investigator (Project III), P01 GM055876-18, NIH/NIGMS, Interaction of Inhalational Anesthetics with Macromolecules (PI: Eckenhoff), Project III: NMR Studies of Anesthetic Interaction with Ion Channels and Receptors (PI: Yan Xu), 08/01/13-07/31/18
OVERVIEW
Dr. Taylor’s laboratory investigates the mechanisms through which inflammation or injury produces changes in the peripheral nerves, spinal cord, and brain, leading to a transition from acute pain to chronic pain. They explore innovative ideas using state-of-the art techniques to better understand the molecular neurobiology of pain sensitization and opioid dependence, and thus contribute to new pharmacotherapeutic approaches to the development of safe and efficacious analgesic drugs.

PROJECTS
Discovery of Prolonged Endogenous Analgesia and Dependence
Dr. Taylor’s group discovered that tissue inflammation produces a latent sensitization (LS) that is masked by spinal mu opioid receptor (MOR) signaling for over a year, even after complete recovery from injury and re-establishment of normal pain thresholds. Disruption with MOR inverse agonists reinstates pain and precipitates cellular, somatic, and aversive signs of physical withdrawal; this phenomenon requires N-methyl-D-aspartate receptor-mediated activation of calcium-sensitive adenyl cyclase type 1 (AC1). This work generated a new conceptual model of the transition from acute to chronic pain, based on the delicate balance between LS and endogenous analgesia that develops after painful tissue injury (Taylor and Corder, 2014). First, injury activates pain pathways. Second, the spinal cord establishes MOR constitutive activity (MORCA) as it attempts to control pain. Third, over time, the body becomes dependent on MORCA, which paradoxically sensitizes pain pathways. Stress or injury escalates opposing inhibitory and excitatory influences on nociceptive processing as a pathological consequence of increased endogenous opioid receptor tone. Pain begets MORCA, which begets pain vulnerability in a vicious cycle. The result is a silent insidious state characterized by the escalation of two opposing excitatory and inhibitory influences on pain transmission: LS mediated by AC1 (which maintains the accelerator), and pain inhibition mediated by MORCA (which maintains the brake). This raises the prospect that opposing homeostatic interactions between MORCA analgesia and latent NMDAR–AC1-mediated pain sensitization create a lasting vulnerability to develop chronic pain. Thus, chronic pain syndromes may result from a failure in constitutive signaling of spinal MORs and a loss of endogenous analgesic control. Because of the close interplay between stress, chronic pain relapse, and addiction, Dr. Taylor is launching a new project to test the hypothesis that stress will reduce MORCA, thus unleashing a pain episode. With this work, Dr. Taylor’s lab plans to generate clinical trials to either: a) facilitate endogenous opioid receptor analgesia, thus restricting chronic pain within a state of remission; or b) extinguish chronic pain altogether.
Neuropeptidergic Inhibition of Spinal Pain Transmission

Dorsal horn microcircuitry. The Taylor lab’s initial work indicated that intrathecal administration of NPY acts in a dose- and receptor-dependent manner to reduce behavioral signs of inflammatory pain and peripheral neuropathic pain (Taiwo et al, 2002; Intondi et al, 2008). They then discovered that an injury-induced enhancement of endogenous NPY-Y1 receptor GPCR signaling could be maintained long enough to confine chronic inflammatory and neuropathic pain within a state of remission (Solway et al, PNAS, 2011). The objective of the current third period of grant renewal is to determine whether injury induces a sustained spinal release of NPY, leading to the inhibition of pronociceptive Y1R-expressing interneurons in the dorsal horn. To achieve this, they are implementing transformative neuroscience and biomedical research approaches – new innovative methods to measure neuropeptide release in vivo, a new approach to microinject AAV virus into mouse DRG, GCaMP6 imaging of neuronal activity both in the spinal cord slice and the whole animal, optogenetics coupled with patch clamp neurophysiology of adult Y1R-GFP, and other Y1R transgenic mice to study the microcircuitry of pain modulation in the dorsal horn.

PPAR gamma Inhibition of Spinal Pain Transmission

Painful diabetic neuropathic pain. This R01 project was just renewed for a second five-year period to study the peroxisome proliferator-activated receptor (PPAR) family of nuclear receptors as a novel class of analgesic compounds for chronic pain (Taiwo and Taylor, 2002). Three isoforms of PPAR have been identified: α, β/δ, and γ. Peripheral PPARγ is well-characterized as a key target of the thiazolidinedione (TZD) class of FDA-approved anti-diabetic drugs, which includes rosiglitazone and pioglitazone. The Taylor lab has extended its potential targets to the spinal cord with their discovery of PPARγ mRNA and protein in the dorsal horn (Churi et al, 2008). They found that PPARγ agonists rapidly reduce the hyperalgesia associated with inflammation or nerve injury in a dose- and PPARγ-dependent manner (Morgenweck et al, 2013) in part via a novel non-genomic translation-independent mechanism at spinal glia (Griggs et al, 2015). This work is important and timely because TZDs are FDA-approved for diabetes and are in clinical trials for CNS neurodegenerative diseases. Therefore, their findings could lead to the rapid translation of basic science to the clinical treatment of chronic pain. Their renewal R01 application extends their studies to painful diabetic neuropathy (PDN), using the Zucker Diabetic Fatty (ZDF) rat and Leprdb/db (db/db) mouse hereditary models of type 2 diabetes. In ZDF, Dr. Taylor’s group observed behavioral signs of motivational/affective pain (using a novel mechanical conflict-avoidance assay), and in both ZDF and db/db, they found elevated plasma methylglyoxal, a cellular metabolite of glucose that is markedly increased in the blood of hyperglycemic patients and contributes to PDN. To determine MG mechanism of action, they established a mouse model of MG-induced pain that includes multiple behavioral signs of spontaneous, evoked, and affective pain (using a conditioned place aversion assay), as well as molecular signs of spinal neuronal activation. They are testing the central hypothesis that elevated MG in type 2 diabetes causes PDN and that this metabolic hyperalgesia can be alleviated by drugs targeting MG (Aim 1), TRPA1 (Aim 2), AC1 and Epac (Aim 3), and/or PPARγ (Aim 4), thus advancing a new pharmacotherapeutic strategy for painful diabetic neuropathy.

TLQP-21 and C3aR1, a Novel Receptor/Ligand Interaction in Neuropathic Pain

Neuroimmune crosstalk. The central hypothesis of this proposal is that TLQP-21 activation of C3aR1 in the dorsal horn of the spinal cord establishes and maintains neuropathic pain. The complement 3a receptor (C3aR1) participates in microglial signaling under pathological conditions and was recently shown to be activated by the neuropeptide TLQP-21. Lucy Vulchanova previously demonstrated that TLQP-21 elicits hyperalgesia and contributes to nerve injury-induced hypersensitivity through an unknown mechanism in the spinal cord. In collaboration with her group and with Dr. Suzanne Doolen, Dr. Taylor’s lab used Ca2+ imaging in spinal slices with a new innovative method to selectively record the activity of microglial neurons, and determined that the cellular target for TLQP-21 is the C3aR1 on microglia. Their results suggest a novel neuroimmune signaling pathway involving TLQP-21-induced activation of microglial C3aR1 that then contributes to spinal neuropaesthetic and neuropathic pain. This unique dual-ligand activation of C3aR1 by a neuropeptide (TLQP-21) and an immune mediator (C3a) appears to represent a potential broad-spectrum mechanism throughout the CNS for integration of neuroimmune crosstalk at the molecular level. Suzanne Doolen is leading an effort to scale up funding of this project with an R01 submission in FY19 that will focus on microglial function during neuropathic pain using a novel GCaMP6 imaging approach.

Glutamate Receptor Modulation of Calcium Signaling in Neuropathic Pain

Glutamate receptors. During her K01 career development award, Dr. Suzanne Doolen found that inflammation produces an increase in dorsal horn calcium permeable (CP)-AMPA expression and function, a shift that persists at least 21 days
after injury. This suggests that CP-AMPARs drive the induction and/or maintenance of LS (described above). N-Methyl-D-aspartate receptors (NMDAR) are pivotal for synaptic plasticity. Conventional NMDARs consist of heterotetrameric structures composed of GluN1 and GluN2 subunits. In contrast, a third subunit, GluN3, assembles with NMDAR subunits to form a “nonconventional” NMDAR. While NMDAR-activity is required for acute increases in complete Freund’s adjuvant (CFA)-induced CP-AMPAR activity and behavioral hypersensitivity, little is known regarding GluN3-mediated regulation of AMPAR plasticity in chronic pain settings. Using novel GluN3 antagonists from their collaborators Dr. Steven Traynelis and Kasper Hansen, the group’s current project explores these mechanisms in detail, namely, to test the hypothesis that inflammation increases CP-AMPARs in pronociceptive dorsal horn neurons that then initiates the development of LS (and thus chronic pain) by a GluN3-dependent mechanism.

Antinociceptive Mechanisms of Spinal Manipulative Therapy for Neuropathic Pain

Alternative medicine. This new R15 investigates the mechanism of analgesic action of spinal manipulative therapy (SMT), a non-pharmacologic, complementary and integrative health mind and body intervention that is widely used to treat chronic pain. Dr. Onifer’s group has developed an innovative rat model of a frequently used non-thrust SMT technique, low velocity variable amplitude spinal manipulation (LVVA-SM) using a custom-made motorized device. Their preliminary data in a well-characterized rat model of chronic peripheral neuropathic pain (spared nerve injury) indicate that LVVA-SM decreases behavioral signs of chronic pain (hindpaw mechanical allodynia). This application determines whether LVVA-SM-induced anti-allodynia is mediated by endogenous activation of cannabinoid receptors in the spinal cord dorsal horn.

Endogenous Opioid Dependence. While it is accepted that dependence develops with repeated exposure to opiate drugs, the group’s paper in Science (Corder et al.) was the first to provide strong evidence for endogenous opioid dependence. They found that injury initiated not only MORCA analgesia, but also a compensatory process of dependence to opioid receptor signaling, both of which could be revealed upon challenge with opiate receptor inverse agonists. Thus, µ-opioid receptor blockade during the post-hyperalgesia state precipitated hallmarks of both cellular withdrawal (cAMP overshoot) in spinal cord neurons and physical withdrawal (jumping, paw tremor, teeth chattering, wet dog shakes, hyperalgesia) arising from the brain. They believe that this opponent process between opioid analgesia and dependence represents an allostatic state of chronic pain vulnerability in the brain.

Central neuropathic pain of multiple sclerosis. Approximately two-thirds of patients with multiple sclerosis (MS) experience neuropathic pain. Despite this, the pain of MS is understudied and not well treated. The FDA recently approved fingolimod as a disease-modifying therapy (DMT) to prevent MS relapses. Fingolimod modulates the function of the sphingosine-1-phosphate receptor-1 (S1PR1), a GPCR. To determine whether S1PR1 ligands such as fingolimod ameliorate the pain of MS, the group is using an optimized experimental autoimmune encephalomyelitis (EAE) mouse model of MS. They predict that intrathecal administration of S1PR1 agonists will target pathological processes in spinal glia to alleviate the central neuropathic pain of MS.

Central neuropathic pain in Women with Spinal Cord Injury. Central neuropathic pain develops in greater than 75% of both males and females suffering a spinal cord injury (SCI), and is particularly debilitating in veterans. Unfortunately, chronic neuropathic SCI pain severely impacts the quality of life of both individuals with SCI and their caregivers, and is extremely difficult to manage. Analgesic drugs such as pregabalin are only partially effective in a small subset of patients. Our incomplete understanding of underlying mechanisms stalls the development of druggable targets for SCI pain. An important clue comes from the mounting evidence that intraspinal inflammation, specifically microglial activation, contributes to neuropathic pain following peripheral nerve injury, and this is sexually dimorphic. These studies suggest that sex differences may have masked the effectiveness of pharmacotherapeutics for neuropathic pain in earlier clinical trials. To address this question, in collaboration with multiple investigators within the Spinal Cord and Brain Injury Research Center at the University of Kentucky, the research group is using behavioral pharmacology and flow cytometry to examine the contribution of sex, spinal microglia, and peripheral inflammation to the development of SCI-induced pain, and investigating pioglitazone and rosiglitazone or other PPARα agonists as new analgesics for women with SCI. Their new preliminary data suggest that PIO reduces pain in female mice at doses that are 100-1,000-fold less than required to reduce pain in male mice. Since sexually dimorphic pain responses are being recognized across a variety of neuropathologies, development of effective immunomodulatory agents through the completion of their studies could have a broad impact on the fields of neuroscience and immunology.
Cooper AH, Brightwell JJ†, Hedden NS, Taylor BK. The left central nucleus of the amygdala contributes to mechanical allodynia and hyperalgesia following right-sided peripheral nerve injury. Neuroscience Letters, Aug 13 (2018).


CURRENT FUNDING

PI, NIH/NIDA RO1 DA037621-01A1, 08/15/15-05/31/20: “Long-term activation of spinal opioid analgesia after inflammation”

PI, NIH/NINDS 2 R01 NS45954-11, 09/10/02-11/30/21: “Neuropeptidergic Inhibition of Spinal Pain Transmission”

PI, NIH/NINDS 2 R01 NS062306-07, 12/18/08-3/31/22: “PPAR gamma Inhibition of Spinal Pain Transmission”

Co-I (subcontract), NIH/NIDA R01 NS088518-01, 07/01/14-06/30/19: “TLPQ-21 and C3aR1, a Novel Receptor/Ligand Interaction in Neuropathic Pain”

Sponsor, NIH/NIDA KO1 DA31961-01A1, 02/01/14-01/31/19: “Glutamate Receptor Modulation of Calcium Signaling in Neuropathic Pain”

Co-PI, National Center for Complementary and Integrative Health R15AT009612-01, 07/01/17-06/30/20: “Antinociceptive Mechanisms of Spinal Manipulative Therapy for Neuropathic Pain”
DEPARTMENT OF ANESTHESIOLOGY AND PERIOPERATIVE MEDICINE

OVERVIEW
My research objective is to understand the mechanisms that initiate and maintain chronic pain with the goal of developing therapeutic drug targets that outperform those currently available. I have developed a system for live cell Ca2+-imaging simultaneously from a multitude of cells in adult spinal cord slices. In my initial studies using this technique, I was able to show that glutamate-evoked Ca2+ signals are largely mediated by AMPA receptors (AMPAR) and are potentiated after neuropathic injury. I am currently extending these techniques to allow for genetically-encoded Ca2+-imaging in neuronal and non-neuronal cells that contribute to pain neurotransmission.

PROJECTS

AMPAR Plasticity That Contributes to Chronic Pain
We have made a striking observation that inflammation produces an increase in dorsal horn synaptic calcium permeable (CP)-AMPAR expression and function, a shift that persists at least 21 days after injury. This suggests that CP-AMPARs drive the induction and/or maintenance of long-lasting central sensitization that may result in susceptibility to the development of chronic pain. These findings along with studies from the ventral tegmental area that demonstrate a shift from conventional to non-conventional (GluN3-containing) NMDAR expression after cocaine injection that is necessary for the expression of cocaine-evoked AMPAR plasticity provide the premise for this research focus: to test the hypothesis that inflammation increases CP-AMPARs in pronociceptive dorsal horn neurons during long-lasting central sensitization (and thus chronic pain) by a GluN3-dependent mechanism.

Microglial Signaling in Neuropathic Pain
We recently published a study that demonstrates that the complement 3a receptor (C3aR1) is specifically expressed on spinal microglia and its expression increases after nerve injury. We demonstrated that selective activation of C3aR1 on spinal microglia (using the neuropeptide TLQP-21) produced hyperalgesia and increased microglial [Ca2+]i. Our findings suggest that TLQP-21 and the endogenous immune mediator C3a lead to activation of microglial C3aR1s. We propose a novel neuroimmune signaling pathway involving TLQP-21-induced activation of microglial C3aR1 that then contributes to spinal neuroplasticity and neuropathic pain. However, the intracellular signaling mechanisms downstream of C3aR1 activation that lead to neuropathic pain are unknown. Our findings along with studies from peripheral immune cells that demonstrate C3aR-mediated cytokine production provide the premise for an upcoming NIH R01 research grant proposal focused on microglial function during neuropathic pain.

PUBLICATIONS


CURRENT FUNDING

PI, NIH/NIDA K01 DA0319610, 04/01/14-03/31/19: “Glutamate receptor modulation of calcium signaling in neuropathic pain.”
XU LAB
Biomedical Science Tower 3, Room 2054

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OVERVIEW

The research in Dr. Xu’s laboratory focuses on (1) receptor engineering as a new class of drugs for the treatment of chronic pain, (2) development of new non-opioid analgesics for the treatment of acute and chronic pain, (3) rational design of new therapeutic strategies to treat neuronal injuries during and after global cerebral ischemia, and (4) the molecular and cellular mechanisms underlying the actions of low-affinity neurological drugs such as general anesthetics and alcohols. In the first project, recent activities have been directed towards developing targeted delivery of engineered ion channels to nociceptors to treat chronic pain. In the second project, new drugs that work through the glycinergic receptor pathway are being developed and optimized for potential clinical translation. In the third project, systemic immune modulation and its coupling with the central nervous system (CNS) are investigated to develop new therapies for reperfusion injuries. The fourth project involves the 3-D structure and dynamics measurements of ion channel receptors. Dr. Xu is also interested in the biological basis of consciousness (approaching from unconsciousness to consciousness).

PROJECTS

RELIEPH for Interstitial Cystitis
About 7.9 million women and 4.6 million men in the US suffer from interstitial cystitis/bladder pain syndrome (IC/BPS). For many patients, the currently available treatments are inadequate and prone to adverse side effects, including potential dependence and abuse of prescription painkillers. An innovative nonpharmacological approach is being developed in Dr. Xu’s lab to treat the debilitating condition of IC/BPS using a newly developed chemical genetics technology called RELIEPH (Receptor Engineering to Lessen Inflammation-Evoked Pain and Hyperactivity). The technology, which is based on the same principles as optogenetics and DREADD, will install engineered chloride (Cl−) channels into urothelial cells and peripheral nociceptors to control bladder hyperactivity and to alleviate pain in IC/BPS. The central hypothesis is that
the expression of non-native Cl– channels in the neuron-like urothelial cells and in peripheral nerves can dynamically re-set the hypersensitization of the peripheral afferents without affecting the process of normal nociception. Two different types of “chemical genetic” designs are being tested in a rat model of IC/BPS. The first type acts passively by sensing inflammatory conditions such as acidosis in urothelial cells and peri-nerve tissues. Since the etiology of IC/BPS is still unknown and inflammation is not always present, the second type is designed to selectively respond to small natural chemicals (including metabolites of certain foods) that would otherwise have little or no analgesic action without the engineered Cl– channels. Promising data have demonstrated the efficacy of these engineered channels in treating inflammatory pain and in restoring three outcome measures (intercontraction intervals, peak micturition pressure, and micturition pressure threshold) in a rat model of IC/BPS. The innovative idea and bold approaches will lead to the development of fundamentally new IC/BPS therapy that will greatly and effectively improve chronic pain management and reduce the risk of prescription drug abuse.

Developing Receptor Therapeutics to Treat Chronic Pain

Pain is a complex sensation with physical and emotional components. Current approaches to treat physical pain focus on screening, optimizing, or developing drug molecules that work on existing targets in the body. The inherent limitations of these conventional approaches are twofold: First, drugs are developed around and are limited to receptors in the CNS with multiple functions. Second, most drugs are active in the brain and thus have psychoactive potential. Dr. Xu's group is developing a new strategy to provide the peripheral nerves with designed analgesic targets. More specifically, the investigators use non-native ion channels as a form of medication. By creating “drug-able” modulations of peripheral nociceptors, they hope to treat the root of nociceptive and inflammatory pain by titrating the excitability of afferent neurons, thereby elevating the pain threshold proportional to the extent of the pain-evoking pathological conditions. Dr. Xu's lab is engineering non-immunogenic surveillance Cl– channel receptors, specifically homing for peripheral terminals of the C- and Aδ-fibers and their cell bodies in the dorsal root ganglia. These channels are designed to be silent (non-conducting) under normal physiological conditions and thus will not interfere with normal nociception. The designed channels will either spontaneously respond to inflammation-induced changes in the peripheral tissue environment (such as tissue acidosis due to inflammation) or can be activated by small activating molecules that would otherwise have negligible or no analgesic effects.

Injury Mechanisms and Systemic Immune Responses after Global Cerebral Ischemia

Cardiovascular diseases, which frequently result in cardiac arrest, remain the leading cause of death in the USA. Most patients who are successfully resuscitated after cardiac arrest die in the hospital due to delayed brain injuries. A new therapeutic concept is being developed to manipulate protective immune responses, thereby improving the long-term neurological outcomes by preventing and reversing delayed brain injuries.

This is a collaborative project that brings together two investigative teams at the University of Pittsburgh and Texas Tech University, with many years of combined research experience in (1) the treatment of reperfusion injuries after global cerebral ischemia due to cardiac arrest and resuscitation, (2) mechanisms of neuronal injury and protection through systemic immune responses, and (3) systemic drug delivery to the CNS. The investigators use partially and completely immune-deficient mice to carefully dissect the systemic immune components that can be programmed as post-treatment strategies. They designed a way to condition bone-marrow-derived macrophagic and dendritic cells for immune reconstitution and developed CNS-targeting nanoparticles to knock down pro-inflammatory cytokine signaling using RNA interference technologies. These studies will pave the way towards ultimately identifying the most effective strategies to treat global ischemia after cardiac arrest and to bring the new discoveries from the bench top to the bedside.

Molecular and Cellular Mechanisms Underlying the Actions of Low-Affinity Neurological Drugs

This project focuses on in-depth investigations of the molecular nature of general anesthetic interaction with neuronal membrane constituents. Recent research efforts have combined the use of modern molecular biology techniques with various biophysical approaches, notably state-of-the-art, high-resolution, solution- and solid-state nuclear magnetic resonance (NMR), to elucidate the effects of general anesthetics on the structures and dynamics of the transmembrane segments of the human glycine receptors. The project aims to identify the structure-function and dynamics-function relationships with direct binding and dynamics analyses at the sub-molecular and atomic levels.
Biological Basis of Consciousness

Neurons communicate with each other dynamically, but how such communications lead to consciousness remains unclear. Dr. Xu’s group has developed a theoretical model to understand the dynamic nature of sensory activity and information integration in a hierarchical network. Their mathematical model offers mechanistic insights into the emergence of information integration from a stochastic process and suggests that patients losing consciousness under the influence of anesthesia might be the result of reduced information accessibility in the neural network, which hampers the flow of sensory information. Those findings shed new light on precisely how changes in brain activity can lead to the loss and re-emergence of consciousness.

PUBLICATIONS


CURRENT FUNDING

Principal Investigator, R01DK117383-01, NIH/NIDDK, RELIEPH for Interstitial Cystitis, 07/01/18-03/31/23

Principal Investigator, 1R01GM49202-22, NIH/NIGMS, Developing Receptor Therapeutics to Treat Chronic Pain, 04/10/15-01/31/19

Principal Investigator, R01GM114851-04, NIH/NIGMS, Injury Mechanisms and Systemic Immune Responses after Cerebral Global Ischemia, 09/01/14-07/31/19

Program Director, 2T32 GM075770-12, NIH/NIGMS, Research Training in Anesthesiology and Pain Medicine, 07/01/07-06/30/22

Principal Investigator (Project III), P01 GM055876-17, NIH/NIGMS, Interaction of Inhalational Anesthetics with Macromolecules (PI: Eckenhoff), Project III: NMR Studies of Anesthetic Interaction with Ion Channels and Receptors (PI: Yan Xu), 08/01/13-07/31/18

Co-Investigator (Pei Tang, PI), R01GM056257-16, NIH/NIGMS, Anesthetic Sites in Transmembrane Peptides by NMR, 05/01/98-01-31/19
As a National Institutes of Health (NIH) RO1 principal investigator, Dr. Zhang continues to complete work on his research project “WISP1 and TLR4 Signaling in Ventilator-induced Lung Injury” with his two collaborators, Drs. Tim Billiar, Chair of the Department of Surgery and Bruce Pitt, immediate past Chair of the Department of Environmental and Occupational Health at the University of Pittsburgh.

In addition, as an editorial board member of some professional anesthesiology journals and an NIH Special Emphasis Panel review member, Dr. Zhang actively participated in the manuscript and grant reviewing process. As a re-certified anesthesiologist and WISER Simulation Center instructor, he accomplishes his assigned clinical duties under national guidelines and most up-to-date evidence-based practice. He also teaches simulation courses for medical students and residents. Dr. Zhang was invited as a keynote speaker at national anesthesiology and simulation conferences in China over the past several years to greatly increase the visibility and impact of UPMC/UPSOM in China.

**PROJECTS**

**WISP1 and TLR4 Signaling in Ventilator-induced Lung Injury**

The Zhang group’s previous unbiased genome-wide association studies in a genetically diverse panel of 23 mouse strains identified WNT1-inducible signaling pathway protein 1 (WISP1) as playing an important role in a murine ventilator-induced lung injury (VILI model). In addition, they identified that innate immune signaling via Toll-like receptor 4 (TLR4) plays a critical role in the pathogenesis of VILI and that stretch-induced WISP1 expression and its pro-inflammatory effect were TLR4-dependent.

Sepsis is a common predisposing factor for acute respiratory distress syndrome, and many patients with this condition require mechanical ventilation. Although both sepsis and mechanical ventilation signal via TLR4 as Dr. Zhang’s research group and others have previously shown, the molecular determinants underlying the activation of TLR4 signaling in the latter condition with different tidal volumes are unknown.

Dr. Zhang’s research group proposes to further investigate the role of WISP1, αvβ3 and β5 integrin, IL-33, and TLR4 signaling in their newly-developed and highly relevant preclinical model of (polymicrobial) sepsis and mechanical ventilation (two-hit model: MV+CLP-sepsis) in intact mice. They (Li et al., Am J Resp Cell Mol Biol 47: 528-535, 2012; Chen et al., Scientific Reports 6:28841,2016) and their colleagues (Ding et al., Shock 43: 352-360, 2015) noted that the matricellular protein WISP1 contributes to TLR4-mediated sterile and infectious acute lung injury (ALI). The role of integrins in mediating the WISP1 effect was apparent in the arginylglycylaspartic acid (RGD)-sensitive nature of cecal ligation and puncture (CLP)-induced ALI and a component that could be ascribed to WISP1-integrin β6 interaction via neutralizing antibodies. Although sepsis is the primary cause of respiratory failure, requiring the supportive measures of mechanical ventilation, and mechanical ventilation itself may cause iatrogenic ALI, few reports have combined these stimuli in a calibrated double hit ALI model. Accordingly, they explored the role of WISP1 and integrin β5 and IL-33 in the
underlying mechanisms of ALI during mechanical ventilation in a murine model (CLP) of polymicrobial sepsis.

Their results suggest that WISP1-αvβ3 integrin signaling is a critical immune modulator in TLR4 pathways in macrophages and may be an important contributor to TLR4/CD14-mediated inflammation in polymicrobial sepsis-induced lung injury. Their results also showed that mechanical ventilation with normal tidal volume increased both WISP1 production and integrin β5 expression two-fold in intact lung after CLP and signaled through TLR4-MyD88 to aggravate sepsis-induced lung injury, while mechanical ventilation with low tidal volume produced a protective effect on lung injury induced by CLP/sepsis.

Their recent results (Ding X, et al. Shock. 2018 Sep 5. doi: 10.1097; Ding X, et al. Critical Care 2018 DOI 10.1186/s13054-0182237-0) showed that the IL-33-ST2 pathway plays a dominant role in lung injury observed when moderate tidal volume (MTV, 10ml/kg) is used within the first six hours following the onset of sepsis. The strong induction of IL-33 by MTV and conversely, the suppression of IL-33 by low tidal volume (LTV 6ml/kg), further confirm that IL-33 expression and signaling is very much dependent on the degree of mechanical stretch. Their results support the use of protective ventilation strategies when mechanical ventilation is required for the management of intra-abdominal sepsis.

In addition, their recent study (Xia, et al Int J Mol Med. 2018, in press) explored the potential role of non-canonical Wnt signaling in the pathogenesis of VILI and found that six hours of mechanical ventilation induced lung injury in a volume-dependent fashion (LTV: 6 ml/kg or MTV: 12 ml/kg) in a previously reported sensitive strain (A/J) of mice. MTV ventilation increased the protein levels of WISP1, phospho glycogensynthase kinase, β-catenin, phosphorylated Ras homolog gene family, member A, and phosphorylated C-Jun N-terminal kinase (p-JNK). Inhibition of rho-associated, coiled-coil-containing protein kinase 1 by Y27632 and JNK by SP600125 attenuated MTV-induced lung injury and decreased the protein levels of components in the non-canonical Wnt signaling pathways, including WISP1.

**Significant Results**

They confirmed that TLR4 and CD14 are critical in transducing CLP-mediated ALI (including the elevation of intrapulmonary WISP1) and demonstrated that intrapulmonary αvβ3 is increased by polymicrobial sepsis in a TLR4, CD14-dependent fashion. Comparison of cultured macrophages revealed that: a) WISP1 by itself increased the release of tumor necrosis factor alpha (TNF-α) from RAW264.7 cells (with baseline expression of αvβ3) in an RGD-sensitive fashion; but b) primary cultures of peritoneal macrophages (PMø) required activation of TLRs to induce de novo synthesis of αvβ3, enabling WISP1 to stimulate release of TNF. The specific requirement for β3 integrin was apparent when the effect of WISP1 was lost in PMø isolated from β3-/- mice. WISP1 enhanced TLR4-mediated extracellular-signal-regulated kinase (ERK) signaling; U0126 (an ERK inhibitor) blocked lipopolysaccharide (LPS)-induced β3 integrin expression; and WISP1 enhanced TNF-α release.

They also showed that LPS induced upregulation of integrin β5 through the TLR4-MyD88 signaling pathway. They further demonstrated that mechanical ventilation with normal tidal volume significantly aggravated mild sepsis-induced lung injury and inflammation responses, whereas in TLR4-null mice, intratracheal administration of WISP1 antibody or integrin β5 antibody significantly attenuated lung injury. These findings were recapitulated in mouse PMø in vitro after LPS and WISP1 recombinant protein in a sequential stimulation. The enhanced integrin β5 expression in murine PMø augmented the production of cytokines and chemokines, which was accompanied in the amplified polymorphonuclear leukocyte migration into the lung. However, these enhanced inflammatory responses vanished in PMø obtained from TLR4-null
mice, and furthermore, inhibition of integrin β5 expression by applying the integrin β5 siRNA decreased the inflammatory response.

In addition, they showed that mild lung injury secondary to sepsis (CLP; 12 h) can sensitize intact mouse lung to subsequent moderate tidal volume (10 ml/kg) ventilation injury (manifested as increased alveolar capillary permeability, lung injury, neutrophil sequestration, and synthesis and release of cytokines and chemokines) for prolonged periods of ventilation (6 h). This two-hit model is TLR4-sensitive and shows important pro-injury and inflammatory contributions from both WISP1 and integrin β5. In isolated PMø, we further defined the nature of WISP1 signaling and identified a requisite TLR4-dependent activation of αVβ5 and MyD88-NF-kB pathway inflammatory mediator biosynthesis.

Their study further confirms that mechanical ventilation induces lung injury paralleled with increasing WISP1 expression. Non-canonical Wnt signaling involved in mechanical VILI and the suppression of the non-canonical Wnt signaling pathway significantly alleviated VILI. WISP1 expression is regulated by the non-canonical Wnt signaling pathway in A/J mice. The modulation of both WISP1 and Wnt signaling may provide novel therapeutic strategies for VILI.

Key Outcomes
• CLP, WISP1-αvβ3 integrin, and TLR4 signaling: Collectively these data suggest that WISP1-αvβ3 integrin signaling is a critical immune modulator in TLR4 pathways in macrophages and may be an important contributor to TLR4/CD14-mediated inflammation in polymicrobial sepsis-induced lung injury.
• CLP, mechanical ventilation, WISP1-αvβ5 integrin, IL-33, and TLR4: These results indicate that mechanical ventilation with MTV (10ml/kg) increased both WISP1 and IL-33 production and integrin β5 expression two-fold in intact lung after CLP and signaled through TLR4-MyD88 to aggravate sepsis-induced lung injury, while mechanical ventilation with LTV (6 ml/kg) suppressed WISP1 and IL-33 production to attenuate sepsis-induced lung injury.
• Non-canonical Wnt signaling participates in VILI by modulating WISP1 expression that we previously noted was critical for development of VILI. The non-canonical Wnt signaling pathway could provide a preventive and therapeutic target for VILI.

PUBLICATIONS


CURRENT FUNDING

PI, R01GM108639-01A1 GRANT11514656, NIH Research Project Grant, National Institute for General Medical Sciences, WISP1 and TLR4 Signaling in Ventilator-induced Lung Injury (VILI), 08/01/2014 – 07/31/2019
PHILLIP S. ADAMS, DO, Assistant Professor

OVERVIEW
My research interests involve developmental, hemodynamic, and postoperative outcome aspects of congenital heart disease (CHD) and CHD surgery. I am looking at how non-invasive nasal nitric oxide (nNO) assessment relates to cardiac function and CHD outcomes. In addition, I am also investigating whether nNO measurements may be able to predict adverse respiratory events in children having surgery who have had a recent respiratory illness. I am also interested in post-cardiopulmonary bypass (CPB) acute kidney injury (AKI) and using near infrared spectroscopy (NIRS) assessment as a means of early detection. I have also been involved in residency training and I am investigating how a mindfulness curriculum affects trainee perception of burnout and stress.

PROJECTS
Nitric Oxide Bioavailability in Complex Congenital Heart Disease
We are implementing nNO measurements in children with CHD. We have observed that single ventricle type CHD and in particular, those with systemic right ventricles, are at risk for having low nNO. In addition, those with low nNO have two times the risk of experiencing the composite end point of either heart transplant or death. Our research group has just submitted a DOD Investigator-initiated Research Award grant to help fund our project of comprehensively examining the nitric oxide pathway in CHD patients.

Nasal Nitric Oxide for Predicting Perioperative Respiratory Adverse Events
The Society for Pediatric Anesthesia has awarded me a $50,000 grant to investigate the relationship nNO levels and perioperative respiratory events in children who have had recent respiratory infections. Nasal NO levels are known to increase when the airways are inflamed. Airway hypersensitivity can last for several weeks even after “cold” symptoms have subsided, yet these patients remain at risk for adverse airway events. The goal is to determine if higher nNO levels correlate with increased perioperative airway events.

Near-Infrared Spectroscopy and Biomarkers for Detection of Acute Kidney Injury After Congenital Heart Surgery
This study utilized NIRS to measure renal oxygenation during congenital cardiac surgery. We coupled these measurements with novel urinary biomarkers to identify relationships with postoperative AKI as diagnosed by traditional creatinine and urine output measures. Interestingly, the relationship between NIRS and the biomarkers was stronger than that between the traditional creatinine markers, which are known to be less sensitive in newborns. Our manuscript describing these findings has been accepted in Pediatric Critical Care Medicine.

Mindfulness in Anesthesiology Resident Training
This project involves providing a course on mindfulness and positive behavior strategies for junior anesthesiology trainees and aims to show that it improves burnout, stress, and depression scores. We have observed that regardless of course participation, those who felt they were able to implement wellness principles showed lower levels of burnout. We have also identified that residents demonstrate lower levels of well-being than faculty, but that each have different areas in which they scored the lowest, suggesting different stressors are at play at different levels of one’s career.

PUBLICATIONS

CURRENT FUNDING
• PI, UPMC Department of Anesthesiology and Perioperative Medicine Educational Seed Grant, Mindfulness in Anesthesiology Resident Training, 9/2016-8/2017
• PI, UPMC Department of Anesthesiology and Perioperative Medicine Educational Seed Grant, Predicting Acute Kidney Injury in Infants After Cardiopulmonary Bypass Surgery: Near-infrared Spectroscopy (NIRS) and Biomarkers Can Make an Early Diagnosis, 8/2016-11/2017
• PI, Society for Pediatric Anesthesia Young Investigator Grant, Nasal Nitric Oxide For Predicting Perioperative Respiratory Adverse Events (PRAE), 1/1/18-12/31/18
PATRICIA L. DALBY, MD, Associate Professor

PROJECTS

Patient and Family Satisfaction with “Condition O” Emergency Care Questionnaire Development

Completed University of Pittsburgh School of Medicine Scholarly Project for Hanzi Lena Zhan and Brian Slater with faculty mentor: Patricia L. Dalby, MD

“Condition O” is a single operator-dispensed batch emergency call system to activate responders for urgent situations. It was implemented for emergent fetal and/or maternal conditions in 2005 at UPMC Magee-Womens Hospital (MWH). The program was started to overcome interdisciplinary communication barriers and emulate the success of similar medical emergency teams (METs), which are single-call systems that have been successfully used for general medical, surgical, and pediatric patients. One aim was to encourage staff to obtain extra help efficiently. We also aimed to design the system so that any staff member can call it. It is designed to help treat acute situations in which immediate action/evaluation is needed to avoid fetal and/or maternal harm. The most common situations in which it has been called are non-reassuring fetal heart rate situations and post-partum hemorrhages.

Response times and efficiency of care have improved since implementation, but concerns remain regarding the reactions of patients and their families to large numbers of responders suddenly appearing at a delicate and personal time in their maternal-fetal care. A survey questionnaire has been developed, validated, and found reliable for the assessment of mothers and their families who have experienced a “Condition O” at MWH.

Because the process of delivering emergency obstetric care with the use of a rapid response team is remarkably similar to the care delivered in the ICU, we chose to modify a validated tool known as the Family Satisfaction in the Intensive Care Unit questionnaire (FS-ICU) in order to measure patient and family satisfaction with two separate surveys following emergent obstetric crisis. During questionnaire development, the initial questionnaire was administered within 48 hours and an optional repeat administered for reliability within 24 hours or after the initial emotional reaction was over. Ninety-three percent (93%) of respondents had completed all items for each of the survey questions. Internal consistency assessed by Cronbach’s alpha was consistently high across the two surveys with \( \alpha = 0.905 \) for the patient survey (ps) and \( \alpha = 0.841 \) for the family survey (fs). The test-retest values highly correlated for both models also: with \( r = 0.80, p < 0.001 \) for the ps and \( r = 0.85, p < 0.001 \) for the fs. Subscale correlations were 0.850 and 0.806 for the patient and family models, respectively.

The questionnaire is a modality to improve patient emergency care and to elicit patient concerns over their care. The Patient and Family Satisfaction Questionnaires are psychometrically sound with regards to measurement of satisfaction with care and medical decision-making of patients and families involved with acute obstetrical care. To date, patients have responded positively to Condition O response team care at our hospital. Last year, our Condition O response was reviewed and revised by committees at MWH.

Some valuable insights have been gained by using this instrument to improve patient care. Further implementation of the response team and the survey is ongoing, and we plan to utilize the surveys to assess the response of the revisions.

Genetic Determinants of Ante Partum, Parturition, and Postpartum Pain and Labor Analgesia

Primary Investigator: Patricia Dalby, MD (formerly Inna Belfer, MD, PhD)

Co-investigator: Grace Lim, MD

New approaches to predict, prevent, and treat acute and persistent labor-related pain are needed. It has been predicted that up to 30% of women may develop a chronic pain syndrome related to childbirth. Every woman has individual pain sensitivity and this may be predicted by their “sensory profile,” identified with Quantitative Sensory Testing (QST).
Variations in obstetric analgesia and labor-related pain may be related to a woman’s overall pain sensitivity, or it may be that thresholds of experimental pain in late pregnancy differ from those at baseline. There may be genetic coding for pain sensitivity, in which certain gene sequences have already been well-studied. In the present prospective longitudinal study, we assess the responses of healthy pregnant women to standard painful stimulation, including thermal and mechanical stimuli. In addition, we evaluate pain status and pain co-morbid traits, including sleep and mood, using validated standard questionnaires. This data is being collected in the first and third trimesters of the women’s ante partum and postpartum periods. Women are followed in the postpartum period for the development of chronic pain syndromes. Saliva or blood samples have been collected for future genetic analysis. These will be compared to the same individuals’ pain descriptors of their labor and delivery process.

Almost 180 patients have been recruited to date, but the withdrawal rate (45 women) has been high due to the time commitment and complexity of the study. Almost 60 women have completed the study. Genetic analysis has not been conducted. Preliminary analysis of the psychological and QST data has indicated an increase in the antenatal period to pressure tolerance and some possible changes in heat tolerance in the peri-partum period. Some alterations in the catastrophizing profiles of the women are also emerging for pressure and heat tolerance. In one preliminary analysis, we separated participants into vaginal delivery and cesarean section groups for QST periods 1-2 for the heat data and saw that the vaginal delivery group showed greater heat thresholds and heat tolerance than the cesarean group during that first period. Women with lasting pain after delivery were characterized by increased mechanical pain sensitivity. Lower anxiety and depression at three month assessments were prevalent in vaginal delivery patients. Clinical variables did not yield any significant data to be included in the results. If this bears out long-term in the study, it might indicate differences in the two groups of women early in pregnancy.

Interestingly, in the labor pain and phenotype portion of the study, we found some indications of a possible role played by phenotypical differences in eye color in the labor pain response. After receiving epidural analgesia, dark-eyed subjects trended towards experiencing more pain reduction both at rest and during movement than light-eyed subjects. At present, statistical significance has not been found, but this pilot study revealed patterns between eye color and pain-related traits in pregnant women in a labor pain model. Much larger patient sample sizes would be needed to prove scientific significance.

**Protein Shake and Progress of Labor Study**

*Summer MWH Research Internship Project for Jessica Shaffer and Samantha Braun*

**Primary Investigators:** Pamela Flood MD; Ina Beifier, MD, PhD; and Jonathan Waters, MD

**Co-investigators:** Patricia Dalby, MD; Jodi Martin; Manuel C. Vallejo, MD

Women in labor are commonly restricted to intake of ice chips only to prevent aspiration, a rare situation in which they may require general anesthesia for an emergent cesarean section. After the first trimester of pregnancy, gastro-esophageal sphincter tone is reduced and in labor, gastric motility is reduced, rendering aspiration of vomitus potentially more possible. However, recent literature reports that the actual risk of aspiration during labor is extremely low (seven in 10 million births in cases accumulated between 1979 and 1990 in the United States). The risk of aspiration has been markedly reduced with improved general anesthetic techniques due to faster-acting induction agents, better antacids, cuffed endotracheal tubes, and other improved techniques for maternal airway management. In addition, the requirement for general anesthesia has been reduced by the increased availability of regional anesthesia. Accumulating evidence suggests that nutritional restriction is not benign. The process of labor induces extreme metabolic demand associated with a doubling of cardiac output and increased respiration reminiscent of that required for extreme aerobic activity, and as such, laboring women can develop a state of accelerated starvation. This state of starvation results in the production of ketones as an alternative energy source and prolonged labor is associated with ketone production that is exacerbated by fasting.

This secondary study utilizing data from a previous study by co-investigator Dr. Manuel Vallejo looked at the progress of labor in two groups of laboring women. The women were demographically matched; one group of women followed the normal dietary restrictions of no food or drink except ice chips (traditionally kept in US labor and delivery wards), and the other group of women were supplemented in early labor with a protein shake. Certain points in labor progress were captured in the two groups and subjected to mathematical analysis.
The data was evaluated with a validated multivariable time series model using PLTTools (PLT Soft, San Francisco, CA) for NONMEM (Globomax; Ellicott City, MD). Briefly, labor progress was estimated with the equation: CD = (10-TCD)(-L1*TIME) + TCD (-L2*TIME), where CD is cervical dilation, TCD is the cervical dilation at which latent labor transitions to active labor, L1 is the exponent for the active labor term, and L2 is the exponent for the latent labor curve. Variables such as ethnicity were evaluated as X variables on the active labor rate constant, and continuous variables were evaluated as an additive variable on the active labor rate constant. This method has been found to be highly sensitive and specific in the detection of significant effects on labor progress.

Brief Report: Ultrasound-Guided Epidural Labor Analgesia in Morbidly Obese Parturients

This study was conducted as a fellowship-related research project by Thomas J. Vernon, MD during his 2016-2017 obstetrical anesthesia fellowship year.

Ultrasound has revolutionized many anesthetic procedures such as peripheral nerve blocks and central line placement. Studies have examined the benefits of ultrasound-guided labor epidural catheter placement in various patient populations. Although some studies have demonstrated benefits, such as confirming the correct spinal level, predicting the depth to the epidural space, decreasing the number of attempts, improving first pass success rate, and reducing the incidence of failed epidural analgesia in resident trainees, others have demonstrated no differences in these outcomes when the procedure is performed in uncomplicated patients. Particularly in obese patients, palpation of neuraxial landmarks can be difficult, and obesity is associated with increased difficulty with epidural catheter placement, longer placement times, and a higher failure rate. Ultrasound may help visualize the spine and offset these challenges, although there are few data comparing its practical application for daily use against the current standard of a palpation-based only technique.

The aim of this study was to assess whether ultrasound-guided epidural catheter placement in morbidly obese parturients (BMI ≥40) is associated with clinically relevant and practical benefits for both the patient and provider. Our primary hypothesis was that ultrasound-guided epidural catheter placement in morbidly obese parturients reduces total time required to perform the procedure. Other outcomes measured included number of attempts, first attempt success rate, complication rates, and patient satisfaction.

The primary outcome was the total time (in minutes) to successful placement of the epidural catheter for labor analgesia, defined as the sum of the ultrasound or palpation time, plus the epidural catheter placement time. Initial sample size was calculated based on previous work comparing time-to-placement of combined spinal-epidural anesthesia during cesarean delivery among obese patients (BMI ≥ 30) with and without ultrasound. Data were de-identified and analysis performed by an independent investigator blinded to group assignment. Distribution normality of continuous data were examined using box plots and histograms.

The mean total procedure time in the ultrasound group was found to be 6.1 minutes compared to a mean of 11.0 minutes in the palpation group (P = 0.05). Although evaluating a patient with ultrasound took nominally more time than palpation (1.8 vs 0.9 min respectively; P < 0.001), it resulted in reduced epidural catheter placement time (mean 4.33 minutes using ultrasound vs. mean 10.1 minutes using palpation; P = 0.03) and significantly fewer attempts (median one attempt with ultrasound vs. five attempts with palpation; P = 0.02). Despite the reduction in time and number of attempts, ultrasound use was not associated with differences in patient anxiety or satisfaction with either the procedure itself or their overall experience. There were no differences between groups regarding complications. In the palpation group, there were two cases of transient paresthesia during epidural needle placement, one unilateral block requiring epidural catheter adjustment, and one inadvertent dural puncture resulting in a subsequent post-dural puncture headache (declined epidural blood patch). None of these complications were noted in the ultrasound group.

The study conclusions were that in morbidly obese parturients, ultrasound-guided epidural catheter insertion is associated with reduced procedure time compared to palpation alone. This finding represents practical benefits to both the patient and provider. With a brief initial ultrasonographical evaluation, providers can complete epidural catheter placement in fewer attempts and reduce overall procedure time. While no significant differences were noted in patient satisfaction, this study was underpowered for the outcome of satisfaction. Although complication rates between groups did not reach statistical significance, this study was not powered for these outcomes; the fact that the complications were noted to occur only in the palpation group suggests that a larger study is warranted to evaluate whether ultrasound guidance can reduce the risk for these untoward outcomes in the morbidly obese population.
TOMAS DRABEK, MD, PHD
Associate Professor

OVERVIEW

The Drabek research group is currently focused on characterizing systemic and organ-specific responses to prolonged cardiac arrest (CA) to identify therapeutic targets for future therapies. Novel strategies currently being tested include systemic cytokine removal by hemoadsorption or single anti-cytokine strategies to improve outcomes from CA by ameliorating post-CA syndrome, and exploration of dopaminergic signaling and its disruption after CA to identify optimal therapeutic strategies to advance neuro-rehabilitation after CA.

Both Dr. Drabek and his trainees have received multiple national awards, e.g. Young Investigator Award (American Heart Association), Young Investigator Award (Society of Critical Care Medicine), Young Investigator Award (European Resuscitation Council), Best of Meeting Award (International Anesthesia Research Society), etc.

Dr. Drabek’s research has been supported by Department of Anesthesiology and Perioperative Medicine Seed Grants and grants from the Laerdal Foundation for Acute Medicine, the Society of Cardiovascular Anesthesiologists, the American Heart Association (AHA), the National Institutes of Health (NIH), and the Department of Defense (DoD).

PROJECTS

Dopamine System-focused Neurorehabilitation Model for Improving Neurorecovery among Cardiac Arrest Survivors

While survival has improved with modern resuscitation and targeted temperature management, sudden CA survivors can exhibit multiple motor and cognitive impairments due to neurological sequelae resulting from the associated hypoxic-ischemic brain injury. Further, these survivors represent a “new” population with these impairments for rehabilitation specialists to treat. Current practice is to borrow management strategies used for other acquired brain injury populations to manage issues like low cognitive arousal, agitation/restlessness, depression/anxiety, and movement disorders (myoclonus). However, the pathology underlying these seemingly overlapping symptoms may be very different depending on the etiology of the brain injury. Our pilot data (J Neurochem 2017) reveal that dopamine transmission derangements after experimental CA are very different than what is observed with similar studies done in our laboratory with experimental traumatic brain injury (TBI). This suggests that clinical treatment strategies different from what is used to treat TBI, are needed to treat the CA population. Our goal is to develop a well-characterized CA model of survival that can be used as a test bed for examining rehabilitation-focused treatments that impact dopamine neurotransmission-associated myoclonus, cognitive deficits, and maladaptive behaviors (anxiety, anhedonia). This translational research collaboration is a novel extension of our excellence in CA clinical care program. The described work aims to identify tailored and effective treatments for rehabilitation and recovery for the population surviving CA.

Combination of Extracorporeal Life Support and Mesenchymal Stem Cell Therapy for Treatment of ARDS in Combat Casualties and Evacuation of Service Members with ARDS

Transfer of injured service members from a Level 3 combat support hospital to level 4 and 5 medical facilities increases their chances of survival from devastating injuries. Aeromedical evacuation of patients with Acute Respiratory Distress Syndrome (ARDS) sometimes isn’t possible because of the limitations of providing in-flight ventilator support, with possible further deterioration in patient status. Cell-based therapy with adult bone marrow-derived mesenchymal stromal cells (B-MSCs) in experimental models of ARDS data suggest that administered allogeneic B-MSCs can mitigate hypoxemia and promote recovery. However, it is unknown how this new form of therapy can be used adjunct to current supportive measures for lung failure. Our objective is to complete a series of preclinical studies in large animal models using extracorporeal membrane oxygenation (ECMO), low-flow low-pressure ECMO (A-lung) alone or in combination with B-MSCs in sheep with ARDS.
Emergency Preservation and Resuscitation after Exsanguination Cardiac Arrest from Trauma

Current outcomes from CA are often suboptimal. The research group at the Safar Center for Resuscitation Research recently established a novel concept of emergency preservation with delayed resuscitation (EPR) for victims of exsanguination CA. The concept of “emergency preservation” utilizes an ice-cold aortic flush to rapidly achieve deep hypothermia that would prevent further damage and allow time for transport and damage control surgery. Delayed resuscitation is then achieved via cardiopulmonary bypass (CPB) (J Trauma Acute Care Surg 2017).

While initial experiments used a canine model (e.g. Circulation 2006, J Cereb Blood Flow Metab 2008), Dr. Drabek’s group developed a rodent model of EPR. A miniaturized CPB circuit enables the utilization of molecular tools to define potential therapeutic targets and develop drugs that would augment the effect of hypothermic preservation. The research group initially characterized the rodent EPR model using rapid lethal hemorrhage followed by 20 minutes of CA (Crit Care Med 2007). Rapid induction of deep hypothermia (15 °C) allowed survival from otherwise lethal insults with excellent outcomes. Extending the duration of CA to up to 60 minutes resulted in intact neurologic survival, while further extension to 75 minutes was associated with high mortality and neurologic impairment in survivors (Resuscitation 2008) and increased secondary injury cascades (Resuscitation 2008). The blood-brain barrier was not disrupted, even in insults that were associated with poor outcomes (Resuscitation 2009; Neurosci Lett 2014). The delta-opioid agonist DADLE, linked to hibernation-induction agents with organ-preservation properties, failed to augment the hypothermic protection (Resuscitation 2008). Deeper levels of hypothermia (21 °C vs. 28 °C) resulted in better neurologic outcomes. Surprisingly, this was associated with attenuated microglial activation, but not neuronal death (Anesth Analg 2009). This finding shifted the group’s focus to neuroinflammation. The Drabek research team pioneered a method of selective depletion of microglia using intrahippocampal injection of clodronate, a pro-drug that depletes macrophages when injected systemically (Resuscitation 2012). Their current results also suggest significant regional differences in the brain’s neuroinflammatory response to CA (Ther Hypothermia Temp Manag 2015).

Recently, the Drabek group established a normovolemic ventricular fibrillation (VF) CA model (Crit Care Med 2013). They characterized the model and explored cerebral blood flow after asphyxial CA vs. VFCA (Resuscitation 2014). They also characterized early neuroinflammatory region-specific responses to various durations of VFCA (Resuscitation 2014). The team used fast-scan cyclic voltammetry to explore dopamine signaling, establishing effective neurorehabilitation–relevant treatments to improve multidimensional recovery after VFCA (J Neurochem 2017). This research is being conducted in collaboration with the Pittsburgh NMR Center for Biomedical Research, Carnegie Mellon University, and Duquesne University.

PUBLICATIONS


CURRENT FUNDING

- Co-I, 1R21NS108386-01A1, NIH, Dopamine System Focused Neurorehabilitation Model for Improving Neurorecovery among Cardiac Arrest Survivors, 2018-2020
- Co-I, 1BTPA34170555, AHA, Dopamine Systems and Rehabilitation Treatments for Improving Neurorecovery among Cardiac Arrest Survivors, 2018-2021
TRENT D. EMERICK, MD, MBA
Assistant Professor

OVERVIEW

As Director of Quality Improvement and Innovation in the Chronic Pain Division and Associate Fellowship Director, my research involves a myriad of quality improvement projects, including clinic and operating room efficiency analyses, inpatient chronic pain service consult analyses, and development of new protocols within the chronic pain division. Other interests include cancer pain, craniofacial pain, and abdominal/pelvic pain. I also closely work with the Totalcare Inflammatory Bowel Disease Program and the Totalcare Musculoskeletal Clinic. Ongoing projects include work with residents, fellows, and medical students on topics such as hypertension in the chronic pain clinic, outpatient ketamine infusion analyses, outcomes of spinal cord stimulation within our division, outcomes of TAP/QL blocks for chronic pain, and prescription drug monitoring program analyses.

PROJECTS

Understanding Revenue Streams: Prevalence of Substance Abuse in Inpatient Chronic Pain Patients at a Large, University-based Hospital
Brandon Staub, MD, MS; Tammy Flemming, CRNP; Trent Emerick MD, MBA
This work was presented at the ASA Practice Management Conference, New Orleans, LA, January 2018.
An inpatient chronic pain consult service may find that a significant percentage of their new inpatient chronic pain consults focus on substance use and not true chronic pain issues. Although in-depth training into substance use is not often part of formal anesthesiology training, the treatment of these patients represents a great way to diversify the chronic pain service line and open new revenue streams for the anesthesiology department as part of the Perioperative Surgical Home. These consults are often deferred to other services such as addiction psychiatry, toxicology, or internal medicine and represent a loss of potential consultations. Substance use could take the form of illicit substance use (cocaine, heroin, etc.) or the use of typical pain medications in a non-prescribed manner (buying opioids off the street, etc.). Patients with a history of substance use or on maintenance therapy for substance use (such as suboxone or methadone) often have more challenging treatment plans and are potentially exposed to additional comorbidities. Currently, chronic pain faculty, fellows, and trainees get minimal training on substance use despite many “chronic pain” consults regarding this topic (as opposed to purely a chronic pain issue). The goal of this project is to identify the prevalence of substance use in new inpatient chronic pain consult patients at a large academic hospital. Identification of the prevalence of substance use is important to understand if additional resources need to be devoted to education and training of staff and faculty regarding inpatient management of patients with a history of substance abuse to more fully diversify the consultation revenue stream.

Designing a “Totalcare” Clinic: An Anesthesiologist’s Utility in a Multidisciplinary Musculoskeletal Health Clinic at a Large Academic Medical Center
Hayden Hundley, MD, MPH; Trent Emerick MD, MBA
This work was presented at the ASA Practice Management Conference, New Orleans, LA, January 2018.
A multidisciplinary clinic was established in July 2015 for musculoskeletal health-related issues. The goal of this clinic was to integrate numerous medical specialties under one clinic. Physicians from the Pitt/UPMC Departments of Physical Medicine and Rehabilitation and Anesthesiology and Perioperative Medicine were the primary providers at this clinic. Physicians from the Departments of Neurosurgery and Orthopedic Surgery and the Division of Rheumatology were also
involved. The clinic was staffed by an anesthesiologist one half day per week. New patients also saw a physical therapist on the same day as their first appointment with the primary provider. Patients could also schedule to see a dietician and pain psychologist who were also available in the same clinic. Multidisciplinary case conferences involving providers from all specialties occurred on a monthly basis to further integrate and streamline patient care. Referral sources to the clinic include primary care providers, emergency room providers, orthopedic surgeons, and neurosurgeons.

Using an Anesthesiology Trained Chronic Pain Physician for Perioperative Inpatient and Outpatient Pain Management as Part of the Perioperative Surgical Home

Neal Shah MD; Trent Emerick MD, MBA

This work was presented at the ASA Practice Management Conference, New Orleans, LA, January 2018.

We developed a novel approach with the Department of Neurosurgery to pre-operatively evaluate high risk and challenging chronic pain patients undergoing various neurosurgical procedures to develop a plan to manage post-operative pain. Appropriate referral patients are identified in the neurosurgical clinics by physicians and physician assistants. No definitive criteria for referral is used; instead, chronic pain consultation referrals were left up to the discretion of the neurosurgical team. Patients are evaluated in the chronic pain clinic pre-operatively and a plan for how to manage pain after the procedure is determined. Once the patient is admitted for the surgical procedure, the chronic pain team is consulted and enacts the plan determined at the initial outpatient visit. On discharge, a pain plan is given to the patient and further pain management is guided by the patient’s primary care provider/chronic pain specialist or other managing physician. Since inception of the program in July 2017, eight patients have undergone this novel approach. Patients referred included those with a history of substance abuse on outpatient addiction maintenance therapy, those with preoperative high oral morphine equivalent usage, and those who specifically requested a pain clinic consultation. Almost all these patients described feeling less anxious about their pain management throughout the perioperative period. In an era where reimbursements are becoming tied to patient satisfaction, approaches such as this can help hospitals improve quality of care. Further implementation of such an approach in conjunction with other surgical departments can help improve quality of care in chronic pain patients undergoing a wide variety of surgical procedures. After this pilot program, the next likely step would be a larger-scale program involving a statistical analysis of patient satisfaction, provider satisfaction, and perioperative outcome measures.
IBINSON LAB

LAB MEMBERS
James W. Ibinson, MD, PhD (PI)
Keith Vogt, MD, PhD (Co-I)
Howard Aizenstein MD, PhD (Department of Psychiatry and PI of the Geriatric Psychiatry Neuroimaging Lab, mentorship)
Brian A. Williams, MD, MBA (mentorship)
Ajay Wasan, MD, MSc (mentorship)

OVERVIEW
Functional connectivity magnetic resonance imaging (fcMRI) analyzes the co-variation of low frequency (< 0.1 Hz) oscillations in the MRI signal that signals communication between brain regions. These oscillations reflect spontaneous neuronal activity and are present at rest, thus allowing the study of chronic neurological states. The Ibinson lab is now applying fcMRI to two critical issues in anesthesiology: pain and post-operative cognitive dysfunction.

PROJECTS
Using Functional Connectivity to Differentiate Between Pain and Resting States
In a 2011 report to the Department of Health and Human Services, the Institute of Medicine stated that “relieving pain should be a national priority,” estimating that over 116 million Americans suffer from chronic pain, with medical treatment and lost productivity costing up to $635 billion yearly. The Ibinson lab believes that a critical step towards the development of effective treatments for both acute and chronic pain is identifying a biomarker for pain and that fcMRI may be the ideal tool to identify such biomarkers, since pain perception is a psychological phenomenon.

Previously, they identified a connectivity pattern that differentiated an acutely painful state from the non-painful resting state that resulted in abstracts awarded “Best of Meeting” at the 2013 International Anesthesia Research Society (IARS) Annual Meeting and “Best of Category” at the 2014 IARS meeting, and the initial development was published in Brain Connectivity. They followed that up with studies investigating the correlation between activity in these brain regions with pain level, bringing them closer to their goal of a biomarker, as well as a study showing that chronic pain patients have specific alterations in resting state connectivity patterns. Using this as preliminary data, the Ibinson lab recently applied for a Multisite Clinical Center for the NIH’s upcoming Acute to Chronic Pain Signatures Program.

Quantifying the Neural Correlates of Post-Operative Cognitive Dysfunction and Investigating its Link to Pre-Clinical Alzheimer’s Disease
Post-operative Cognitive Dysfunction (POCD, now referred to as Perioperative Cognitive Disorder) is a poorly understood complication of surgery and/or anesthesia that results in significant morbidity, especially in the elderly. Current evidence suggests that the rate of POCD one week post-surgery, regardless of procedure, in patients over the age of 65 ranges from 30-40%. Neither the mechanism nor the key cerebral substrates of POCD have been convincingly determined in humans. This lack of understanding hampers the ability to measure POCD’s effect on cognitive function, monitor its natural time course, and precisely quantify the effects of potential treatments. Interestingly, new research has exposed a potential link between POCD and pre-clinical underlying Alzheimer’s disease. Imaging studies focusing on anatomic changes have shown mixed results, suggesting that studies of brain function are needed to guide POCD research. Thus, the Ibinson lab is investigating the hypothesis that functional neuroimaging can detect the neural correlates of POCD and quantify the changes in brain function and/or morphology over time, serving as a biomarker for both those at risk and the effect of preventative treatment.

In work to be completed in early 2019, they will have applied their pain fcMRI pipeline to images collected before and after anesthesia for major surgery. Analysis of the imaging data has shown repeatable changes in brain connectivity that normalize in three-month follow up scans, with evidence of brain injury in the hippocampus found using anatomic scans.
TRANSLATIONAL AND QUALITY IMPROVEMENT RESEARCH

that highlight areas of inflammation. These findings are being used as preliminary data for a Biomedical Laboratory Research and Development Merit Review Award (Parent I01) through the Department of Veterans Affairs (VA). The Ibinson lab’s experience with the use of advanced anesthetic techniques to avoid general anesthesia and presumably reduce neuroinflammation will allow them to eventually test whether POCD improves due to avoiding pro-inflammatory inhalational anesthetics and routinely using anti-inflammatory medications such as systemic lidocaine.

CURRENT FUNDING
- Co-Investigator, DoD 13232002 (PI: Brian Williams), Department of Defense, Total Joint Replacement with Four-drug Nerve Block in Veterans, 2015-2019
- Principal Investigator, University of Pittsburgh Physicians Academic Foundation, Investigating the Link between Preclinical Alzheimer’s Disease and Postoperative Cognitive Dysfunction Using Functional Neuroimaging, 2016-2018
- Principal Investigator, VISN 4 Competitive Pilot Program Fund, Quantifying the Neural Correlates of POCD, 2017-2019

Dr. A. MURAT KAYNAR, MD, MPH, Professor

Dr. Kaynar’s overarching research program continues to focus on the long-term effects of sepsis and acute respiratory distress syndrome (ARDS). He studies the role of zinc and matrix metalloproteinases (MMPs) to elucidate their role in sepsis and ARDS, with the subsequent aim of applying his findings to the management of these diseases. Recently, he added a Drosophila model of sepsis to his armamentarium to dissect long-term outcomes after sepsis (Cost of Surviving Sepsis: A Novel Model of Recovery from Sepsis in Drosophila melanogaster, Intensive Care Med Exp. 2016). This model provides the added advantage of an innate immunity-only system. His work involves small animal models of the aforementioned diseases and his work has been recently published in American Journal of Respiratory and Critical Care Medicine, Journal of Critical Care, PLOS One, and American Journal of Respiratory Cell and Molecular Biology. He was awarded an NIH R01 grant at the end of FY15 to study zinc in mouse models of pneumonia, and progress is encouraging; Dr. Kaynar’s team developed a novel model of resolution of sepsis in Drosophila with promising preliminary work in mice and is working towards a follow-up competitive grant. Dr. Kaynar is using small molecular modulators of metabolism that regulate long-term inflammation, establishing collaborations with the University of Pittsburgh Department of Pharmacology as well as the University of Paris to dissect the interaction between metabolism and inflammation.

Along the same line of studying the long-term effects of acute inflammatory events, Dr. Kaynar is exploring the role of intraoperative anesthetic variables (mechanical ventilation, type of anesthesia) in the operating room in outcomes of patients using data from anesthesia electronic medical records. He is the primary mentor for a T32 program to explore the predictive role of intraoperative variables on long-term outcomes. He also has a patent application pending approval.

Dr. Kaynar’s research aligns with his role as Program Director of the Anesthesiology Critical Care Medicine Fellowship Program and quality initiatives in which he took part in the Departments of Anesthesiology and Perioperative Medicine and Critical Care Medicine.

MAJOR PROJECTS
- Combined Viral and Bacterial Infection and Zinc Homeostasis in Distal Lung. Funded by R01HL126711 NIH/NHLBI, Role: PI. This project focuses on the role of zinc in resolution of pneumonia (H1N1 and S. aureus) in mouse models. The current project also aligns with an ongoing clinical trial.
- **Aerobic Glycolysis and Long-Term Outcomes from Sepsis**, Funded by UPP Foundation Grant 2017, Role: PI. Cost of Surviving Sepsis. This recently-funded project uses a Drosophila model of sepsis to explore inflammation, functional impairment, metabolic derangements, and lifespan in the recovery phase of sepsis. The preliminary data have been translated to a mouse model.

- **Neutrophil Collagenase in Sepsis and Ventilator-induced Lung Injury** (completed), Funded by K08 NIH, Role: PI. The primary goal of this career development award is to develop a better understanding of the mechanisms of sepsis, leading to more effective therapies for patients. Although the grant is completed, Dr. Kaynar is planning to expand the work into a follow-up grant.

- **Cardiovascular Consequences of Infection and Sepsis**, Funding: BaCCoR (CTSI Basic to Clinical Collaborative Research Pilot Program), Role: PI. This recently completed project explored cardiovascular disease in sepsis survivors from the standpoint of the immune response.

- **MMP Polymorphisms in Sepsis**, Role: PI. The project’s primary goal is to bridge the bench findings of animal models of sepsis to the available large data set of human sepsis established in the Department of Critical Care Medicine.

- **Long-term Effects of Mechanical Ventilation in Minimally Invasive Esophagectomy** Role: PI. The project’s primary goal is to test the hypothesis that high intraoperative tidal volumes lead to increased 28- and 90-day mortality.

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**GERHARDT KONIG, MD, Assistant Professor**

**OVERVIEW**

Dr. Konig’s current research, clinical, and academic interests include patient blood management, clinical dashboards, autonomous control of fluid and blood product administration, perioperative sensors, devices, technology, and innovation.

**PROJECTS**

**Objective Peripartum Maternal Hemodynamic Monitoring:** Development of a new device that measures post-partum uterine tone

**Comparison of Bacterial Load Between Shed, Washed, and Filtered Salvaged Blood with Circulating Venous Blood during Surgery for Penetrating Trauma:** Study investigating the bacterial load in cell salvaged blood in comparison to venous blood in patients undergoing surgery for penetrating abdominal trauma

**Perioperative Fluid Management System:** Development of a new device to facilitate perioperative fluid administration

**PUBLICATIONS**


**CURRENT FUNDING**

- PI, F_195-2017_Konig, Center for Medical Innovation, Objective Peripartum Maternal Hemodynamic Monitoring, 2017-present
- PI, Investigator-initiated Study, LivaNova Inc., Comparison of Bacterial Load Between Shed, Washed, And Filtered Salvaged Blood with Circulating Venous Blood During Surgery for Penetrating Trauma, 2018-current
Clinical and translational research in obstetric anesthesiology at UPMC Magee-Womens Hospital seeks to optimize maternal and neonatal health by developing novel and personalized clinical management strategies. Research from the Lim lab continues to focus on the primary themes of obstetric anesthesia and perinatology; pain and analgesia in the perinatal period; and outcomes optimization in vulnerable populations. Most recently, their work has focused on identifying the potential role of puerperal pain and labor analgesia on postpartum depression (PPD) risk.

In a retrospective observational study, 201 women with higher improvements in pain after initiation of labor epidural analgesia were found to be associated with lower PPD scores. After adjusting for covariates, pain improvement remained a significant predictor of depression scores ($r = 0.49, P = 0.008$), accounting for 6.6% of the variability in PPD scores. The full model, including pain, body mass index, anxiety and/or depression, perineal lacerations, and anemia, explained 24% of the variability in PPD scores. They concluded that although the extent of labor pain relief by epidural analgesia predicts lower PPD scores, the relative contribution of percent improvement in pain to risk for PPD symptoms may be less than other established risk factors for depression. These data support that the clinical significance of labor analgesia in the development of PPD needs to be more clearly defined.

Preliminary results from a prospective observational study corroborate the findings above, showing evidence of a relationship between the emotional burden of pain (operationalized by the pain unpleasantness burden) and postpartum depression symptoms. The relationship exists even after adjusting for state-trait anxiety, baseline depression, body mass index, perineal lacerations during labor, and duration of labor. Group differences in these relationships appear to exist between women with different analgesia preferences: among women who choose and receive epidural labor analgesia, high labor pain burden is significantly associated with postpartum depression scores at six weeks postpartum, whereas among women who choose and do not receive epidural labor analgesia, this relationship does not appear to exist.

To further add to the understanding of the role of labor analgesia on postpartum outcomes, Dr. Lim’s research group is completing an early-phase randomized control trial that will determine the dose-response effect between labor pain, labor analgesia, and depression. They are following these women and their infants for a period of three months to assess outcomes, including PPD, chronic pain, maternal-infant bonding, and parenting self-efficacy (ClinicalTrials.gov Identifier: NCT02692404).

FUTURE RESEARCH DIRECTIONS

In future work, baseline psychological variables, pain sensitivity, and intrapartum pain will be systematically evaluated for their relative influence on the development of PPD. A feasible study design to assess the role of labor pain improvement in PPD risk reduction will be generated. Thus, Dr. Lim and her colleagues will be able to identify the influence of labor pain on PPD risk, thereby allowing investigators to efficiently target novel pain management strategies.

Dr. Lim’s long-term goals are to expand this methodology to tailor novel and personalized labor pain management strategies to other vulnerable populations, including parturients with opioid addictions and obesity. Funding for a preliminary study investigating the role of ketamine in cesarean delivery has been secured, and a prospective randomized control trial is being organized.
Future work will build on these predictive models and clinical trial results, to identify other perinatal factors requiring optimization, and to identify effective clinical management strategies that enhance maternal-infant outcomes beyond the immediate postpartum period.

PUBLICATIONS


CURRENT FUNDING

- PI, Society for Education in Anesthesia (SEAd) Grant, Residents as Teachers: Effect of a Patient Education Strategy on Resident Self-Efficacy and Maternal Outcomes (The EDUCATE Study), 7/1/2016 – 6/30/2017
- Scholar, NIH K12Building Interdisciplinary Research Careers in Women’s Health (BIRCWH), Yoel Sadovsky, PhD, Principal Investigator, 9/1/2016 – 9/1/2021
OVERVIEW

I have been involved in medical simulation for education and assessment for my 20-year career at the University of Pittsburgh. In the last 10 years, I’ve been fortunate to work with a group of multi-institutional researchers, studying the uses of simulation in providing formative assessment to practicing physicians, specifically anesthesiologists. (see: Weinger MB, Banerjee A, Burden AR, McIvor WR, et al: Simulation-based assessment of the management of critical events by board-certified anesthesiologists. Anesthesiology 2017; 127: 475-489). We have recently received funding for a follow up study with the goal of determining the motivations for actions in simulated crisis events.

In the last 18 months, I have begun to create virtual reality (VR) simulation. VR simulation addresses many of the shortcomings of mannequin simulation. I’m very excited to begin studying the uses and impact of VR simulation in the future.

PROJECTS

IMPACTS: Improving Medical Performance during Acute Crises Through Simulation
Determining the decision-making and action strategies used by physicians to detect and manage uncommon but potentially lethal clinical events is critical to improving the “rescue” of patients from such situations. This multicenter study by physicians and experts in cognitive science will use high-fidelity simulations along with rigorous performance assessment and psychological interview methods to identify which decision-making approaches are the most successful and what aspects of the individual clinicians’ training or work processes could be modified to improve outcomes when these events occur during actual patient care.

Understanding the Cognition and Decision Making of Community Anesthesiologists in Their Management of End-of-Case Neuromuscular Blockade: A Mixed Methods Study
This is three-site prospective, observational, mixed-methods study using clinical vignettes and cognitive interviews to better understand the decision-making approaches and preferences of practicing community anesthesiologists regarding the management of non-depolarizing neuromuscular blockade at the end of general endotracheal anesthesia cases.

Determining the Usability of Virtual Reality Simulation for Medical Education
Virtual reality simulation will be trialed with participants who range from novices/uninitiated to practicing professionals to determine its usability and feasibility in medical education.

CURRENT FUNDING

Co-investigator, R18 HS026158-01, Department of Health and Human Services/Agency for Healthcare Research and Quality (Weinger, PI), IMPACTS: Improving medical performance during acute crises through simulation, 8/2/18-7/30/23
OVERVIEW
Neural-immune communication plays a significant role in the body’s reaction to injury and infection. In response to injury, cytokines and neuropeptides are released from nerve endings and activate the immune system. Reciprocally, immune cells release cytokines and growth factors that activate neurons. However, the precise mechanisms of neural-immune interdependence in the peripheral nervous system have not been elucidated. When this communication derails, neurogenic inflammation may develop. Neurogenic inflammation is known to play a role in the pathogenesis of many diseases, as well as chronic pain. Modulation of the peripheral milieu shortly after injury may not only be a strategy to improve the immune response and prevent the development of chronic pain, but also address acute pain.

PROJECTS
The Role of Neurturin in Neural-Immune Communication
To explore the mechanisms underlying neural-immune communication, we are studying the role of neurturin (Nrtn). Nrtn, a member of the glial cell line-derived neurotrophic factor family, is a growth factor that can modulate both the immune and neural cell function. Evidence suggests that an inflammation-induced increase in growth factor signaling evokes the release of calcitonin gene-related peptide and other peptides from primary afferents and consequently leads to stimulation of immune cells. In previous studies using mice that overexpress neurturin in the skin (Nrtn-OE mice), we found that increased levels of Nrtn caused an increase in proinflammatory cytokine expression in the skin in response to Candida albicans infection and led to a faster clearance of C. albicans from the Nrtn-OE skin. To further explore the role of Nrtn as a modulator of the inflammatory response, we used the complete Freund’s adjuvant (CFA) inflammation model and examined the expression of tumor necrosis factor alpha (TNF-α) in wildtype (WT) and Nrtn-OE mice.

NrtnOE and C57BL/6 (WT) male mice were injected with CFA in the hindpaws. Analysis of the hindpaws 12 hours post-inoculation demonstrated that Nrtn-OE mice had increased TNF-α in response to CFA relative to WT mice. However, this increase in TNF-α did not result in increased thermal sensitivity. Female NrtnOE mice did not demonstrate an increase in TNF-α to CFA inoculation. To study the effects of acute administration of Nrtn on CFA-induced inflammation, WT mice were injected with Nrtn along with CFA. The injection of Nrtn (with CFA) into the hindpaws of WT mice increased TNF-α to levels similar to those seen in NrtnOE skin. Moreover, glial derived neurotrophic factor (GDNF) and artemin, other members of the same neurotrophic family as Nrtn, did not increase TNF-α, demonstrating that this effect is unique to Nrtn. This supports a role for Nrtn as a mediator of the local immune response.

Future Directions: Nrtn may be ideal for modulation of neural-immune communication because it plays a role in neural development and impacts the immune response to inflammatory challenge. Future studies will elucidate the mechanisms by which Nrtn affects specific cell types in the immune system. Furthermore, studies will be designed to evaluate the sex differences observed. Other neurotrophic factors will also be studied to determine their potential roles in neurogenic inflammation.

Evaluation of the Role of Neuronal-derived MD-1 in Cutaneous Neural-Immune Signaling
Toll-like receptors (TLRs) are a group of receptors that recognize specific molecules from pathogens and damaged tissues and initiate the innate immune response. One of these receptors, RP105, can stimulate immune cells directly and via dimerization with other traditional TLRs (such as TLR -2 and -4) to amplify the response to their respective ligands. The ligand of RP-105 is MD-1, a molecule known to be released by macrophages that is increased in inflammation. Interestingly, MD-1 has also been demonstrated to be produced by neurons but not its receptor, RP105. The potential effects of neuronal-derived MD-1 on the immune system have not been explored. Evaluation of mRNA expression of the dorsal root ganglion (DRG) of NrtnOE mice demonstrated that MD-1 was upregulated compared to WT mice, suggestive
that this may be one mechanism by which Nrtn impacts neural-immune interactions. Therefore, to validate and further explore the effects of Nrtn on MD-1, a series of in vitro experiments have been performed.

Incubation of Nrtn with cultured DRG neurons demonstrated that Nrtn increased mRNA expression of MD-1. Initial studies have not revealed a significant difference in mRNA expression with concentration of Nrtn. Furthermore, neither GDNF nor artemin were able to increase MD-1 mRNA expression. This demonstrates that Nrtn regulates neuronal MD-1 expression.

Future Directions: MD-1 has been recently recognized as an important component of the innate immune response. Its presence in the peripheral nervous system (without the presence of its receptor) suggests that it may be released from neurons and this may be a mechanism of neural-immune communication. The effect of Nrtn and other growth factors on neuronal-derived MD-1 will be evaluated further. In addition, MrgprD-ChR2 and TRPV1-ChR2 mice (transgenic mice with blue light sensitive ion channels, Channelrhodopsin, in MrgprD+ and TRPV1+ neurons, respectively) will be used to study the release of MD-1 from these subsets of neurons. Finally, studies will be performed to demonstrate that neuronal-derived MD-1 can activate cells of the immune system.

MIHAELA VISOIU, MD
Assistant Professor

OVERVIEW

Postoperative pain control is difficult in pediatric populations. Pediatric regional anesthesia and perioperative pain management to improve patient and family satisfaction with pain control is my passion. I aim to develop new techniques for the placement and use of ultrasound-guided blocks in children, infants, and neonates and implement new protocols.

PROJECTS

Regional Anesthesia and Teenager Postoperative Pain Perception
The prevalence of moderate to severe pain is high in hospitalized teenage patients (11-18 years old) admitted to surgical services. A comprehensive approach to postoperative pain should include preoperative pain risk assessment, information about the postoperative pain control protocol, additional medical interventions that can trigger pain and suffering, and an understanding of patient’s mood, anxiety, and catastrophic attention to pain. The aims of this study are to determine (1) the preoperative and postoperative factors influencing teenage postoperative pain perception; and (2) suffering, defined as patient’s anxiety, pain catastrophizing thoughts, and mood.

A Better Understanding of Self-Reported Pain in Teenagers Undergoing Laparoscopic Surgical Procedures
There is an anecdotal and clinical impression that teenage patients report exaggerated postoperative pain scores that do not correlate with their actual level of pain. Nurse and parental perception of teenagers’ pain is important and can be complemented by knowledge of patient pain behavior, pain catastrophizing thoughts, anxiety, and mood level.

The aims of this study were to (1) determine the patient, parent, nurse level of agreement with teenager pain scores; (2) correlate the reported pain scores with teenager pain behavior scores as reported by the parent and nurse; and (3) identify psychosocial factors that may contribute to teenager pain perception.
Ropivacaine With Clonidine for Pediatric Rectus Sheath Blocks - The Magic Combination? A Double Blinded Prospective Study

The overall hypothesis is that ropivacaine combined with clonidine administered via single injection ultrasound guided bilateral rectus sheath blocks is a more complete and feasible pain control approach than ropivacaine alone. We will test this hypothesis by pursuing the following specific aims: 1) determine if the ropivacaine/clonidine combination is superior in providing long-lasting analgesia to ropivacaine alone; and 2) advance the understanding of ropivacaine/clonidine rectus sheath blockade and determine if this combination significantly improves satisfaction with pain control due to psychological benefits of clonidine.

Paravertebral Nerve Blocks for Pediatric Regional Anesthesia: A Pittsburgh Eight Years Clinical Practice

The main aim of this study is to address the fact there are only a few pediatric paravertebral blocks cases have been reported in literature, and the patterns related to use for different surgical procedures and different age groups is not available. The second aim is to determine the pattern of local anesthetic dosage selection for paravertebral nerve block placement, and to determine the type and amount of ropivacaine administered per block single injection, catheter, level, and weight, the initial administration, and total administration. Also, we will present the analgesic medication usages for anesthesia.

Continuous Paravertebral Block for Postoperative Analgesia after Pediatric Nuss Procedure: a UPMC Children’s Hospital of Pittsburgh Pain Management Protocol

Postoperative pain after the Nuss procedure is severe, requiring a pain management protocol that combines multimodal analgesia with a continuous regional technique. Our goal is to present our analgesic protocol that will minimize side effects from opioid consumption, adverse events (severe pain), and decrease length of hospital stay (goal is for discharge on postoperative day 4).

PUBLICATIONS


CURRENT FUNDING

PI, UPMC Department of Anesthesiology and Perioperative Medicine, Ropivacaine With Clonidine for Pediatric Rectus Sheath Blocks - The Magic Combination? A Double Blinded Prospective Study, 2015-present
TRANSLATIONAL AND QUALITY IMPROVEMENT RESEARCH

KEITH M. VOGT, MD, PHD, Assistant Professor

OVERVIEW
My research broadly applies bioengineering principles to better understand human neuroscience relevant to anesthesiology and perioperative medicine. My current focus is on how human memory is affected by pain during sedation with diverse anesthetic agents. Specifically, we are exploring where pain acts in the brain to affect memory and what physiologic measurements could reveal a learned sympathetic response to aversive stimuli, despite no explicit recollection of the event. Pharmacologically distinct anesthetics have multiple effects on different aspects of memory while simultaneously modulating consciousness. This unusual psychologic milieu is particularly relevant to the experience of surgery and anesthesia, where aversive experiences may be experienced with impaired contextualization. Preliminary fMRI results reveal interacting effects for pain and midazolam on both the hippocampus and amygdala. This is being further explored in a project funded by a Mentored Research Training Grant from the Foundation for Anesthesia Education and Research.

PROJECTS

Determining the effect of pain on memory and how this is modulated by anesthetics
The impact of poorly-contextualized memories is not well characterized. Through experimental manipulation in volunteer subjects, I seek to better understand how pain affects both explicit and implicit measures of memory, including when consciousness is modulated by anesthetics. This has obvious relevance to anesthesia practice, but may also have long-range implications for better understanding certain neuro-psychiatric sequelae that result from maladaptive memories.

Despite no explicit recollection of which word cues were paired with pain, long-lasting implicit memory can form, and we have demonstrated that anesthetics (specifically midazolam and ketamine) implicitly alter pain’s effect on behavior. We are currently using functional neuroimaging to determine which brain areas are responsible for these effects. In the FAER-funded study, we compare the effects of midazolam and ketamine on the hippocampus and amygdala in a randomized crossover study. I am also pleased to have mentored an award-winning anesthesiology resident abstract examining functional connectivity changes between medial temporal lobe memory structures and brain regions involved in pain processing. Strategically choosing anesthetic agents based on their receptor pharmacology and using them at low doses will allow selective inhibition of brain structures known to be involved in memory, and we will be able to capture this anatomic modulation in action.

Development of functional connectivity MRI as a biomarker for pain
Functional connectivity MRI (fcMRI) has emerged as a powerful task-independent method to study interactions between brain regions. Pain represents a difficult problem to treat, in part because monitoring treatment efficacy depends solely on subjective scoring of pain. Since residency, I have worked with Dr. Jim Ibinson to develop fcMRI as a tool to characterize the experience of pain. After determining the optimum data processing parameters for pain-task fcMRI, we developed an analytic framework to detect and monitor the severity of pain being experienced. This included the novel demonstration that the connections of the posterior insula, particularly to the posterior cingulate cortex, show significant modulations between three conditions: pain, non-painful somatosensory stimulation, and the resting state. Further development of this classification algorithm may allow identification of the presence of pain and quantification of the severity of pain without relying on subjective reporting. Insights into the broad functions of the insula and use fcMRI as a technique are anticipated to have cross-project relevance.

CURRENT FUNDING

OVERVIEW

Dr. Wasan’s current research interests are in the areas of tracking pain treatment outcomes using electronic records, mechanism-based treatment studies of negative affect in pain, quantitative sensory testing, functional magnetic resonance imaging (fMRI), and preventing prescription opioid misuse in patients with chronic pain. Since coming to Pittsburgh in 2013, Dr. Wasan has built a clinical and translational chronic pain research program new to the department, successfully mentored several junior faculty in the department who have since obtained independent funding, and obtained new external grant funding each year. He has authored and co-authored over 50 new research publications since coming to the University of Pittsburgh.

Before coming to Pitt/UPMC at the beginning of FY14, Dr. Wasan was an Associate Professor of Anesthesiology and Psychiatry at Harvard Medical School and Director of the Section of Clinical Pain Research at Brigham and Women’s Hospital in Boston; hence, some of the below grants were awarded to his prior institutions. However, this work has continued with funding to Pitt in 2013-2018.

PROJECTS

Use of Extampza ER to Modulate Pill Swallowing Difficulties in Patients with Chronic Pain
Collegium Pharmaceuticals, Investigator Initiated Study Grant; Funding period: 2017-2019; Principals Investigator: Ajay D. Wasan, MD, MSc
This is an investigator-initiated study to examine the role of a newly formulated opioid delivery system to address difficulties patients may encounter swallowing pain medications.

Implementing Contextual Factors Assessment in Clinical Settings
PCORI PROMIS Dissemination and Implementation Program; Funding period: 2018-2020; Principal Investigators: Drs. Ajay D. Wasan and Carol Greco (Department of Psychiatry)
This is a study of the impacts on clinical care of pain specialists formally assessing and addressing expectations for improvement and other doctor-patient relationship factors at the start of treatment with each patient.

Big Data Analytics for Pain Treatment Decision-Making
CTSI of the University of Pittsburgh, Pain Research Challenge; Funding Period: 2018-2019; Principal Investigator: Ajay D. Wasan
This is a data analysis study of our pain treatment registry, which contains patient reported outcomes and merged electronic medical record data on 24,000 unique patients seen in our pain clinics.

Prescription Drug Monitoring Program (PDMP) System User Training
Department of Health of the State of Pennsylvania; Funding Period: 2018; Principal Investigator: Ajay D. Wasan
This pain education research grant updates modules to teach providers how to best use the PDMP program in opioid prescribing and then delivers this content to providers in the Western Pennsylvania area.

Brain Reorganization in Chronic Pain and Drug Abuse
NIH NIDA P50 (DA044121-01A1); Funding period: 2018-2023; Principal Investigator: Vania Apkarian, PhD, Northwestern University; Co-investigator: Ajay D. Wasan, MD, MSc
RESEARCH

TRANSLATIONAL AND QUALITY IMPROVEMENT RESEARCH

This is a center grant to investigate the impacts of opioid prescribing for chronic pain on brain systems regulating pain, affect, and reward.

**Provider-Targeted Behavioral Interventions to Prevent Unsafe Opioid Prescribing for Acute Non-Cancer Pain in Primary Care**

PCORI Large Pragmatic Trials Program; Funding period: 2017-2020; Principal Investigator: Kevin Kraemer, MD, University of Pittsburgh Dept. of Medicine; Co-investigator: Ajay D. Wasan, MD, MSc

The main goal is implementing a health system electronic health record (EHR) strategy to change provider opioid prescribing behavior for acute musculoskeletal pain. This is a large pragmatic trial in 10,000 patients prescribed opioids for acute musculoskeletal pain. It is a provider-level, cluster randomized intervention to one of four arms. Each arm provides a different level of decision support through the EHR.

**Brain Mechanisms Underlying CBT-Related Reductions in Fibromyalgia**

NIH NIAMS R01 (AR064367-01A1); Funding period: 2014-2019; Principal Investigator: Robert R. Edwards, PhD MSPH, Brigham and Women’s Hospital; Co-investigator: Ajay D. Wasan, MD, MSc

This work focuses on fibromyalgia (FM), which is characterized by persistent, widespread body pain, with significant evidence of altered brain processing of various stimuli. One of the few effective treatments for FM is cognitive-behavioral therapy (CBT), which has been shown to reduce pain intensity and pain-related disability, potentially via reductions in catastrophizing, an important psychosocial factor that plays a crucial role in shaping individual differences in pain-related outcomes. Our overarching goal in this study is to understand the neurobiological pathways by which CBT and reduced catastrophizing facilitate improvements in chronic pain. Such information will refine biopsychosocial models of pain, identify potential non-responders early in treatment, and facilitate the enhancement of psychosocial interventions for chronic musculoskeletal pain. We have shown previously in a small sample that CBT reduced pain catastrophizing and produced corresponding changes in brain activation in “pain matrix” processing areas and the functional connectivity of these areas to the default mode network (DMN). In the larger, current study, participants with FM are randomized to eight weekly treatments with CBT or an education/attention control and followed up for six months. fMRI data, including functional connectivity during both a resting and evoked deep-tissue pain state, are collected at baseline, mid-treatment, and after the final treatment visit. We hypothesize that CBT will reduce catastrophizing early in treatment, resulting in adaptive changes in the brain’s responses to an externally-applied noxious stimulus. These changes will then predict subsequent changes in patients’ resting state connectivity in DMN and pain-relevant brain regions, which will underlie long-term improvements in clinical pain.

**Neuroimaging Acupuncture Effects on Brain Activity in Chronic Low Back Pain**

NIH NCAAM P01 (1 P01 AT006663-01); Funding period: 2012-2018; Principal Investigator: Bruce Rosen, MD, PhD, Massachusetts General Hospital; Co-investigator: Ajay D. Wasan, MD, MSc

This program project grant proposes that real and sham acupuncture differentially modulate the brain’s specific intrinsic connectivity networks and alter somatotopy (the functional organization of the somatosensory cortex). Our overall goal is to evaluate whether the brain neurocircuitry subserving chronic low back pain (cLBP) responds differentially to real versus “sham” acupuncture. To test our specific hypotheses, we are employing fMRI to assess brain networks subserving both clinical and experimental pain, acupuncture stimulation, and somatotopy in cLBP patients. These measures will be performed at baseline and following seven weeks of acupuncture (ACUP), sham acupuncture with somatosensation (SHAM-sn), sham acupuncture without somatosensation (SHAM-ml), or wait list (WL). Aim 1 will characterize the pain neurocircuitry in cLBP, as well as low back SI somatotopy, and brain response to acupuncture stimuli. Aim 2 will evaluate the longitudinal effects of ACUP vs. SHAM-sn on brain networks and SI somatotopy in cLBP, while Aim 3 will evaluate the longitudinal effects of SHAM-sn vs. SHAM-ml on these same neuroimaging markers. Understanding the neural influence of somatosensation on acupuncture placebo effects will significantly impact our understanding of acupuncture and allow for development of more inert acupuncture placebos.

**Targeted Interventions to Prevent Chronic Low Back Pain (LBP) in High Risk Patients: A Multi-Site Pragmatic Randomized Control Trial (RCT)**

PCORI: Pragmatic Clinical Studies and Large Simple Trials to Evaluate Patient-Centered Outcomes; Funding period: 2015-2020; Principal Investigator: Anthony Delitto, PhD, University of Pittsburgh School of Rehabilitation Sciences; Co-investigator: Ajay D. Wasan, MD, MSc
This is a 1,500 subject RCT to evaluate whether early physical therapy + CBT prevents the transition from acute to chronic LBP. Preventing the transition from acute to chronic LBP is a crucial public health issue. LBP is the most common chronic painful condition in the United States and incurs approximately $100 billion in direct healthcare costs. A wealth of data indicates that psychosocial variables, such as high levels of pain catastrophizing or negative affect, are the best predictors of acute LBP becoming chronic. This study will compare referral of patients with LBP < three months duration to physical therapy with a cognitive-behavioral emphasis to usual care in a primary care setting.

**Subgrouping of Patients with Rheumatoid Arthritis Based on Biophysical and Psychosocial Factors**

*Pfizer: Investigator-initiated Clinical Research Program; Funding period: 2016-2018; Principal Investigator: Yong Hwong, MD, Division of Rheumatology, University of Pittsburgh; Co-investigator: Ajay D. Wasan, MD, MSc*

This is a longitudinal cohort study utilizing the treatment outcomes tracking software platform called RACER. This study investigates the impacts of co-morbid pain syndromes (such as overlying neuropathic pain) and disruptions in depression, anxiety, or sleep on the outcomes of disease modifying rheumatic disease agents (DMARDs—such as Embrel) on rheumatoid arthritis treatment outcomes.

This program project grant proposes that real and sham acupuncture differentially modulate the brain’s specific intrinsic connectivity networks and alter somatotopy (the functional organization of the somatosensory cortex). Our overall goal is to evaluate whether the brain neurocircuitry subserving chronic low back pain (cLBP) responds differentially to real versus “sham” acupuncture. To test our specific hypotheses, we are employing fMRI to assess brain networks subserving both clinical and experimental pain, acupuncture stimulation, and somatotopy in cLBP patients. These measures will be performed at baseline and following seven weeks of acupuncture (ACUP), sham acupuncture with somatosensation (SHAM-sn), sham acupuncture without somatosensation (SHAM-mI), or wait list (WL). Aim 1 will characterize the pain neurocircuitry in cLBP, as well as low back SI somatotopy, and brain response to acupuncture stimuli. Aim 2 will evaluate the longitudinal effects of ACUP vs. SHAM-sn on brain networks and SI somatotopy in cLBP, while Aim 3 will evaluate the longitudinal effects of SHAM-sn vs. SHAM-mI on these same neuroimaging markers. Understanding the neural influence of somatosensation on acupuncture placebo effects will significantly impact our understanding of acupuncture and allow for development of more inert acupuncture placebos.

**PUBLICATIONS**

- PMID: 30001225
TRANSLATIONAL AND QUALITY IMPROVEMENT RESEARCH


OVERVIEW

My energies have focused on trying to reduce allogeneic blood transfusion through several strategies, one of which is better coagulation management using point of care laboratory devices.

PROJECTS

Expanded Access IND Administration of HBOC-201 in Patients with Severe Acute Anemia
To provide Hemopure to patients where blood is not an option, an expanded use IND from the FDA was obtained to facilitate administration of Hemopure to patients who have severe anemias. The IND is associated with the IRB, who have given permission to use this product in 30 patients.
Data, Tools, and Infrastructure for Surveillance of Biologics

Dovel Technologies, LLC is assembling a team to pursue two indefinite delivery/indefinite quantity (IDIQ) opportunities under the Food and Drug Administration (FDA) Center for Biologics Evaluation and Research (CBER) Biologics Effectiveness and Safety (BEST) initiative. I have been asked to be part of this team.

The first opportunity is BEST: Data, Tools and Infrastructure for Surveillance of Biologics, which strives to expand and enhance the current CBER capabilities with respect to data sources, infrastructure, methods, and tools and to conduct surveillance and epidemiologic studies that promote CBER’s Office of Biostatistics and Epidemiology’s (OBE) mission to assure the safety and effectiveness of biologic products including vaccines, blood and blood products, tissues, and advanced therapeutics.

Algorithm for Predicting Obstetric Hemorrhage

In conjunction with Michelle Pressly, Robert Parker, and Gilles Clermont, we have been working to develop predictive analytic tools to predict obstetrical hemorrhage and VTE. We have developed the algorithms and are now working to test the algorithms against data from the MOMI database.

PUBLICATIONS

- Petty K, Waters JH, Sakamoto SB, Yazer MH. Antenatal Anemia Increases the Risk of Receiving Post-partum Red Blood Cell Transfusions Although the Overall Risk of Transfusion is Low. Transfusion 2018;58:360-365. DOI: 10.1111/trf.14434
The Department of Anesthesiology and Perioperative Medicine continues to maintain its own industry-sponsored Clinical Trials Program (CTP). The self-contained program has been designed to provide, within the department, all the services necessary for faculty members, as both principal investigators and sub-investigators, to fully execute a clinical trial. Services include contract and budget negotiations, clinical research coordinator support, and Institutional Review Board (IRB) submissions. The CTP is also committed to developing new study opportunities for all department faculty members by promoting departmental resources and expertise to the pharmaceutical industry as a whole. The strong relationships with pharmaceutical companies continue to bring a significant number of potential sponsored clinical trials. In FY18, we contracted clinical trials with two new sponsors. In addition, the CTP serves as a training ground in clinical research for anesthesiology attending physicians, residents, and fellows.

To ensure satisfaction of all legal and ethical local and national requirements, the staff reviews research protocols, develops patient consent forms, verifies that studies are being conducted in compliance with federal regulations and Good Clinical Practices, and obtains proper IRB approvals. The program also manages all the financial aspects of clinical trials, including developing and negotiating budget and managing grants. Finally, the CTP’s six full-time clinical research associates oversee the conduct of clinical trials. This oversight includes but is not limited to coordination of trial initiation, facilitation and monitoring of patients after enrollment, and study progress monitoring, with a special focus on patient safety, quality of data collection, and record keeping.

During FY18, the CTP was involved in 19 active studies, including one study that had been recruiting subjects for over seven years. CTP contracted five new clinical trials and completed eleven ongoing clinical trials. Contracted grants totaled $768,819 (direct contracted revenue, $615,732; indirect contracted revenue, $153,086). Over 50 faculty members were involved in clinical sponsored research at eight UPMC sites. CPT interacted with 12 different companies, one organization, and one university (American Heart Association, Endo Pharmaceuticals Inc., Innacoll Pharmaceuticals, Ltd., Mallinckrodt Pharmaceuticals, Mallinckrodt Hospital Products, Inc., Merck Sharp & Dohme Corp., Mylan Specialty L.P., Octapharma USA, Octapharma Pharmazeutika Produktionsges m.b.H, Pacira Pharmaceuticals, Inc., Prolong Pharmaceuticals, LLC, Trevena, Inc., and the University of Pennsylvania).

**FY18 CLINICAL TRIALS**

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**JONATHAN H. WATERS, MD, Vice Chair for Clinical Research**
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<td>Planinsic, Raymond</td>
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<td>A Phase III, Open-label Study to Evaluate the Safety of TRV130 in Patients with Acute Pain for which Parenteral Opioid Therapy is Warranted</td>
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<td>Subramaniam, Kathirvel</td>
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<td>Subramaniam, Kathirvel</td>
<td>Mallinckrodt Hospital Products, Inc.</td>
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<td>Subramaniam, Kathirvel</td>
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<td>The Effect of Intraoperative Continuous Remifentanil Infusion on Glycemic Response and Variability in Patients Undergoing Cardiac Surgery with Cardiopulmonary Bypass: A Prospective, Randomized, Open Label Clinical Trial</td>
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<td>Subramaniam, Kathirvel</td>
<td>Pacira Pharmaceuticals, Inc.</td>
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<td>Visoiu, Mihaela</td>
<td>Endo Pharmaceuticals, Inc.</td>
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<td>Visoiu, Mihaela</td>
<td>Innacoll Pharmaceuticals, Ltd.</td>
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<td>Visoiu, Mihaela</td>
<td>Mallinckrodt Pharmaceuticals</td>
<td>A Phase IV, Open-label Study of the Pharmacokinetics and Safety of XARTEMIS™ XR (7.5 mg Oxycodone Hydrochloride/325 mg Acetaminophen) in Postsurgical Adolescent Subjects (Ages 12 to 17) with Moderate to Severe Acute Pain</td>
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<td>Waters, Jonathan</td>
<td>Octapharma Pharmazeutika Produktionsges m.b.H</td>
<td>A Phase III, Randomized, Double-blind, Multi-center study to Access the Efficacy And Safety of OCTLPEX, a Four-factor Prothrombin Complex Concentrate (4F-PCC), Compared to the 4F-PCC Beriplex P/N (Kcentra), in Patients Needing Urgent Surgery with Significant Bleeding Risk</td>
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<td>Waters, Jonathan</td>
<td>Prolong Pharmaceuticals, LLC</td>
<td>An Open Label, Phase 1 Safety Study of SANGUINATE Infusion in Patients with Acute Severe Anemia who are Unable to Receive Red Blood Cell Transfusion</td>
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<td>Waters, Jonathan</td>
<td>Trevena, Inc.</td>
<td>A Phase 3, Open-label Study to Evaluate the Safety of TRV130 in Patients with Acute Pain for which Parenteral Opioid Therapy is Warranted</td>
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RESEARCH

RESEARCH FELLOWSHIPS

The department’s research fellowships provide the opportunity for individuals to work with renowned clinical and basic science investigators in a variety of disciplines. Students can explore investigative careers, while others will develop into clinician-scientists who will lead the field of anesthesiology research.

NIH T32 RESEARCH FELLOWSHIPS

The department holds two T32 research fellowships. The goal of these programs is to develop clinician-scientists to become leaders in the field of anesthesiology research and train the next generation of pain researchers.

The National Institute of General Medical Sciences (NIGMS) of the NIH funds our T32 Postdoctoral Training Program, “Research Training in Anesthesiology and Pain Medicine,” directed by Professor Yan Xu, PhD, Vice Chair for Basic Sciences. In FY18, four trainees were supported under this training program, which aims to develop clinician-scientists into anesthesiology research leaders by providing rigorous postdoctoral research training emphasizing hypothesis-driven laboratory or clinical research. Thirty-seven leading scientists in anesthesiology and related disciplines, including critical care medicine, surgery, computational & systems biology, and neuroscience, serve as training faculty. Trainees are expected to spend at least two years in the training program and devote an 80% minimum effort toward their research. In FY17, the NIGMS renewed this training grant for a third five-year period. The program began supporting three trainee positions per year beginning July 1, 2017.

The National Institute of Neurological Disorders and Stroke (NINDS) of the NIH funds our second T32 Pre/Postdoctoral Training Program, “Training in Mechanisms and Clinical Presentation of Pain.” In FY18, the program was directed by Howard Gutstein, MD and recently transitioned to program director Michael Gold, PhD. The program aims to recruit and train the best pre- and post-PhD fellows in cutting-edge theory, techniques, and research strategies, preparing them to become the next generation of pain researchers. Twenty-four scientists in anesthesiology and related fields such as neurobiology, medicine, otolaryngology, and physical medicine and rehabilitation, have signed on to mentor the trainees.

Dr. Xu’s training program focuses on training physician scientists, primarily MDs and MD/PhDs, to prepare for careers in academic anesthesiology while the NINDS supported Pain T32 training program focuses solely on pain research and targets third- and fourth-year pre-doctoral graduate students and PhD postdoctoral fellows.

FY18 T32 Postdoctoral Scholars – Research Training in Anesthesiology and Pain Medicine

- Joel Aldo Caporoso, PhD (2017-current)
- Maria Cohen, MD (2017-current)
- Michael Schnetz, MD, PhD (2017-current)
- Benedict Alter, MD, PhD (2018-current)

FY18 T32 Pre- and Post-doctoral Scholars – Training in Mechanisms and Clinical Presentation of Pain

Pre-Doctoral

- Cynthia M. Arokiaraj (2017-2018)
- Jillian J. Weeks (2017-2018)

Post-Doctoral

- Brian S. Edwards (2017-2018)
- Lillian L. Laemmle (2017-2018)

CHARLES W. SCHERTZ RESEARCH FELLOWSHIP

This research fellowship offers a 12-24 month research training opportunity for graduates of an anesthesiology residency or pain medicine fellowship program who intend to pursue an academic career. The program is open to individuals who have successfully completed a four-year residency in anesthesiology and are board-certified or board-eligible.
SUMMER RESEARCH FELLOWSHIPS FOR MEDICAL STUDENTS

Our department serves as a host site for the Foundation for Anesthesia Education and Research (FAER) Medical Student Anesthesia Research Fellowship (MSARF). In 2018, we were one of 36 sites selected nationwide. This program was created to encourage talented medical students to consider careers in anesthesiology research and perioperative medicine and offers medical students an eight week anesthesiology-related research experience. MSARF fellows have the opportunity to present research abstracts at the American Society of Anesthesiologists annual meeting. Past MSARF fellows have gone on to anesthesiology residencies at institutions including NYU Langone Medical Center, the University of Pennsylvania Perelman School of Medicine, Massachusetts General Hospital, and Washington University School of Medicine in St. Louis.

FAER MSARF Fellow (2017)
• Matthew Orlowski (West Virginia University School of Medicine) - Effects on Tolerance of Morphine Induced Interactions Between PDGFR-beta and EGFR in Rat Models

FAER MSARF Fellows (2018)
• Austin Cusick (Ohio University Heritage College of Osteopathic Medicine) - Localizing Brain Areas for Response of Acute Exacerbations in Chronic Low Back Pain Patients with Negative Affect
• Jeffrey Johnson (Florida State University College of Medicine) - Perioperative Neurocognitive Disorder: MRI Changes Before and After Surgery

Research Training in Anesthesiology and Pain Medicine
Program Director: Yan Xu, PhD

FY18 Fellows

Benedict J. Alter, MD, PhD

Education/Training:
University of Pittsburgh, T32 Postdoctoral Scholar
University of Pittsburgh, Pain Medicine Fellowship, 2018
University of California, San Francisco, Anesthesiology Residency, Research Scholars track, 2017
Research mentor: Dr. Howard Fields, MD, PhD
Washington University School of Medicine, MD and PhD in Neuroscience, 2012
Research mentor: Dr. Rob Gereau, PhD
Washington University in St. Louis, AB Biology - Summa cum Laude, 2003

Mentor: Ajay Wasan, MD, MSc, Vice Chair for Pain Medicine, Professor of Anesthesiology and Perioperative Medicine and Psychiatry, University of Pittsburgh

Research Overview
The complicated process by which a painful stimulus becomes a painful perception is central to pain neurobiology and to the clinical problem of pain management. Interestingly, the perception of pain is far removed from the transduction of painful stimuli (nociception). Significant top-down processing is known to occur, allowing for a state-dependence of pain perception. How an organism integrates different behavioral states with incoming nociceptive signals strongly shapes pain perception. One example of this process can be found in placebo analgesia, where prior experiences of pain relief lead to analgesia with the administration of an inert substance. My overall hypothesis is that changes in top-down processing of pain perception contribute to the development and maintenance of chronic pain states. My goals are to improve our understanding of descending modulatory systems in health and disease, target these systems to develop novel interventions for pain management, and develop assessment tools measuring descending modulation for clinical and translational use.

During my residency and T32-funded postdoctoral work, I have investigated a psychophysical manifestation of descending modulation in healthy volunteers, termed “offset analgesia,” and found that offset analgesia can be contingently paired with cues in a training paradigm such that following training the cues themselves are analgesic. Future directions include exploring the neural and physiologic correlates of this paradigm, identifying key behavioral parameters driving conditioned learning, and translating this behavioral intervention to pain management.
RESEARCH FELLOWSHIPS

Publications and Abstracts

Grants
- PI, Neural and physiologic correlates of endogenous analgesia. UPMC Department of Anesthesiology and Perioperative Medicine Seed Grant, 3/2019-3/2020
  This project tests the hypothesis that different psychophysical responses thought to reflect endogenous analgesia share similar effector mechanisms in healthy volunteers using behavioral manipulations, physiologic monitoring of heart rate and skin conductance, and brain imaging with functional near-infrared spectroscopy.

Joel Caporoso, PhD

Education/Training:
BS, Biochemistry, Saint Vincent College
MS, Chemistry, The University of Akron
PhD, Chemistry, The University of Akron
T32 Postdoctoral Fellow, University of Pittsburgh School of Medicine, Department of Anesthesiology and Perioperative Medicine

Mentor: Yan Xu, PhD
Vice Chair for Basic Research, Department of Anesthesiology and Perioperative Medicine; Peter Winter Professor of Anesthesiology; Professor of Pharmacology & Chemical Biology, Physics & Astronomy, and Structural Biology

Research Overview
My current research interests include the development and evaluation of novel therapeutics to treat chronic pain. Our drug discovery approach begins with the glycine receptors, which are ligand-gated ion channels important for the sensation of pain. It was recently established that the primary component of marijuana, Δ(9)-tetrahydrocannabinol (THC), produces analgesia through potentiation of glycine receptors; however, THC also produces psychoactive side effects through interactions with other receptors. Therefore, a novel analgesic that can specifically target the glycine receptor is highly desirable. Molecular modeling allows us to screen potential lead compounds for target specificity and electrophysiology is then employed to verify their allosteric effects on the glycine receptor. Various modern nociception tests on rodent models are used to measure the in vivo analgesic effects of validated compounds. Preliminary data on one lead compound series suggest that they are potent analgesics with three actions: the first against inflammatory pain when administered alone, the second against neuropathic pain, and the third against normal nociception when administered with sub-therapeutic morphine. Further development of this drug may have a significant impact on the reduction of clinical opioid use.

Graduate Research
My previous research interests for my doctoral dissertation involved the study of ribonucleoprotein complexes through integrated methods. Various biophysical techniques such as nuclear magnetic resonance and small-angle X-ray scattering were combined with classical biochemical methods to study the structure and binding relationship of SMRT/HDAC1 Associated Repressor Protein with Steroid Activator RNA 1.
Maria Cohen, MD

Education/Training:
BA, Biology, Case Western Reserve University  
MD, Northeast Ohio Medical University  
Internship, Integrated Cardiothoracic Surgery, UPMC  
T32 Postdoctoral Fellowship, University of Pittsburgh School of Medicine, Department of Anesthesiology and Perioperative Medicine

Mentor: Yoram Vodovotz, PhD, Professor of Surgery, Immunology, Bioengineering, Computational Biology, Clinical and Translational Science, and Communication Science and Disorders, Department of Surgery

Research Overview
Current research includes pharmacogenomics in trauma patients, specifically looking at candidate single nucleotide polymorphisms (SNPs) linked with anesthetic medications and their associations with clinical outcomes and systemic inflammatory mediators. Recent SNPs associated with anesthetics are 1) sevoflurane and rs1695, rs4715332, and rs2032582; 2) propofol and rs6746030 and rs6313; 3) opioids and rs1799971. We are studying the clinical outcome parameters of intensive care unit (ICU) length of stay (LOS), total LOS, requirement for ventilation, length of time on ventilation support, and Marshall multiple organ dysfunction score. Thirty-one systemic inflammatory mediators are measured as well. Additionally, a review paper on SNP quality control and validation is in preparation. Research goals include advancing our understanding of SNP studies and anesthetic medications and their impact and contribution to precision medicine and pharmacogenomics.

Publications

Presentations
Michael Schnetz, MD, PhD

Education/Training:
Case Western Reserve University, MD, 2014
Case Western Reserve University, PhD Genomics, 2010
Westminster College, BS, Biochemistry, 2004

Mentors:
- A. Murat Kaynar, MD, MPH (primary), Professor, Departments of Critical Care Medicine and Anesthesiology and Perioperative Medicine
- Harry Hochheiser, PhD, Associate Professor, Department of Biomedical Informatics; Associate Professor, Intelligent Systems Program
- David Danks, PhD, Department Head & L.L. Thurstone Professor of Philosophy and Psychology, Carnegie Mellon University
- Douglas Landsittel, PhD, Professor of Biomedical Informatics, Biostatistics, and Clinical and Translational Science
- Michael Becich MD, PhD, Chairman and Distinguished University Professor, Department of Biomedical Informatics; Professor of Pathology, Information Sciences, Telecommunications and Clinical/Translational Sciences
- Yan Xu PhD, Peter Winter Professor of Anesthesiology; Professor of Pharmacology & Chemical Biology, Physics & Astronomy, and Structural Biology
- Aman Mahajan, MD, PhD, MBA, Professor of Anesthesiology and Perioperative Medicine, Bioinformatics, and Pharmacology; Professor of Bioengineering, Swanson School of Engineering

Research Overview
My research efforts are currently focused on using big data approaches to better understand complex patient physiology as expressed during surgery and its relationship to postoperative outcomes. Specifically, we have developed a technology called the Triple Variable Index (TVI) that combines the information generated across time from three common monitoring systems, MAP, BIS, and MAC. We have used TVI to identify commonly expressed patterns of intraoperative physiology with distinctive patient, procedure, and outcome characteristics. TVI patterns differ in their intraoperative hypotension profiles and we have developed a prediction model to identify patients early in surgery who will experience a pattern of severe hypotension. This model will allow clinicians to implement early therapy to reduce hypotension and prevent hypotension-related complications. The TVI project has led to one publication and another under peer-review for publication in the journal Anesthesiology. More broadly, I am interested in mapping the behavior of intraoperative patterns of physiology in the postoperative period to identify common “clinical trajectories” that lead to postoperative death. The identification of such trajectories will broaden the potential space for clinical intervention to prevent poor outcomes.

Grants

Publications and Abstracts
The 16th annual Safar Symposium and sixth annual Multi-Departmental Trainees’ Research Day was held May 31-June 1, 2018. This yearly event honors the late Dr. Peter Safar and his wife Eva for their contributions to the scientific community and highlights current research in areas spanning Dr. Safar’s interests. The research day event is a collaboration between the Departments of Anesthesiology, Critical Care Medicine, Emergency Medicine, Neurological Surgery, and Physical Medicine & Rehabilitation, as well as the Peter M. Winter Institute for Simulation Education and Research (WISER).

The theme of the 2018 event was The Opioid Epidemic: Implications for Resuscitation Medicine. Forty-one posters were presented, as well as five oral presentations from trainees in each of the five collaborating departments. Kerry Ann Koper, an undergraduate student working with mentor Yan Xu, PhD, was the oral presenter from the Department of Anesthesiology, presenting “T1 Difference Image Voxel by Voxel Variance Analysis Reveals Blood Brain Barrier Changes in Mice Following Cardiac Arrest and Resuscitation.”

Benedict Alter, MD, PhD, a pain medicine fellow and T32 postdoctoral scholar, tied for the Best Poster Award among all the posters at the symposium for “Optimizing Conditioned Analgesia for Translational Applications.” Two trainees tied for the top Department of Anesthesiology poster award. Christopher (Tyler) Smith, MD, a PGY-2 anesthesiology resident working with mentors James Ibinson, MD, PhD and Keith Vogt, MD, PhD, presented the poster “Midazolam Sedation During the Periodic Experience of Pain Decreases Functional Connectivity both Within and Between Brain Systems for Pain Processing and Memory Encoding” and Marta Wells, BS, a graduate student working with mentor Pei Tang, PhD, presented “Structure Determination of the α7 Nicotinic Acetylcholine Receptor Intracellular Domain.”

Lewis S. Nelson, MD, Professor and Chair of Emergency Medicine, and Chief of the Division of Medical Toxicology, Rutgers New Jersey Medical School, delivered the 38th Peter and Eva Safar Annual Lecture in Medical Sciences and Humanities, “The Newest Opium War: Insights into the Current Opioid Crisis.”

WISER director Paul E. Phrampus, MD moderated day two of the symposium, which focused on Advancing Your Nursing Career Through Simulation.
OPTIMIZING CONDITIONED ANALGESIA FOR TRANSLATIONAL APPLICATIONS
Alter B, Strigo I, Fields H

1Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh School of Medicine
2Department of Anesthesia and Perioperative Care, University of California San Francisco
3Department of Psychiatry, University of California San Francisco
4Department of Neurology, University of California San Francisco

INTRODUCTION
Pain and pain relief are strongly affected by learning. Classical conditioning techniques have been used in experimental settings to produce analgesia. In healthy volunteers, visual or auditory cues (conditioned stimuli, CS) can be paired with an analgesic manipulation (unconditioned stimulus, UCS) to elicit conditioned analgesia. Despite these discoveries, the key characteristics of the CS and UCS required for optimal analgesia are largely unknown, including which modality of cue (visual, auditory, or audiovisual) is most effective. Cue optimization in healthy volunteers will allow for more rapid translation of conditioned analgesia as an adjunctive non-pharmacologic therapy in clinical populations.

HYPOTHESIS
In healthy volunteers, multimodal audiovisual cues elicit greater analgesia than auditory or visual cues in a novel conditioned analgesia paradigm using offset analgesia.

METHODS
Eighty-one healthy volunteers were randomized into one of four groups based on CS: (1) a visual CS (blue field with “pain relief”), (2) an auditory CS (simple tone), (3) an audiovisual CS (combination of the visual and auditory CS), and (4) a non-contingently paired control group. In all groups, the UCS was an endogenous analgesic phenomenon known as offset analgesia, evoked with a complex heat stimulus delivered using a cutaneous thermode applied to the volar surface of the forearm. During a training phase, UCS and CS were paired nine times in each group, with CS varying by group. Conditioned analgesia was measured by presenting the CS during a noxious heat stimulus without offset analgesia. Other within-subject controls included target CS, novel CS, and no CS test conditions. A two-way repeated measures ANOVA model with post-hoc testing was used to measure differences within and across subject groups.

RESULTS
Following training in the test phase, both visual and audiovisual CS presentation during a noxious heat stimulus resulted in significant decreases in pain, measured on COVAS. Interestingly, there was no significant decrease in pain in the auditory group. Importantly, there was no decrease in pain in the non-contingent control group. The magnitude of conditioned analgesia in the visual group was large – comparing the visual and non-contingent control groups showed a mean difference in pain intensity in the test phase of 27.6 mm (95% CI, 7.6 mm – 47.5 mm, adjusted p=0.0036).

CONCLUSIONS
Visual and audiovisual groups demonstrated evidence of conditioned analgesia, although there was no significant difference between the two groups. Auditory stimuli were not sufficient to elicit conditioned analgesia. Moreover, using offset analgesia as a UCS in this novel paradigm was effective in eliciting conditioned analgesia.

SIGNIFICANCE
Visual conditioning cues can elicit significant analgesia in the conditioned analgesia paradigm described above. The tested paradigm could potentially be used in clinical contexts as an opioid-sparring adjunct. One area of interest is in patients requiring intravenous patient-controlled analgesia-delivered opioids for post-operative pain management.

RESEARCH / GRANT SUPPORT
Financial support was provided by the Foundation for Anesthesia Education and Research “Research Fellowship Grant” (BA) and Research Scholar Funds from the UCSF Department of Anesthesia and Perioperative Care (BA).
THE TRIPLE VARIABLE INDEX REVEALS SHARED PATTERNS OF PHYSIOLOGY THAT BROADEN THE UTILITY OF COMMON INTRAOPERATIVE MONITORING SYSTEMS TO CAPTURE RISK INFORMATION NOT IDENTIFIED BY ESTABLISHED MODELS


INTRODUCTION

Triple low state studies suggest that relationships between MAP, BIS, and MAC levels during surgery contain valuable, clinically relevant information not revealed by the variables individually. The triple low state is associated with postoperative death\(^1\)-\(^3\), yet its defining thresholds, MAP <75 mmHg, BIS <45, and MAC <0.8, are not individually associated with risk. The combined behavior of MAP, BIS, MAC levels captured moment to moment during surgery in individual patients remains uncharacterized. Additionally, how such information may improve our understanding of patient physiology and perioperative risk remains unknown.

Here, we introduce a novel methodology called the Triple Variable Index (TVI) that combines the information generated from concurrently monitored MAP, BIS, and MAC levels into a single composite variable that can be mapped across time. We hypothesized that TVI analysis identifies key relationships that 1) underlie MAP, BIS, and MAC behavior, and 2) identified relationships capture a multitude of risk information that informs postoperative mortality.

METHODS

Surgeries monitoring concurrent MAP, BIS, and inhaled anesthetic concentrations in adult patients (\(\geq\)18 years) at UPMC between January and July 2014 were identified (n=5,296). Applying the TVI methodology, MAP, BIS, and MAC data were normalized, combined into a single index variable, and mapped over time, and k-means were clustered (unsupervised machine learning algorithm). Patient, surgical, and physiologic characteristics, intraoperative medications and events, and postoperative mortality were compared between identified clusters.

RESULTS

We analyzed 333,179; 168,007; and 199,311 individual MAP, BIS, and MAC measurements respectively to generate and map 54,574 TVI values. We identified commonly expressed patterns of physiology characterized by unanticipated relationships between MAP, BIS, and MAC variables, considering the known effects of inhaled anesthetics. An elevated pattern displayed the highest MAP and BIS levels despite being exposed to the highest MAC levels (86.5 mmHg, 45.3, and 0.98, respectively). A depressed pattern displayed the lowest MAP and BIS levels while being exposed to the lowest MAC levels (76.6 mmHg, 38.0, 0.66). Patterns are associated with numerous factors that likely form complex interactions to influence TVI expression. Depressed pattern surgeries were most frequently associated with increased patient age (54.5 yrs.), ASA Physical Status 4 (27.3%) and 5 (1.6%), cardiac and emergent surgery (16% and 12.8%), cardiopulmonary bypass (9.8%), and etomidate (12.6%),
phenylephrine (83.0%), epinephrine (18.0%), norepinephrine (21.2%), vasopressin (21.0%), and remifentanil (8.5%) administration during surgery. Pattern (elevated, mixed, depressed) surgeries were associated with distinct levels of intraoperative hypotension (28.8%, 33.0%, 52.3%), triple low state exposure (9.4%, 30.3%, 80.0%), and 30-day postoperative mortality (0.8%, 2.7%, 5.6%). TVI analysis informs the risk of postoperative death at MAP and BIS levels (75 mmHg, 40) commonly observed but not associated with risk and in a higher proportion of study surgeries than hypotension and triple low state models (100% vs. 38% and 41%, respectively).

CONCLUSIONS
Intraoperative monitoring data contain valuable information beyond that used for common clinical applications.

REFERENCES
EMOTIONAL BURDEN AND PSYCHOPHYSICAL PREDICTORS OF LABOR PAIN
Grace Lim, MD, MS1; Lia M. Farrell, BS1; Andrea Gillman, PhD2; Robert R. Edwards, PhD3; Ajay D. Wasan, MD, MSc2

1University of Pittsburgh & UPMC Magee-Womens Hospital
2University of Pittsburgh & UPMC Pain Medicine at Centre Commons
3Harvard Medical School, Brigham & Women’s Hospital, Boston, MA

INTRODUCTION
Labor analgesia is associated with reduced risk for postpartum depression (1,2,3), but the nature of this relationship is poorly understood. Understanding the relationship is key to identifying the role that targeted analgesic interventions may play in women predisposed to pain-associated depression. As a first step to better understanding this relationship, we aimed to characterize the physical and emotional components of labor pain and identify psychophysical predictors of labor pain.

METHODS
After giving written informed consent, pregnant women in their third trimester with singleton gestation and planning to use labor epidural analgesia were recruited and prospectively followed. At the third trimester clinic visit, psychometric assessment by quantitative sensory testing (QST) measurements, encompassing heat threshold and tolerance, pressure threshold and tolerance, and heat and mechanical temporal summation, were recorded. Baseline anxiety, pain catastrophizing, and resiliency were measured. During labor and delivery, women completed hourly assessments of pain intensity and pain unpleasantness by visual analog scale on 100-millimeter lines using an electronic pain diary. Pearson coefficient estimated the correlation between pain intensity and pain unpleasantness. The relationship between QST variables and pain burden was assessed using simple and multiple linear regression, in which baseline and demographic variables were controlled.

RESULTS
Fifty-six women completed all study procedures. Pain intensity and pain unpleasantness were highly correlated, indicating similar emotional and physical pain burdens during labor (Pearson correlation coefficient estimate, 0.97). Pain intensity and unpleasantness exhibited high inter- and intra-individual variability (Figure). Heat and mechanical temporal summation are significant predictors of pain intensity burden (data to be presented).

CONCLUSIONS
The physical and emotional components of pain are highly correlated in laboring women. Heat and mechanical temporal summation predict labor pain intensity, with mechanical temporal summation being easily performed at the bedside. Psychophysical predictors of labor pain will classify women susceptible to severe labor pain, enabling targeted enrollment for future investigations.

REFERENCES
MODERATION-MEDIATION EFFECTS BETWEEN LABOR AND POSTPARTUM PAIN, PRENATAL FACTORS, AND POSTPARTUM DEPRESSION
Grace Lim (presenting author)\textsuperscript{1}, Lia M. Farrell\textsuperscript{1}, Stephanie Nam\textsuperscript{1}, and Ajay D. Wasan\textsuperscript{2}
\textsuperscript{1}Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh, UPMC Magee-Womens Hospital
\textsuperscript{2}Department of Anesthesiology and Perioperative Medicine and Psychiatry, University of Pittsburgh, UPMC

BACKGROUND
Labor pain has been linked to postpartum depression, but the mechanism for this relationship is unclear. Moderator-mediator models can investigate indirect associations between pain and depression. The nature of the relationship between labor and puerperal pain and depression is critical to understanding modifiable risk factors for depression.

OBJECTIVES
To assess psychometric and psychological factors predictive of labor and puerperal pain and depression, and to assess moderating-mediating effects between pain and depression.

METHODS
A prospective observational design was chosen. Primiparous women planning a vaginal delivery were enrolled in the third trimester and followed until three months postpartum. The primary outcome was depression score at six weeks postpartum (Edinburgh Postnatal Depression Scale, EPDS). Baseline assessments of depression, anxiety, perceived social support, catastrophizing, and quantitative sensory testing (QST) variables were completed. During labor and delivery, hourly assessments of pain intensity and pain unpleasantness using an electronic pain diary were recorded. Postpartum assessments included EPDS, pain inventory, anxiety, perceived stress, maternal-infant bonding, breastfeeding, infant development, and parenting self-efficacy. Analyses will be stratified by epidural analgesia utilization, to assess a moderation effect by analgesia preference. Multivariable linear regression will assess: (1) the pain and depression relationship, controlling for covariates; and (2) pain as a mediator in the relationship between psychiatric variables and depression.

RESULTS
Fifty-seven women who received labor epidural analgesia and 17 women who received no analgesia completed study procedures. Analysis is in progress.

CONCLUSIONS
Factors associated with labor and puerperal pain and depression will be identified. Moderator-mediator effects will be presented.
UNUSUALLY EARLY PRESENTATION OF SEPTIC PELVIC THROMBOPHLEBITIS
AFTER TXA FOR POSTPARTUM HEMORRHAGE

David L. Seng, DO (presenting author); Grace Lim, MD, MS
Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh & UPMC

INTRODUCTION
Tranexamic acid (TXA) has recently gained traction for postpartum hemorrhage (PPH) after demonstrating a reduction in death due to bleeding in the WOMAN trial (1). However, in higher-resource settings where TXA and its effect on maternal morbidity and mortality remains vague, there may still be uncertainty regarding whether administration in this setting is linked to unmitigated thromboembolic events.

CASE
A 31-year-old G4P3013 with a history of systemic lupus erythematosus presented at 38 weeks and six days gestation with preeclampsia without severe features. A repeat cesarean delivery was performed under spinal anesthesia. Atony was reported despite an infusion of 20 IU per hour of oxytocin and a subsequent increase to 36 IU per hour, two 200 microgram doses of intramuscular carboprost, and 10 units of oxytocin into the uterine musculature. TXA 1 gm was given intravenously. A B-Lynch suture resulted in adequate hemostasis. Estimated blood loss after the procedure was 1750 mL. Postoperatively, atony continued with copious clots on fundal exam. The patient underwent bilateral uterine artery embolization. On postpartum day 2, she became progressively tachycardic with fever. Computer tomography (CT) of the chest, abdomen, and pelvis did not show evidence of pulmonary embolism. However, thrombosis of the right gonadal vein with extension into the inferior vena cava was noted. A diagnosis of septic pelvic thrombophlebitis was made. She was started on a six-month course of anticoagulation with low-molecular weight heparin after a negative workup for bleeding disorders.

DISCUSSION
Septic pelvic thrombophlebitis (SPT) is a diagnosis of exclusion and a rare condition affecting 1:800 cesarean deliveries and 1:9000 vaginal deliveries, typically diagnosed one to two weeks postpartum (2). Suspicion of SPT in this patient was raised, given her risk factors and presentation: cesarean delivery, a dextro-occluded ovarian vein seen on CT, and a constellation of symptoms including unabating fever, tachycardia, and abdominal pain. However, one may question if TXA provoked or exacerbated early thrombus formation in this case. This concern for uncontrolled clotting is universally prefaced in many studies and is the focus of a French case series by Frimat et al. where 18 cases of renal cortical necrosis were identified in patients given TXA for PPH, albeit at high doses (3). With data thus far suggesting a modest effect size of TXA for PPH on maternal mortality in higher-resource settings (4), the question of benefit over harm in these environments may remain a legitimate point of investigation.

REFERENCES
1. Lancet. 2017 May 27; 389 (10084):2105-16
THE EFFECT OF GENDER ON 360-DEGREE EVALUATIONS AT ONE ACADEMIC CENTER
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UPMC Children’s Hospital of Pittsburgh

INTRODUCTION
Gender bias is a potential issue in the education environment. It may affect how medical students, residents, and fellows are educated, evaluated, and provided feedback. Some studies have demonstrated that female trainees receive less independence, are graded differently from male trainees, and receive more critical feedback. There is currently limited data investigating the influence of the gender of the evaluator on male and female trainees. Do male evaluators grade female trainees more harshly than male trainees or do female evaluators grade female trainees more harshly? We hypothesized that the evaluations of male and female trainees would be different from male and female evaluators. Specifically, we hypothesized that female evaluators would be more critical than male evaluators when grading female trainees.

METHODS
At UPMC Children’s Hospital of Pittsburgh, gender of the evaluator has been tracked as part of the 360-degree evaluation tool for the pediatric anesthesiology fellowship. Fellows receive evaluations from PACU nurses, preoperative nurse practitioners, anesthesia technicians, and administrative staff as part of their 360-degree evaluation process. They are evaluated on a Likert scale (1=unsatisfactory, 9=superior) on qualities related to professionalism and communication, not patient care or medical knowledge. Tracking gender of the evaluator allows comparison of evaluator gender to fellow gender. An overall grade was collected for each fellow from each evaluator.

RESULTS
Deidentified data from 2014 to 2017 was retrospectively reviewed for 360-degree evaluations. From 2014 to 2017, 577 evaluations were performed on 36 fellows (20 male, 16 female). Male fellows received 354 evaluations and female fellows received 223. A global score was collected for each evaluation. The average global score for females was higher than for males (8.52 vs. 8.41, respectively), but this was not statistically significant (p=0.129). The global scores for male and female fellows were separately investigated from male and female evaluators. The results are outlined in Table 1.

DISCUSSION
The global score from a 360-degree evaluation tool demonstrated higher scores for female fellows than for male fellows in one academic center. This difference was even higher from male evaluators. This finding differed from the hypothesis that gender bias may result in lower scores for female fellows and suggests that gender bias may not be as prevalent in this specific population with this specific tool. It is possible that the evaluation tool used affected the results and was biased in favor of female fellows.

<table>
<thead>
<tr>
<th>Fellow Gender (total number)</th>
<th>Female Evaluator Grade</th>
<th>Female Evaluator Grade</th>
<th>Male Evaluator Grade</th>
<th>Male Evaluator Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female (223)</td>
<td>8.47</td>
<td>8.61</td>
<td>0.03</td>
<td>0.29</td>
</tr>
<tr>
<td>Male (354)</td>
<td>8.42</td>
<td>8.42</td>
<td></td>
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</tr>
</tbody>
</table>

Table 1. Effect of evaluator gender on fellow 360-degree global score
The following abstract was presented at the 7th International Association for the Study of Pain (IASP) World Congress on Pain in Boston, MA, September 12-16, 2018.

HYPERALGESIA IN EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS: MEDIATION BY ASTROCYTES IN THE DORSAL HORN?
Benjamin C. Shaw, Suzanne Doolen, Renee R. Donahue, Carolyn M. Grachen, Bradley K. Taylor

AIM OF INVESTIGATION
Multiple sclerosis (MS) is a human neuroinflammatory disease, affecting millions of individuals worldwide. Common consequences of MS include autonomic dysregulation, paresis or paralysis, fatigue, and chronic pain. The prevalence of pain is high (about 50%, many indicating this is the most debilitating symptom), and is refractory to disease-modifying therapies (DMTs) and even opioid analgesics. Despite this, we know little of the neurobiological mechanisms underlying the pain of MS. Our most useful tool in understanding this mechanism is an animal model of MS—experimental autoimmune encephalomyelitis (EAE). Our recent publication in PAIN established a dose-dependent correlation between fingolimod, an S1PR agonist, and reduction of EAE-induced astrogliosis and hyperalgesia. Astrocytes are key mediators of many animal models of chronic pain, and a logical target given their pathological role in MS. The aim of this investigation was to extend our previous correlative data into a more causative description of the spinal mechanisms of EAE-induced hyperalgesia.

METHODS
We induced EAE in female C57BL/6 mice with subcutaneous injections to each flank of an emulsion containing 250 μg heat-inactivated Mycobacterium tuberculosis and 150 μg MOG35-55 (myelin oligodendrocyte glycoprotein, residues 35-55) per injection, with two injections on D0 and two on D6. This is a relatively low dose that yields a mild form of EAE that does not produce frank paralysis, allowing us to test evoked behaviors. To increase permeability of the blood-brain barrier, mice received pertussis toxin (200 ng per injection, i.p.) on D0 and D2. We tested mechanical hyperalgesia (von Frey filaments), cold hyperalgesia (plantar application of 10 μL acetone), and neuromotor dysfunction (Clinical Scoring with a 0-10 ordinal scale). Drugs were administered at the initial peak of EAE-associated mechanical hyperalgesia (von Frey threshold less than 0.20 g) as either a single dose or once daily for 14 days, followed by further behavioral testing before collection of spinal cords for localization and quantification of glial fibrillary acidic protein (GFAP).

RESULTS
Using the S1PR1-eGFP mouse, we found that dorsal horn astrocytes robustly express S1PR1 at the plasma membrane, a key target for the treatment of the pain of EAE. We next injected L-alpha-aminoadipate (LAA, 100 nmol, intrathecal) to selectively ablate astrocytes. Preliminary qualitative analysis of astrocyte number using GFAP immunohistochemistry strongly suggests that LAA robustly decreased GFAP immunoreactivity. Consistent with the literature using LAA in other models of neuropathic pain, LAA but not vehicle reduced mechanical hyperalgesia (two-way ANOVA F1, 10 = 574, p < 0.0001; one-way post-hoc at 24 hour time point 0.98 g ± 0.06 g vs 0.14 g ± 0.01 g, F1, 10 = 177, p < 0.0001, Bonferroni) and cold hyperalgesia (two-way ANOVA F1, 10 = 21, p = 0.0010; one-way post-hoc at 24 hour time point 2.10 s ± 0.45 s vs 6.33 s ± 0.56 s, F1, 10 = 34, p = 0.0010, Bonferroni) in EAE mice.

CONCLUSIONS
We are the first to show that LAA reduces mechanical hyperalgesia in EAE mice and that LAA reduces cold hyperalgesia in any model of neuropathic pain. These early data suggest that astrocytes are key mediators of EAE-induced hyperalgesia. Current studies are in progress to quantify LAA-induced down-regulation of astrocyte number and GFAP intensity, and to determine the astrocytic signaling pathways, e.g. those involving JNK, in EAE.

ACKNOWLEDGMENTS/DISCLOSURES
Supported by NIH T32GM118292 to BCS, NIH K01DA031961 to SD, and NIH R01NS62306 to BKT.
The following abstract was presented at the 7th International Association for the Study of Pain (IASP) World Congress on Pain in Boston, MA, September 12-16, 2018.

KAPPA OPIOID RECEPTORS PROVIDE ENDOGENOUS POSTOPERATIVE ANALGESIA BY INHIBITING AN ADENYLYL CYCLASE-1-DEPENDENT MECHANISM IN THE SPINAL CORD
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2. Department of Physiology, University of Kentucky, Lexington, Kentucky, and Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania

AIM OF INVESTIGATION
We employed a murine model of chronic postoperative pain that engenders a silent, long-lasting sensitization of nociceptive neurons (latent sensitization, LS) in the dorsal horn; a phenomenon that is masked by the compensatory activity of endogenous inhibitory systems (Corder et al., Science, 2013; Solway et al., PNAS, 2011). We hypothesized that kappa opioid receptor (KOR) signaling participates in the masking of LS by inhibiting adenylyl cyclase-1 (AC1) and/or the downstream cAMP target proteins protein kinase A (PKA) and exchange protein activated by cAMP (Epac).

METHODS
We performed surgical incision (SI) of the hindpaw in C57BL/6 mice (Jang JD et al, J Neuroinfl, 2011), and then waited four weeks or 13 months after the resolution of mechanical hypersensitivity (up-down method using von Frey hairs). Next, we intrathecally (i.t.) delivered selective KOR antagonists (Nor-BNI and LY2456302, 0.1ug, 1ug, 10ug), and evaluated mechanical sensitivity at 1h, 2h, 3h, 6h, 24h, 48h, 72h, 96h, and 120h time points. To examine LS-associated sensitization of spinal neurons, we used immunohistochemistry to localize and quantify light touch-induced expression of phosphorylated signal-regulated kinase (pERK) in the dorsal horn. Lastly, to test the hypothesis that LS is driven by AC1 signaling, we administered the AC1 inhibitor (NB001, 1.5ug, i.t.) 15 minutes before LY2456302 (10ug, i.t.).

RESULTS
When compared to vehicle controls (5 ul, i.t.), we found that Nor-BNI or LY2456302 reinstated mechanical hypersensitivity in a dose-dependent manner when delivered four weeks after SI (two-way ANOVA F (27) =3.7 (Nor-BNI); p<0.0001; F (33) =5.6, p<0.0001 (LY)). NB001 reversed reinstatement of mechanical hypersensitivity induced by LY2456302 (two-way ANOVA F (15, 60) = 3.65, p<0.0002). LY2456302 (10ug, i.t.) increased the number of light touch-induced pERK-positive profiles (one-way ANOVA, F (3, 41) = 27; p<0.001) as compared to saline controls. In a separate study, we found that LY2456302 (10ug) produced reinstatement when delivered 13 months after surgery (two-way ANOVA F (11, 143) = 3.658; p=0.0001), indicating that LS and compensatory KOR analgesia is very long-lasting.

CONCLUSIONS
We conclude that long-lasting KOR signaling provides endogenous analgesia via inhibition of AC-1 signaling pathways in a preclinical LS model of chronic postoperative pain. We are currently examining whether AC1 gene deletion, PKA inhibitors, or Epac inhibitors prevent LY2456302-induced reinstatement of hypersensitivity.

ACKNOWLEDGMENTS
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The following abstract was a poster presentation at the 7th International Association for the Study of Pain (IASP) World Congress on Pain in Boston, MA, September 12-16, 2018.

**NMDA RECEPTOR SUBTYPES MEDIATE LONG LASTING PAIN SENSITIZATION**

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2: Laboratory of Studies of Pain and Inflammation, School of Applied Sciences, State University of Campinas, Limeira, Brazil

**BACKGROUND**

Blockade of endogenous opioid receptors with naltrexone (NTX) reinstates pain hypersensitivity when conducted months after the resolution of hyperalgesia. The latent sensitization (LS) underlying this phenomenon is mediated in part by NMDA (N-methyl-D-aspartate) receptors (NDMARs) and may contribute to the transition from acute to chronic pain (Corder, Doolen et al. 2013). However, the contribution of specific NMDAR subtypes to LS is unknown.

**AIM**

We evaluated the contribution of GluN2A, GluN2B, and GluN3 subtypes to NTX-induced pain reinstatement.

**METHODS**

C57BL male mice (20-25g) were submitted to a plantar incision model (PIM). On day 21 after PIM, mice were pre-treated with GluN2A antagonist PEAQX (3-100 ng/5µL, i.t.), GluN2B antagonist Ro 25-6981 (0.01-10 µg, i.t./5µL) or JR220 (3-100 mg/kg, s.c.), and the GluN3 antagonist TK30 (30-300 ng, i.t./5µL). NTX (3 mg/kg s.c.) was administered 15 minutes later. Mechanical hypersensitivity was assessed with von Frey filaments.

**RESULTS**

PEAQX prevented NTX-induced pain reinstatement in a dose-dependent manner, with a peak effect from 30 to 120 minutes after injection (Fig. 1, p < 0.05, n=8). Ro 25-6981 prevented NTX-induced pain reinstatement at 90 minutes after injection (Fig. 2, p < 0.05, n=8). TK30 prevented NTX-induced pain reinstatement at 60 minutes after injection (Fig. 3, p < 0.05, n=8).

**CONCLUSION**

The NMDAR subtypes GluN2A, GluN2B, and GluN3 modulate NTX-induced pain reinstatement and are important targets to better understand the mechanism of the transition from acute to chronic pain.

**REFERENCE**


**ACKNOWLEDGMENTS**

NIH DA37621 and NS45954-12 to BKT
THE EFFECT OF PERIPHERAL NERVE INJURY ON NEUROPEPTIDE Y1 RECEPTOR EXPRESSION IN INTERNEURONAL POPULATIONS WITHIN THE DORSAL HORN OF THE MOUSE SPINAL CORD

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AIMS
Peripheral nerve injury results in long-lasting neuropathic pain, and current analgesic strategies suffer from inadequate efficacy and a range of adverse effects, including abuse and addiction potential. This can be partially attributed to a limited understanding of nociceptive circuitry within the superficial dorsal horn (DH) of the spinal cord. Amongst potential novel analgesic targets are spinal neurons expressing the neuropeptide Y (NPY) Y1 receptor (Y1R). Endogenous NPY exerts a tonic inhibition of nociceptive signaling following nerve injury, and intrathecal administration of NPY has also been shown to attenuate neuropathic pain; this activity is diminished following the application of Y1R-specific antagonists. Y1Rs are expressed by a heterogenous population of largely excitatory interneurons and projection neurons in the rodent spinal cord and are most predominant in laminae I-III of the DH. Multiple distinct subpopulations of excitatory interneurons have been identified; however, it is unclear which ones express the Y1R and how these integrate into neuronal circuits. Therefore, we investigated Y1R expression with various neurochemically-defined interneuron populations. Specifically, we tested the hypothesis that spared nerve injury (SNI) alters the phenotype of Y1R-expressing interneurons within the DH of mice.

METHODS
All procedures were approved by the University of Kentucky IACUC in accordance with AVMA and IASP guidelines. Adult male Npy1r-eGFP mice (RRID: MMRRC_010554-UCD) underwent either sham or SNI surgery (n = 3/group). Before and 14 days after surgery, mechanical withdrawal thresholds were assessed via application of von Frey filaments to the plantar surface of the hindpaw using the up-down method. Then, following perfusion-fixation, spinal cords were collected and 30 µm L4-5 lumbar sections (5-6 per animal) were immunostained for the neurochemical markers of DH interneuron populations Tlx3 (T-Cell Leukemia Homeobox 3; excitatory interneurons), Pax2 (Paired Box 2; inhibitory interneurons), nNOS (neuronal nitric oxide synthase), calretinin or PKCγ (Protein kinase C gamma) (distinct interneuron subpopulations). Co-labelling of these markers with Y1R-associated eGFP fluorescence was then quantified within regions of the superficial DH (laminae I-III) innervated by transected sciatic nerves7 (medial; M) and the spared sural nerve (centro-lateral; CL) and compared between sham and SNI groups.

RESULTS
Y1R-eGFP-expressing neurons predominately localized within the superficial laminae of the DH. SNI induced a significant decrease in mechanical withdrawal threshold but did not alter the number of Y1R-eGFP-expressing cells within the DH, even after we segregated our quantification within the mediolateral region innervated by the transected sciatic nerves (M) or the spared sural nerve (CL). Over half of observed Y1R-expressing neurons within the DH could be classified as excitatory; Y1R co-labelled extensively with Tlx3 immunofluorescence in M (49.4 ± 3.8%) and CL (54.5 ± 2.9%) regions. This differs from the rat, in which greater than 95% of Y1R-expressing neurons also express Tlx3 (Fu et al., IASP Yokohama 2016). A small percentage of Y1R neurons also were found to co-express markers of the distinct excitatory interneuron populations calretinin (M: 4.8 ± 1.1%; CL: 8.3 ± 1.7%) and PKCγ (M: 18.3 ± 1.9%; CL: 12.6 ± 1.8%). In contrast, little if any Y1R-Pax2 co-labelling was present (M: 1.5 ± 1.2%; CL: 0.8 ± 0.4% Y1R+ cells also expressing Pax2). There was also negligible co-expression of Y1R and the inhibitory interneuron subpopulation marker nNOS (M: 0.2 ± 0.2%; CL: 0.3 ± 0.3%...
of Y1R+ cells also expressing nNOS in M and CL regions respectively). Notably, SNI did not alter Y1R co-labelling with any of these markers, except for PKCγ, in contrast to our previous findings in the rat in which we observed a significant decrease in Tlx3 and an increase in Pax2 Y1R co-labelling. A significant increase in both the number of cells displaying PKCγ immunofluorescence and percentage of Y1R+ neurons also expressing PKCγ was observed following SNI in both the M and CL regions of the DH, both ipsilateral and contralateral to the nerve injury.

CONCLUSIONS
We found that Y1R is expressed within a heterogenous population of largely excitatory interneurons in the mouse DH. By and large, peripheral nerve injury did not change these patterns of expression; however, it did increase the number of PKCγ-expressing neurons. Colocalization differs in mice versus rats. Y1R may present a novel target for spinally-directed analgesics in patient populations whose pain syndromes display resistance to conventional analgesic therapies.

ACKNOWLEDGMENTS
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REFERENCES
This abstract was a poster presentation at the meeting of the Society for Pediatric Anesthesia and the American Academy of Pediatrics, March 23-25, 2018, Phoenix, AZ.

INTRAOPERATIVE INTRAVENOUS LIDOCAINE INFUSION: CASE REPORT FOR TREATMENT OF PEDIATRIC POSTOPERATIVE PAIN
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Pediatric Anesthesiology, UPMC Children’s Hospital of Pittsburgh

SUMMARY
We present the use of intravenous (IV) lidocaine infusion as a supplement for analgesia in a pediatric patient undergoing a portosystemic shunt and splenectomy.

CASE REPORT
A 13-year-old, 50kg boy with a history of frequent episodes of severe bleeding secondary to portal hypertension due to extrahepatic portal venous thrombosis underwent a large midline incision from xyphoid to pubic symphysis for portosystemic shunt and splenectomy. Preoperative studies revealed an otherwise normal liver profile, but a platelet count of 49,000/mm3. After IV induction of general anesthesia, he received a bolus of 2mg/kg of 1% lidocaine, followed by infusion of 2mg/kg/hr and 1mg/kg of ketamine, followed by an infusion of 0.1mg/kg/hr. Fentanyl 3mcg/kg was given as additional intra-operative analgesia. No cardiac dysrhythmias or episodes of hypotension were noticed. Two plasma lidocaine levels were measured: right after the start of infusion - 2.4mg/ml and seven hours later prior to extubation - 4.1mg/ml. Extubation was uneventful and the patient was transported to the pediatric ICU. Postoperative analgesia was hydromorphone patient-controlled analgesia (5 mcg/kg/hr) and ketamine infusion (0.1 mg/kg/hr). The patient was moved from the pediatric ICU to floor on postoperative day 1. Numerical pain scores were less than 2 and overall opioid consumption was minimal.

DISCUSSION
Pain after surgery is a major concern for patients and their families. In our case, regional anesthesia was contraindicated secondary to thrombocytopenia, limiting options for postoperative pain control. IV lidocaine infusion has shown promise for adult perioperative pain management. It demonstrates significant analgesic, anti-hyperalgesic, and anti-inflammatory properties while reducing nausea and ileus duration. Although the exact mechanism is unclear, it is likely due to the decreased need for opioids. Although unknown for pediatric patients, in adults the accepted dosage for analgesia in the perioperative period is an initial bolus of 1-2mg/kg followed by a continuous infusion of 0.5-3mg/kg/hr of IV lidocaine. Plasma levels of lidocaine rapidly decrease after discontinuation of prolonged infusions, with the context-sensitive half-time of a three-day infusion being around 20 to 40 minutes.

Especially in pediatrics where studies are limited and patients are unlikely to report early symptoms of toxicity, monitoring plasma lidocaine is important to ensure that concentrations are below the toxic level of 5mg/ml. Lidocaine has a high hepatic extraction ratio, with its metabolism depending on both hepatic metabolic capacity and hepatic blood flow. In our patient, the second plasma lidocaine value was below the toxic level, but higher than expected. We believe this was a result of liver manipulation during surgery and subsequent elevated transaminases, which were normal preoperatively. We observed a reduction in pain and opioid consumption in the immediate postoperative period, although we were unable to continue the infusion postoperatively. Interestingly, in multiple trials, the analgesic and clinical effects have been shown to exceed the duration by over eight hours, which is more than five times its half-life.

Our case report highlights the need for additional studies on IV lidocaine in the pediatric population.

REFERENCE
Dunn L, Durieux M. Perioperative Use of Intravenous Lidocaine. ANESTHESIOLOGY 2017; 126:729-37
This abstract was a poster presentation at the Fifth Annual Society for Pediatric Pain Medicine Meeting, March 22, 2018 and at the meeting of the Society for Pediatric Anesthesia and the American Academy of Pediatrics, March 23-25, 2018, Phoenix, AZ.

QUADRATUS LUMBORUM BLOCKS FOR FAST TRACK LIVER TRANSPLANTATION
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INTRODUCTION
Postoperative pain immediately following liver transplantation can be significant and delay extubation. Ultrasound-guided quadratus lumborum blocks (QLBs) can facilitate extubation in the operating room and decrease postoperative opioid consumption.

METHODS
We performed a retrospective chart review and identified seven patients (four to 29 years old, mean 17.4 years old) who underwent liver transplantation and had bilateral quadratus lumborum single injection nerve blocks (Figure 1). Four patients had maple syrup urine disease, two patients had Crigler-Najjar syndrome, and one patient had ornithine transcarbamylase deficiency. Three patients received a cadaveric liver and donated their liver to other recipients. Remifentanil (five patients), sufentanil (one patient) and fentanyl (six patients) were used during maintenance of anesthesia. Patient-controlled analgesia with hydromorphone was started immediately after extubation. Postoperative pain scores and consumption of analgesics were presented until 24 hours after conclusion of surgery.

RESULTS
Demographic data and surgical characteristics are presented in Table 1. All blocks were performed under general anesthesia using ultrasound before surgery started. Ropivacaine was the local anesthetic used for all patients and ranged in concentration from 0.2%-1%. Mean volume of ropivacaine administered was 0.3 ml/kg/block (SD +/- 0.09). The mean total amount of ropivacaine administered to each patient was 3.2 mg/kg (SD +/- 0.7). The mean reperfusion time was 273.4 minutes (SD +/- 34.7) after the blocks were performed. Six patients received heparin at a mean interval of 265.3 minutes (SD +/- 64.1) after the blocks were performed. Six patients were extubated immediately after surgery in the operating room. One patient remained intubated secondary to prolonged hemodynamic instability after reperfusion related to the surgical graft. This patient was excluded from the pain score and hydromorphone consumption calculations. There were no incidents of reintubation. Intraoperative and postoperative coagulation profiles are presented in Table 2. The mean pain score over the first 24 hours was 1 (SD +/- 1.6) and the mean hydromorphone consumption over the first 24 hours was 8.7 mcg/kg/hr (SD +/- 2.9).

DISCUSSION
With proper patient selection, QLBs can be effective for intraoperative and postoperative pain control and can facilitate early extubation. The practice of fast track anesthesia may decrease the incidence of pulmonary complications and improve graft function. The blocks should be performed preoperatively to avoid any hematoma formation after reperfusion and heparin administration.

CONCLUSION
More cases are needed to confirm the efficacy and safety of QLB for this patient population.

REFERENCE
This abstract was a poster presentation at the meeting of the Society for Pediatric Anesthesia and the American Academy of Pediatrics, March 23-25, 2018, Phoenix, AZ.

ULTRASOUND-GUIDED SERRATUS ANTERIOR PLANE BLOCK FOR CHEST WALL VASCULAR MALFORMATION RESECTION IN A 13-YEAR-OLD BOY WITH RARE PTEN (PHOSPHATASE AND TENSIN) HAMARTOMA TUMOR SYNDROME

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Surgeries involving the chest wall are among the most painful procedures performed and carry a high risk for chronic pain [1]. Effective pain management helps to promote optimal pulmonary function and avoid complications such as respiratory failure and pneumonia [2]. Opioids are often used but are associated with increased respiratory depression, cough reflex suppression, and delirium. Acceptable regional techniques include intercostal nerve, thoracic paravertebral, and epidural blockade. Intercostal nerve blocks often involve multiple injections, which can be time-consuming [3]. Pneumothorax can occur with both intercostal and paravertebral blockade [3]. Anticoagulation risks, nerve damage, and significant hemodynamic shifts are additional drawbacks associated with paravertebral and neuraxial blockade. Serratus anterior plane block (SAPB) is a novel block with utility for breast procedures, thoracotomy, and rib fracture analgesia. We describe a case where SAPB was used effectively for analgesia following a chest wall malformation resection.

A 39.6kg, 13-year-old boy presented for resection of a right scapular vascular malformation given difficulty laying and sleeping on the mass. He has history of PTEN germline mutation, multiple thoracic and abdominal arteriovenous malformations, a large inferior vena cava aneurysm, and was on twice daily enoxaparin for venous thromboembolism prophylaxis. He underwent general anesthesia and after a 10cm incision, the mass was found directly on the chest wall below the latissimus dorsi and serratus muscle. Part of the intercostal muscle was also resected. A 15x8x4cm soft tissue mass was mobilized and removed. Intraoperatively, he received fentanyl 100mcg, propofol 100mg, dexmedetomidine 8mcg, ketamine 20mg, and acetaminophen 571mg. While supine, a linear array ultrasound transducer (15-6 MHz) was placed across the right mid-axillary line at the level of the fifth rib, where the latissimus dorsi was identified. A 22-gauge, 80mm Sono TAP Pajunk needle was advanced from the supero-anterior to the postero-inferior direction into the fascial plane above the serratus anterior muscle (SAM), where 15cc of 0.5% ropivacaine and 70mcg of clonidine were administered [Fig 1]. Postoperative pain control was excellent, rated as zero on a numeric rating scale (mean 0.37), with minimal requirements for p.r.n intravenous and oral pain medications. The patient was discharged on postoperative day 1 and was able to resume enoxaparin.

Traditional pain control options for patients with chest wall surgeries are associated with multiple side effects, complications, and anticoagulation limitations. SAM is a superficial and easily identifiable target on ultrasound. When close to the mid-axillary line, the lateral cutaneous branch of the intercostal nerves pierces the SAM to innervate the thorax musculature [2]. Injecting anesthetic solution into the fascial plane just superficial to the SAM could provide analgesia to the posterolateral chest wall for surgical pain comparable to paravertebral or epidural blocks. Pneumothorax is also highly unlikely given the superficial location of the block target. SAPBs are simple to perform, less invasive, and can serve as an effective alternative to provide analgesia, reduce opioid usage, and help avoid complications.

REFERENCES
PROPOFOL-RELATED SINGLE NUCLEOTIDE POLYMORPHISMS ARE ASSOCIATED WITH WORSE CLINICAL OUTCOMES AND ALTERED INFLAMMATORY MARKERS IN TRAUMA PATIENTS

Cohen M,1 Shimunek L,2 Namas R,1 Lindberg H,1 Dehaibi F,1 Kaynar M,3 Billiar T,2 Vodovotz Y1

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INTRODUCTION
Propofol is an intravenous anesthetic that is utilized to induce sedation in the setting of critical care. Propofol exhibits a diverse individual response that may be influenced by single nucleotide polymorphisms (SNPs) in serotonin 5HT2A gene (SNP rs6313) and sodium channel SCN9A gene (SNP rs6746030). Rs6313 and rs6746030 are located on chromosomes 13 and 2, respectively, and are in linkage equilibrium (R2 = 0.001). Extensive use of anesthetics and the potential role of novel pharmacogenetics in trauma patients led us to investigate the relationship between propofol-related SNPs, inflammation, and clinical outcomes.

HYPOTHESIS
We hypothesized that the use of anesthetics would impact inflammatory markers and clinical outcomes in trauma patients.

METHODS
Genomic DNA was obtained from 453 blunt trauma patients admitted to the intensive care unit (ICU) and examined for 551,839 SNPs using Illumina Infinium CoreExome-24 v1.1 BeadChip. Patients were segregated into AA and BB genotypes and stringently matched patient sub-groups (based on age, gender, Injury Severity Score, injury type, and the presence or absence of comorbidities) were derived algorithmically using IBM SPSS software. In patients who had surgery, there were no differences in administration of nine other anesthetic agents. We measured 31 inflammatory mediators using the Millipore Sigma Human Cytokine/Chemokine MILLIPLEX™ Panel kit. Clinical outcomes included ICU length of stay (LOS), total hospital LOS, duration and need for mechanical ventilation, and the Marshall Multiple Organ Dysfunction (MOD) score. Inflammatory mediators and MOD Score were analyzed with two-way ANOVA and clinical outcomes with Mann–Whitney U test with statistical significance set at P<0.05.

RESULTS
The comparison of SNP rs6746030 AA vs. BB genotypes (n = 6 per group) and SNP rs6313 AA vs. BB genotypes (n = 6 and 7 per group, respectively) demonstrated significant differences in 20 and 18 mediators, respectively (P < 0.05), but no significant difference in in-hospital clinical outcomes.

CONCLUSIONS
Rs6313 AA and rs6746030 BB genotypes appear to be broadly pro-inflammatory in patients receiving propofol. Despite similar in-hospital outcomes relative to controls, long-term outcomes merit investigation.

SIGNIFICANCE
This is the first clinical demonstration of altered inflammation associated with anesthetic-related SNPs and may point to novel pharmacogenomic applications in trauma.

RESEARCH / GRANT SUPPORT
NIH T32GM075770
CASE REPORT: POSTOPERATIVE ANALGESIA AND PRESERVED MOTOR FUNCTION AFTER HIP AND KNEE REPLACEMENT SURGERIES, WITH MULTIMODAL PERINEURAL ANALGESIA

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ABSTRACT
One case of knee replacement surgery and one of hip replacement surgery are presented describing the achievement of a motor-sparing multimodal perineural analgesia using midazolam, clonidine, dexamethasone, and buprenorphine for same day physical therapy (PT). The analgesic blocks in both cases were administered at the nerves/plexi of the L2-L4 and L4-S3 distributions. Motor function was maintained and same-day weight-bearing physical therapy was achieved. Both patients met or exceeded physical therapy goals and were discharged home on postoperative day 1. These reports forecast potential value with a new approach to facilitate motor-sparing nerve blocks by using multiple perineural analgesic adjuvants but excluding local anesthetic.

INTRODUCTION
Postoperative PT immediately (i.e., the same day) after total knee replacement (TKR) or total hip replacement (THR) has been shown to decrease overall health care costs1 and improve functional outcomes.2 In our institution, patients presenting for knee and hip replacements have been historically scheduled for PT on postoperative day 1 (POD #1). However, we were asked by our orthopedic surgical colleague (author HPI) to utilize a motor-sparing (MS) nerve block analgesic technique that would allow for same day PT to reduce length of stay and improve long-term outcomes for patients. We describe two cases (one TKR with femoral and sciatic nerve blocks and one THR with psoas compartment lumbar plexus and parasacral plexus blocks) in which a motor-sparing multimodal perineural analgesic (MMPNA) block containing preservative-free midazolam, clonidine, dexamethasone, and buprenorphine (MDZ-CBD) was used to achieve same-day PT. Both patients were agreeable to pursuing this care plan at the surgeon’s request in a specific effort to attain same-day PT goals, with these being accomplished in the post-anesthesia care unit (PACU).

All procedures described below were performed by author BAW, after (i) informed consent was obtained, (ii) sterile skin preparation with chlorhexidine gluconate (ChloraPrep®, El Paso, TX), (iii) procedural sedation with midazolam and fentanyl, (iv) peripheral nerve blocks with a Stimuplex® 100 mm needle and nerve stimulator (B.Braun USA, Bethlehem, PA), and (v) hyperbaric bupivacaine spinal (SureBlock, Arrow International, Reading, PA). The blocks to both of the relevant L2-L4 and L4-S3 distributions entailed preservative-free perineural analgesic adjuvants diluted to 44 mL volume per block with normal saline (midazolam 1.5 mg, clonidine 40 mcg, buprenorphine 400 mcg, and dexamethasone 2 mg, per block, two blocks per patient). There was no local anesthetic in these blocks, and they were injected in 5 mL increments with intermittent aspiration. In the operating room, both patients were sedated with IV propofol (titrated to desired effect) and 40 mg ketamine.

FIRST CASE REPORT (TKR: FEMORAL AND SCIATIC BLOCKS)

Presenting Concerns: A 61-year-old, 165 cm, 97.3 kg (BMI=36), ASA Physical Status III male presented for TKR.

Clinical Findings: His history was significant for rheumatoid arthritis, obstructive sleep apnea requiring home oxygen, hypertension, past tobacco use, stable subpleural nodules in the right middle lobe, and osteoarthritis with chronic opioid use (hydrocodone 10 mg QID) that “barely took the edge off.” His other coexisting medications included amlodipine besylate 2.5 mg daily, etanercept 50 mg subcutaneously once a week, hydrochlorothiazide 12.5 mg/ lisinopril 20 mg daily, leflunomide 20 mg daily, prednisone 5 mg daily, and hydroxychloroquine 200 mg daily. Through lifestyle modification, the patient lost 23 kg in the prior six months and reported improvement in sleep apnea. However, the patient was still functionally limited by knee pain, requiring a walker to perform basic activities of daily living (ADLs). Pre-operative numeric rating score (NRS) for pain with movement was 10/10 (and 4/10 at rest).

Diagnostic Focus and Assessment: From an anesthetic care plan perspective, the goal was to provide adequate intra-/post-operative pain relief while allowing for prompt return of motor function postoperatively to complete same day PT.

Therapeutic Focus and Assessment: During the peripheral blocks, the patient did note expected cramping at the injection site due to lack of local anesthetic in the mixture. Before the spinal, post-injection NRS (i.e., after MS-MMPNA blocks) with knee movement was 0/10.
SECOND CASE REPORT (THR: LUMBAR [PSOAS COMPARTMENT] AND PARASACRAL PLEXUS BLOCKS)

Presenting Concerns: A 75-year old, 178 cm, 86 kg (BMI= 27), ASA/PS III male underwent THR.

Clinical Findings: Past medical history was significant for abdominal aneurysm, hypertension, hyperlipidemia, being a prior smoker, and chronic low back pain. His coexisting medications included tramadol 50 mg BID, meloxicam 15 mg daily, ranitidine 150 mg BID, hydrochlorothiazide 25 mg/losinopril 20 mg daily, and simvastatin 40 mg daily. Pre-operative NRS for pain with movement was 9/10, and 4/10 at rest.

Therapeutic Focus and Assessment: Post-block NRS score with movement (after the MS-MMPNA and before the spinal) was 0/10. After an uneventful THR, the patient post-operatively reported 2/10 NRS pain with rest and 3/10 NRS pain with movement and achieved a WAKE score of 9+/10 with all PACU bypass/discharge having been met upon PACU arrival. The non-surgical leg performed a 90° straight leg raise, 120° of knee flexion, and full ROM on dorsi-/plantar flexion ankle pumps. The surgical leg with knee immobilizer on performed a 70° straight leg raise, which was 80° with the immobilizer off. Per the surgeon, the patient was not to perform heel slides for the surgical leg (after THR to prevent dislocation or subluxation), but demonstrated full ROM during ankle pumps. The patient performed same day PT less than three hours after operating room exit, and reported no problems or limitations related to the MS-MMPNA nerve block. On POD#0, all transfers and ambulation were achieved with minimal assistance from one person and a front-wheeled walker. The patient tolerated the full complement of PT evaluation and treatment, including ROM and strength testing, bed mobility, transfers to standing, and ambulation, as well as post-op TKR exercise protocol. By POD#1, he progressed to modified independence for all transfers, ambulation of 150 feet, and was able to climb 10 steps. The patient also demonstrated independent straight leg raise over 10 reps and 90° of knee flexion. Pain rating after completing PT treatment one day after surgery was 1/10. Due to discharge home on POD#1, the duration of the block's analgesia was unable to be determined, but is estimated to have lasted between 28 and 96 hours. During the follow-up call on POD #4, the patient reported that he had no pain, was no longer taking any baseline opioids, and only took one post-surgical oxycodone (5 mg pill). The patient completed three outpatient PT sessions; the originally-scheduled subsequent sessions were canceled because PT goals were achieved ahead of schedule.

DISCUSSION
We report two cases of effective MS-MMPNA that maintained motor function and allowed for same-day physical therapy after TKR and THR, respectively. The L2-L4 and L4-S3 blocks entailed a combination of preservative-free MDZ-CBD with no local anesthetics. Both patients experienced effective analgesia with the only negative side-effect of mild cramping upon administration of the nerve block (which author BAW has found to be common with this drug combination). Both patients successfully completed same-day physical therapy in the Phase 1 PACU and achieved their post-surgical goals either within expectations (THR patient) or ahead of schedule (TKR patient), and neither has experienced any post-operative complications to date.
The first patient had rheumatoid arthritis, with both patients having been diagnosed with degenerative joint disease. As a health condition, rheumatoid arthritis is associated with overexpression of the 18 kilo-Dalton translocator protein (TSPO).5 The current working theory of perineural midazolam analgesia suggests that it induces (specifically in C-fibers) non-apoptotic intracellular calcium increases mediated by TSPO,6 with this analgesic mechanism being distinct from apoptotic intracellular calcium increases produced by either clinical-to-toxic concentrations of local anesthetics, or by much higher concentrations of midazolam. We have observed rare cases of rheumatoid arthritis or other inflammatory arthritis subtypes of greater chronicity and/or severity which did not get a satisfactory response (after similar or different types of surgery) to similar doses as those described herein. We suspect that escalating chronicity and/or severity of inflammatory arthritis leads to overexpression of TSPO. The mechanism of dexamethasone perineural analgesia is controversial,7 while the analgesic mechanisms of perineural clonidine8 and buprenorphine9 have been described elsewhere.

Previous bench-translational research has demonstrated that the somewhat clinically-low concentration of ropivacaine (2.5 mg/mL) is 50% neurotoxic to primary sensory neurons after 24 hr. of exposure, while the concentrations of MDZ-CBD used in this case report are significantly less neurotoxic than ropivacaine, and no more cytotoxic than choline control.6 The apparent potential success of this combination entailing MS-MMPNA, acknowledging potential limitations described herein, warrants further investigation into revising our current model of analgesia which traditionally aims for next-day PT.

When the concept of same-day PT was initiated, the initial pilot plan was to utilize the Phase 1 PACU location. This quickly proved to be less than ideal, as OR-to-PACU traffic and PT exercises were mutually disruptive to each other, and adversely affecting day-to-day operations. As the next pilot plan, the patient would be transferred to our Same Day Pre-op Procedure Unit (including the rooms where the original nerve block processes took place), to both undergo PT and await the floor bed (the readiness for which being indefinitely delayed). The root cause issue being addressed was postop patients in PACU, despite WAKE Score eligibility for PACU discharge (or even PACU bypass) waiting hours for a ready floor bed; by the time the floor bed was ready, it was after-hours for PT team members to meet the patient in his/her room. The authors’ shared vision was to incorporate a value-adding care recovery process in the setting of the lost hours of opportunity during the PACU stay. We believe that the described MS-MMPNA anesthesia care plans render this situation as feasible for the long term, in ways that single-injection nerve blocks which contain traditional local anesthetics would not allow.

REFERENCES
The following abstract was presented at the 16th annual Safar Symposium/sixth annual Multi-Departmental Trainees’ Research Day, May 31-June 1, 2018 in Pittsburgh PA.

STRUCTURES AND FUNCTIONS OF ELIC-GABA$_A$$_R$ CHIMERAS


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INTRODUCTION
Type A y-aminobutyric acid receptors (GABA$_A$Rs) are the major inhibitory pentameric ligand-gated ion channels (pLGICs) in the central nervous system and are targets for general anesthetics. High-resolution structures of GABA$_A$Rs can facilitate our understanding of the mechanism of action of anesthetics and the discovery of new anesthetics.

Hypothesis
General anesthetics primarily target the transmembrane domain (TMD) of pLGICs. The distinctly different functional and pharmacological properties of GABA$_A$Rs and ELIC, a homologous prokaryotic pLGIC, offer an opportunity to dissect the role of the GABA$_A$R TMD in a chimeric form.

Methods
We constructed chimeras that have the extracellular domain (ECD) of ELIC fused to the TMD of either α1 or β3 GABA$_A$R. Anesthetic action on the heteromeric and homomeric ELIC-GABA$_A$R chimeras was characterized by two-electrode voltage clamp (TEVC) using Xenopus laevis oocytes. The structure of the homomeric ELIC-α1GABA$_A$R chimera was determined using x-ray crystallography.

Results
Homomeric ELIC-α1GABA$_A$R chimeras can be activated by the agonist propylamine and potentiated or even activated at a higher concentration by the neurosteroid anesthetic alphaxalone. The crystal structure of the apo resting-state α1GABA$_A$R chimera shows a smaller pore radius than that of previously determined WT desensitized β3GABA$_A$R, except at the -2 position. In addition, heteromeric α1β3GABA$_A$R and homomeric β3GABA$_A$R chimeras are also activated by the agonists GABA or propylamine and potentiated or even activated at a higher concentration by general anesthetics.

Conclusions
The prokaryotic-eukaryotic ELIC-GABA$_A$R chimeras form functional pLGICs. Anesthetic action on these chimeras resembles their action on GABA$_A$Rs instead of ELIC, supporting the hypothesis that anesthetics primarily target the TMD of pLGICs.

Significance
This work establishes an alternative approach for high-resolution crystallographic study of GABA$_A$Rs, for mechanistic understanding of anesthetic action, and for structure-based discovery of novel GABA$_A$R modulators.

Research / Grant Support
NIH (PI: Pei Tang, PhD; Yan Xu, PhD)
DEPARTMENT-SPONSORED MEETINGS

UPMC UPDATE IN ANESTHESIA, PAIN AND INTENSIVE CARE CONFERENCE

Our annual Regional Anesthesia & Ultrasound Guided Techniques Conference was held April 27-29, 2018 at Nemacolin Woodlands Resort in Farmington, PA. This distinctive program is designed to unite experts in anesthesiology in a collaborative educational program and review and update attendees with the knowledge and skills of anesthesia providers and other healthcare providers related to state-of-the-art professional practice.

Course Director Jacques E. Chelly, MD, PhD, MBA collaborated with course co-directors Mark E. Hudson, MD, MBA; Steven L. Orebaugh, MD; Robert Boretsky, MD; Mihaela Visoiu, MD; Cheryl Bernstein, MD; Raymond M. Planinsic, MD, FASA; and Lois Pizzi, MSN, ACNS-BC, RN-BC (Clinical Nurse Specialist, UPMC Shadyside) and conference manager, Barbara Novak Chismar, BA.

Thirty-seven course faculty provided workshops and lectures that detailed the role of psychosocial and genetic factors in pain, the concept of “opioid-free anesthesia and recovery,” the role of the Perioperative Surgical Home, updates in perioperative management for liver transplantation, updates in chronic pain and opioid addiction, pediatric acute and chronic pain medicine, and ultrasound-guided techniques for point-of-care and regional anesthesia.

This activity was sponsored by the University of Pittsburgh Physicians Department of Anesthesiology and Perioperative Medicine and the University of Pittsburgh School of Medicine Center for Continuing Education in the Health Sciences for 16.75 continuing medical education credits and was attended by over 170 health care providers.

2ND ANNUAL REGIONAL ANESTHESIOLOGY & ACUTE PAIN MEDICINE RESEARCH SYMPOSIUM

Our 2nd Annual Regional Anesthesiology & Acute Pain Medicine Fellowship Research Symposium was held at UPMC Shadyside on June 2, 2018. This yearly event is a showcase for our regional anesthesiology fellows’ quality improvement projects and attendees are offered continuing education credits for their participation. Fellows presented five posters and seven lectures:

Posters
• Mazin Albert, DO: Serratus Anterior Plane Block for Analgesia After Lung Transplant Surgery with “Clamshell” Approach
• Rajamani Battula, MD: Costo-Clavicular Block for Surgery Below the Elbow
• Nicole, Hollis, DO: Quadratus Lumborum Block for Postoperative Analgesia after Cesarean Delivery
• Niranjan Maganti, MD: Shoulder Surgery with Suprascapular Block
• Wayne Wang, MD: Epidural Analgesia for End-of-Life Care: Collaboration Between the Acute Pain Service and Palliative Care Service

Lectures
• Jazelle Campbell, MD: Mark Before You Block: Preventing Wrong Side Blocks
• Hector Casiano-Pagan, MD: Fascial Plane Block in Anticoagulated Patients - A Literature Review
• D’onior Felton, MD: Same Day Total Hip Arthroplasty: Identifying Appropriate Patients
• Karthik Hiremath, MD: A Survey of Regional Anesthesia Practices on Anticoagulants at UPMC
• Andrew Hudson, MD: A Case Report of a Potentially Novel Role for Intralipid in Nerve Block Reversal Archana Hudson, MD: The Role of Dexmedetomidine for Post-Operative Analgesia Following Thoracic Surgery
• Ata-ul Rahman, MD: The Curious Case(s) of the Serratus Anterior Plane Block
TEE/CARDIAC ULTRASOUND WORKSHOP

The UPMC Department of Anesthesiology and Perioperative Medicine, in conjunction with the University of Pittsburgh Center for Continuing Medical Education, held the second biennial Boot Camp for Basic TEE Boards and Focused Cardiac Ultrasound Workshop at the Herberman Conference Center at UPMC Shadyside on Saturday, June 9, 2018. Expert faculty from UPMC and throughout the nation presented lectures, conducted problem-based focused discussions, and hands on workshops.

The Course Directors were Kathirvel Subramaniam, MD, MPH, FASE and Michael L. Boisen, MD, both anesthesiologists from UPMC Presbyterian and UPMC Montefiore hospitals. The symposium featured a wide array of national speakers including Drs. Justin Tawil from Medical College of Wisconsin, Heather Hayanga from West Virginia University, Lorenzo De Marchi from MedStar Georgetown University Hospital, Barbara Wilkey from University of Colorado, Someshwar Bandi from Allegheny General Hospital, and Mauricio Del Rio from Duke University. Various department members delivered lectures, moderated problem-based discussions, and participated in workshops. Department faculty Theresa Gelzinis, MD; Mahesh Sardesai MD, MBA; and Stephen McHugh, MD and cardiothoracic anesthesiology fellows David Maerz, MD and Timothy Rohman, MD participated in the event.

Sixty-seven medical specialists registered for the conference, including CRNPs, anesthesiologists, fellows, and residents from other departments, as well as faculty from Maryland, Delaware, West Virginia, Ohio, New York, DC, Missouri, Massachusetts, and the United Kingdom.

The response to this educational event was robust. Following the conference, attendees stated that they would incorporate new strategies with their care team, including utilization of a lung ultrasound machine after central line placement, incorporating basic TEE (transesophageal echocardiography) exams for liver transplants, and adding TTE (transthoracic echocardiography) and TEE didactics into their training programs’ curriculum. Attendees also stated that they are now more likely to use TTE in preoperative assessments and using TEE to evaluate hypotension, diagnose stenosis, and evaluate cases of hemodynamic instability.

The 2018 conference was a huge success. We look forward to the third biennial Boot Camp for Basic TEE Boards and Focused Cardiac Ultrasound Workshop to be held in 2020!


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January 21-27, 2018 marked the 19th annual National CRNA Week. Established by the American Association of Nurse Anesthetists, National CRNA Week was created to encourage CRNAs to educate the public about anesthesia safety, questions to ask prior to undergoing surgery, and the benefits of receiving anesthesia care from nurse anesthetists.

SRNAs and CRNAs staffed tables throughout the various UPMC hospitals to educate visitors about their profession. Our CRNAs also marked this annual occasion by giving back to the community, launching several initiatives during the week:

- For the third year, our CRNAs at UPMC St. Margaret coordinated efforts to help the Wounded Warrior Patrol Family Outing, which brought 13 wounded warrior families to Seven Spring Ski Resort for a week of winter fun and relaxation on February 25-March 1, 2018. They collected donations and sold merchandise to help financially, as well as coordinated volunteers to help at the event.
- The UPMC Mercy CRNAs gave back by donating to FOCUS Pittsburgh to help provide less fortunate children with food.
- Our UPMC Shadyside CRNAs volunteered their time to host an Italian-themed dinner for the families staying at Family House across the street from the hospital. Family House provides affordable accommodations for families with loved ones in surgery/extended recovery in Pittsburgh-area hospitals. Every year, the Shadyside CRNAs host a dinner to support these families and answer questions about nurse anesthesia, CRNAs, and how they impact the care team for patients undergoing surgery.
- A group of SRNAs cooked dinner for the residents at Family House in Oakland near UPMC Presbyterian hospital. The families were very excited by the group’s gesture and enjoyed some great conversations about anesthesia.
- The UPMC Presbyterian/Montefiore CRNAs sponsored a “Donut Day” for their annual Peer Appreciation Reception for the entire Surgical Services Division and all staff in the Gastrointestinal, Radiology, Cardiac Catheterization, Psychiatric, Electrophysiology, Magnetic Resonance Imaging, Gamma Knife, Environmental Services, Interventional Radiology, and Bronchoscopy Labs. The attendees enjoyed 500 donuts in appreciation for their hard work. Donations were also collected for a charity and Jen Coates, CRNA, MSN and SRNAs volunteered time at an anesthesia booth on the 11th floor of UPMC Presbyterian. Many students and nurses attended the demonstration and displayed an interest in nurse anesthesia.
- The CRNAs at UPMC Magee-Womens Hospital celebrated the week with an appreciation breakfast and a Surgical Services Luncheon
- CRNAs at UPMC Children’s Hospital of Pittsburgh (CHP) came together to cook a dinner for the patients and families staying in the Ronald McDonald house, which is attached to CHP and provides housing to patients and families who require frequent and/or chronic care.

This is just a sampling of the many community service projects our CRNAs champion throughout the year, as well as during countless prior National CRNA Weeks.
OPIOID CHARITY EVENT

For the first time, our physicians and CRNAs united to celebrate both National CRNA Week and National Physician Anesthesiologists Week in January 2018 by supporting a charity event to raise awareness of the opioid epidemic and raise funds for Light of Life Rescue Mission, a charity that provides homes for the homeless and food for the hungry and helps people suffering from addiction and abuse. The event, “Medical Providers Against Opioid Addiction,” was organized by resident physician Philip Carullo, MD and was sponsored by UPMC Health Plan, the Pennsylvania Association of Nurse Anesthetists, and the Pennsylvania Society of Anesthesiologists. Over 250 guests enjoyed a night of good music, drinks, food, and networking with colleagues from around the city at the Pittsburgh Aquarium, raising $8,200 money for the Light of Life Charity. The article “Health care providers unite for opioid event” published in the January 15, 2018 edition of the Pittsburgh Post-Gazette spotlighted the event. In follow up to these efforts, Dr. Carullo attended the opening day/press release of the Prescribed to Death Memorial, developed by the National Safety Council for the victims of the opioid epidemic on display at the William Pitt Union on the University of Pittsburgh Oakland campus. On tour from Chicago, the memorial contains a wall of 22,000 pills individually carved with the faces of those who lost their lives to prescription opioid overdose last year. At the event, Dr. Carullo had the chance to talk with Pittsburgh Mayor Bill Peduto about the recent charity event as well as an example of medical provider involvement and collaboration with community organizations.

FOCUS PITTSBURGH PROJECT

The UPMC Mercy CRNAs, along with some other members of the Department of Anesthesiology, decided they would like to find a community outreach program to work with to help make a difference. With guidance from Phyllis Grasser, Vice President of Mission Effectiveness/Spiritual Care at UPMC Mercy, they were led in the direction of FOCUS Pittsburgh. In March 2018, the group made a $1,500 donation to Rev. Paul Abernathy, director of the organization. Pittsburgh FOCUS (Fellowship of Orthodox Christians United to Serve) is a part of the FOCUS North America movement and offers numerous free services to help local people in need. The organization works to establish and promote healthy, healing micro-communities through support, health and well-being initiatives, and leadership development. To date, they have provided meals to over 2,700 children with their Backpack Feeding Program, which provides free weekend meals to children enrolled in the U.S. Dept. of Agriculture National School Lunch Program’s Free or Reduced-Price School Meals. In addition, they provide workforce development, transportation program, a health center, and a Trauma Informed Community Development program, which helps revitalize the community by establishing and promoting healthy healing micro-communities.

WALK FOR THE HOMELESS

A group of UPMC Presbyterian SRNAs and CRNAs participated in the Annual Tunch and Wolf’s Walk for the Homeless on May 26, 2018 at Heinz Field in Pittsburgh (hosted by sportscasters and former Steelers Tunch Ilkin and Craig Wolfley). Proceeds from this 10K walk along the North Shore trail benefit the Light of Life Rescue Mission. This was the eighth consecutive year a CRNA/SNRA group from UPMC Presbyterian participated in the walk, providing basic first aid to walkers and sponsors and conducting blood pressure and pulse oximeter screenings at the event. The volunteer group also treated minor burns and lacerations, provided sun block and water, and triaged more involved injuries to the EMS crew at the walk. CRNA Leanna Madich’s family also helped with basic first aid and participated in the walk.
IN MEMORIAM

ELSIE MURRAY

Elsie Murray, a former CRNA at UPMC Mercy South Side Hospital, passed away on November 15, 2017. Elsie graduated from St. Francis School of Nursing in Pittsburgh and earned a Graduate Certificate from St. Francis School of Anesthesia and a BS in Anesthesia and Human Resources at La Roche College, Pittsburgh, as well as a Master of Public Management from Carnegie Mellon University. She led a long nurse anesthesia career in Pittsburgh starting in the 1960s, working at St. Francis Hospital, Columbia Hospital, Columbia/Forbes Metropolitan Health Center, Forbes Health System, Podiatry Hospital, West Penn Allegheny Health System, and finally UPMC Mercy South Side from 2006 until retiring in 2011.

Recruited as a member of Chi Eta Phi Sorority Inc., Kappa Chapter (professional nursing society) in 1961, Elsie served as Program and Projects Committee Chair and Scholarship Chair and was active on various committees over the years. She also served as Grammateus, Anti-Basileus, and Tamias. As a relatively new member in the early 1960s, she was recommended to the Boule and elected as National Dean of Pledgees, serving in that role from 1961-72. Always a pro-active member, Elsie was elected to serve on both the local Pennsylvania (PA) District V and the PA Association of Nurse Anesthetists (PANA) Boards, rising to Vice President and President of both boards. After serving on several American Association of Nurse Anesthetists committees, she was elected as President of PANA in 2004-05.

Elsie was an active member of the PA Autism Society of Pittsburgh since 1966, serving as a board member from 1982-88 and as a volunteer since 1984 at the annual Pittsburgh Grand Prix Races that benefit the Pittsburgh Autism Society and the Allegheny Valley School Autism Program. Since 2008, Elsie was active as an Associate Member of the Gateway Medical Society of Pittsburgh, attending sponsored community programs, meetings, educational lectures, and other suggested programs, accepting volunteer opportunities as requested, and contributing positive support to benefit the society’s community programs.

Elsie was extremely well loved and respected. Sickness took her away from us at 79 years old, but she will always be in our hearts.

GERALD T. ZAMBANINI

Gerald T. Zambanini died on March 30, 2018. Jerry worked his entire 45-year career at UPMC McKeesport and was the last working CRNA at McKeesport to “drop ether.” He also was the first male CRNA to graduate from the McKeesport School of Anesthesia. A mentor to many SRNA students throughout the years, Jerry had just retired a short 18 months prior to his passing. Jerry will be missed by many who had the pleasure to work alongside him.

SUSAN B. NIEMI

Susan B. Niemi, former Chief Nurse Anesthetist at UPMC Shadyside, passed away on May 2, 2018 at age 75. Susan graduated from Mount Lebanon High School, University of Pittsburgh, West Penn Nursing School, and Citizens Hospital of New Kensington Anesthetist Program. She worked in the medical field her whole life and later relocated to Palm Coast Florida. Susan was a member of the First Presbyterian Church in Pittsburgh, PA, the American Association of Nurse Anesthetists, and the Northern Right Whale Watching Group in Marineland, FL. She enjoyed swimming, traveling, mahjong, and walking with her group of dog walkers. Susan’s dedication and contributions as CRNA Director at UPMC Shadyside will not be forgotten. Her warm personality and genuine love of people will be deeply missed.
Chad Artman, MSN, CRNA (UPMC Presbyterian) won a UPMC Physician Services Platinum (Robert J. Mientus) Star Award, which recognizes staff who consistently contribute to the success of their practice/department and work well with colleagues and the UPMC community; contribute toward workplace effectiveness/efficiency; implement approaches to impact productivity; develop cost-saving plans; exhibit excellent customer service; demonstrate positive interpersonal skills that support diversity; and work on special projects. Chad was honored at an employee recognition luncheon on August 30, 2017 at The University Club. The award came with a $500 prize and automatically designated Chad a recipient of the UPMC Award for Commitment and Excellence in Service.

Brian Blasiole, MD, PhD was identified as a “top performer,” ranking in the top 10 faculty members for teaching excellence in the Pediatric Residency Program’s annual evaluation. Pediatric Residency Program co-director Andrew J. Nowalk, MD, PhD noted the rarity of a non-Pediatrics faculty member receiving this recognition and commended Dr. Blasiole on being held in such high esteem by the pediatric residents at UPMC Children’s Hospital of Pittsburgh.

Two curriculum development grant applications were accepted for funding for our inaugural UPMC Anesthesiology Educational Grant July 2017 funding cycle. The total funding amount was $8,000 USD per project.

- “Evaluation of Anesthesiology Resident Competence and Clinical Impact of a Structured Point-of-Care Ultrasound Training Program.” PI: Daniel R. Mandell, MD (PGY-4 Resident); Faculty Mentors: Michael Boisen, MD & Kathirvel Subramaniam, MD, MPH
- “Teaching Medical Students Anatomy for Regional Anesthesia Using Ultrasound.” PI: Kaarin Michaelsen, MD, PhD (PGY-4 Resident); Faculty Mentor: Steve L. Orebaugh, MD

Raymond M. Planinsic, MD presented the lecture “Coagulation Strategies in Liver Transplant Surgery” at the inaugural hemostasis seminar of the Japanese Perioperative Hemostasis Research Group on August 26, 2017 in Osaka, Japan. The seminar, titled “New Concepts in Perioperative Hemostasis,” was chaired by Kenichi Tanaka, MD, currently Professor and Chief of Cardiac Anesthesiology at the University of Maryland and formerly a resident and faculty member in our department. The seminar was designed for physicians who manage perioperative bleeding and transfusion in critically ill patients. Three renowned physicians from the United States (Drs. Tanaka, Planinsic, and Bradley Taylor, MD, MPH (cardiac surgeon, University of Maryland) reviewed basic hemostasis mechanism, surgical hemostasis, and coagulation strategies in cardiac surgery and liver transplantation.

The Pittsburgh Post-Gazette article “Boston-based program comes to the region to help doctors prescribe safer alternatives to opioids” (July 25, 2017) discussed various efforts in the Pittsburgh region to address safe opioid prescription practices, including UPMC’s 90-90 program directed by Ajay D. Wasan, MD, MSc.
Chad Artman, MSN, CRNA and Stephen A. Esper, MD, MBA were 2017 winners of UPMC's Award for Commitment and Excellence in Service (ACES). ACES honors staff who exemplify UPMC's five core values — Quality & Safety, Dignity & Respect, Caring & Listening, Responsibility & Integrity, and Excellence & Innovation. Each year, fewer than one percent of UPMC staff from across the health system receive this honor. Both winners were recognized at the ACES Recognition Dinner on November 11, 2017 at the David L. Lawrence Convention Center.

Jacques E. Chelly, MD, PhD, MBA was invited to participate as a faculty member at the Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care 71st National Congress 2017 (SIAARTI 2017), which was held October 18-21, 2017 in Rimini, Italy.

Effective September 21, 2017, the Accreditation Council for Graduate Medical Education granted full accreditation to our Regional Anesthesiology and Acute Pain Medicine Fellowship, directed by Dr. Jacques Chelly.

Pittsburgh Magazine named Francis Feld, DNP, LAT, NRP, CRNA (UPMC Passavant) and John M. O’Donnell, MSN, DrPH, CRNA (UPMC Presbyterian and Director of the University of Pittsburgh Nurse Anesthesia Program) 2017 “Excellence in Nursing” honorees in their December 2017 issue.

The Cameos of Caring® awards recognize nursing professional who are as role models within their facility and beyond. Individuals are recognized within specialty categories (Advanced Practice, Case Manager, Donate Life, and Quality & Safety) and are nominated by their facility. Designated committees select a limited number of award recipients for these areas. The 2017 Cameos of Caring Gala was held Saturday, November 4 at the David L. Lawrence Convention Center in Pittsburgh, where two of our outstanding CRNAs were honored. Rick Henker, CRNA, PhD won the Advanced Practice Award. His wife Dr. Hiroko Henker accepted the award on his behalf as Rick was away teaching in Cambodia. Pam Norton, CRNA, BSN from UPMC Presbyterian also won an award. By receiving this prestigious award, Rick and Pam were celebrated for their commitment to consistent, proactive clinical decision-making and excellence in nursing care, and advocacy for patients and their families, and for serving as role models to other healthcare professionals.

Fall 2017
On September 6, 2017, Andrew Herlich, DMD, MD, FAAP, FASA was appointed to the Commonwealth of Pennsylvania Department of Health Rare Diseases Advisory Council. Council members play an integral role in advising the state regarding the incidence and prevalence of rare diseases, advising public and private entities that provide services to or care for people with rare diseases, and developing content for, composing, and publishing reports. The council also establishes protocols for the surveillance of rare diseases and people with rare diseases, develops plans to raise public awareness of rare diseases, and identifies priorities and develops associated policy recommendations regarding treatment and other services for those with rare diseases.

Grace Lim MD, MS served as Chair of the Physician Specialty Education Subcommittee of the Society for Obstetric Anesthesia and Perinatology (SOAP) Education Committee. The subcommittee focuses on dissemination of information practical and relevant to clinical obstetric anesthesia practitioners, highlighting key topics in obstetric anesthesiology with a focus on current evidence and modern practices. The committee also produces educational pieces for global dissemination through social media, the SOAP website and newsletter, and SOAP-sponsored content on OpenAnesthesia.org.

Matthew Orlowski and his mentor Howard B. Gutstein, MD received the 2017 Foundation for Anesthesia Education and Research Medical Student Anesthesia Research Fellowship Symposium Best Basic Research Abstract Award for “Imatinib Prevents EGF-induced Analgesic Tolerance to Morphine in Opioid Naive Rats.” The abstract was accepted as an oral presentation at the symposium at the 2017 American Society of Anesthesiologists annual meeting.

Tetsuro Sakai, MD, PhD was an international speaker at the 94th Annual Scientific Meeting of the Korean Society of Anesthesiologists, November 2-4, 2017 in Seoul. He was also invited as a Visiting Professor with the University of Hawaii Postgraduate Medical Education Program at Okinawa Chubu Hospital from November 13-17, 2017.

Stephen M. McHugh, MD was selected to serve as an American Board of Anesthesiology (ABA) question writer for a two-year term. The ABA examines and certifies physicians who complete an accredited program of anesthesiology training in the United States, with a mission to advance the highest standards of the practice of anesthesiology.

Cristina Roosen-Marcos, MD was awarded the UPMC Children’s Hospital of Pittsburgh (CHP) Patient Safety Award on Wednesday, November 15, 2017. Dr. Roosen was recognized for her dedication and for routinely going “above and beyond” for her patients.

Phillip S. Adams DO was a 2018 recipient of the inaugural Young Investigator Research Grant from the Society for Pediatric Anesthesia (SPA) Patient Safety, Education and Research Fund for the project “Association between Perioperative Respiratory Adverse Events and Nasal Nitric Oxide Measurements” (Mentor: Peter J. Davis, MD). Dr. Adams presented his work at the SPA-American Academy of Pediatrics Pediatric Anesthesiology 2019 meeting in Houston, TX.

The University of Pittsburgh paid tribute to the outstanding achievements of its faculty and students during their 42nd annual Honors Convocation on Friday, February 23, 2018 at the Carnegie Museums of Pittsburgh Music Hall in Oakland. Drs. Andrew Herlich, David G. Metro, William R. McIvor, Rita M. Patel, Raymond M. Planinsic, Tetsuro Sakai, William Simmons, Kathirvel Subramaniam, Erin A. Sullivan, John P. Williams, and Yan Xu were all honored at the event for their accomplishments during 2017.

Charles Luke, MD, MBA was appointed to as Director of our Acute Interventional Perioperative Pain and Regional Anesthesiology Division, effective January 1, 2018. Dr. Luke, Beverly A. Pearce-Smith, MD, and Rita Merman, MD had outstandingly served as AIPPS Interim Co-Directors over the prior several months.

Yan Xu, PhD was appointed the Peter Winter Professor of Anesthesiology. This endowed professorship is named in honor of Peter M. Winter, MD, the renowned second chair of our department. Dr. Xu presented the inaugural lecture, “Losing Your Mind: The Wonders of Anesthesia” as the Peter Winter Professor on Monday, October 2, 2017, Lecture Room 6, Scaife Hall. After the lecture, Dr. Xu’s appointment and Dr. Winter’s life and contributions to the department, the university, and the anesthesiology profession were celebrated at the University Club. The department was honored that Dr. Winter’s family (Chris & Kristin Winter, Karin McCloskey & Carys McCloskey) attended both Dr. Xu’s lecture and the ceremony. Both Chris Winter and Dr. Xu were formally presented with framed certificates to commemorate the establishment of the endowed professorship in the name of Dr. Winter, who passed away in 2016.
Gregory R. Romapala presented and successfully defended his doctoral dissertation on January 29, 2018. Greg was a graduate student in the Center for Neuroscience at the University of Pittsburgh. The title of his thesis was "Role of paternal preconception environment in ethanol- and stress-related phenotypes." This research was conducted in the laboratory of Gregg E. Homanics, PhD, professor of Anesthesiology, Pharmacology & Chemical Biology, and Neurobiology. Greg transitioned to a postdoctoral position at the Icahn School of Medicine at Mount Sinai in New York City to continue working on the cross generational effects of drugs of abuse.

Tetsuro Sakai, MD, PhD, MHA was appointed Secretary of the Society for the Advancement of Transplant Anesthesia (SATA).

Dr. Tetsuro Sakai completed his studies to earn the Master of Health Administration degree from Pennsylvania State University.

The American Society of Anesthesiologists (ASA) Practice Management meeting is considered the premier business event for physician anesthesiologists and practice administrators and among ASA-sponsored events is second only in attendance to the ASA's Annual Meeting. The 2018 ASA Practice Management meeting was held January 26-28 in New Orleans, LA.

One again, our department had a strong presence at the meeting. Six residents, five of whom participated in the poster session, and three faculty members (Mark E. Hudson, MD, MBA; Trent D. Emerick, MD, MBA; Sanford M. Littwin, MD) participated. A total of 20 posters were exhibited at the meeting, seven of which were selected for presentation. Of the seven selected, three were from our department:

- Evan E. Lebovitz, MD; Mark E. Hudson, MD, MBA; Sanford Littwin, MD: Mandatory Environmental Savings Initiative (MESI): Cost Comparison of Anesthetic Techniques in a Large University Hospital System
- Andrius Giedraitis, MD, MBA; Jamie Artman, CRNA, MSN; Brandon Stewart; Susan Mammarella; Mark E. Hudson, MD, MBA: Developing an Operating Room Scorecard for a Large, Multi-hospital Health System
- Neal Shah, MD; Sanford M. Littwin, MD; Jamie Artman, CRNA, MSN; Mark E. Hudson, MD, MBA: Utilizing a “Value” Incentive to Rapidly Introduce Evidence Based Practice Across a Large Multihospital Health Care System

For the seventh year in a row, work presented by the “Hudson Research Team,” a group of residents, faculty, and CRNAs investigating healthcare business and management led by Mark E. Hudson, MD, MBA, won awards at the conference and garnered national attention. The above presentation by resident Dr. Neal Shah won both the 3rd Place FAER Research Award as well as the award for Best Poster by a Resident or Fellow. Dr. Shah’s other poster, “Using an Anesthesiology Trained Chronic Pain Physician for Perioperative Inpatient and Outpatient Pain Management as Part of the Perioperative Surgical Home” (authors: Shah N and Emerick TD) was featured in a news release on EurekAlert!, “Surgery patients in enhanced recovery program leave hospital sooner, take fewer opioids.” Dr. Emerick was quoted in the press release.

Dr. Hudson also moderated a conference session and presented the following invited lectures:

- Friday, January 26, 1 – 1:20 p.m. Active Operating Room Cap Management for Efficiency and Cost Savings
- Saturday, January 27, 7:30 – 8 a.m. Understanding Different Types of Anesthesiology Practices
Nicholas J. Schott, MD accepted the position of Associate Director of our ACGME-accredited Regional Anesthesiology and Acute Pain Fellowship Program starting January 1, 2018.

Kathirvel Subramaniam, MD, MPH, FASE was appointed Chair of the SATA Cardiothoracic Committee.

Spring 2018

Kimberly B. Wysocki, MSN, CRNA (UPMC Presbyterian) received a “You Are A Star” Award from UPMC Physician Services Division. The award recognizes staff members who consistently assist with difficult problems both inside or outside the scope of their regular job duties, pitch in to help others achieve UPMC’s goals, and maintain high morale through kind words or a positive outlook. Kim was nominated for the Star Award by UPMC Presbyterian CRNA Clinical Director Helen DeFranco, who brought attention to a community service project Kim organized in October 2017. Kim rallied UPMC CRNAs, anesthesiologists, project coordinators, and surgical services staff to collect over $2,000 to provide a lunch for the University of South Nevada Trauma hospital’s anesthesia and surgical teams who cared for victims of the horrific Las Vegas mass shooting. The act was a way to thank them for caring for others and to express understanding and empathy in dealing with the loss of so many lives and treating so many injured victims.

Our Pain Medicine fellows Jessica M. Albasha, DO and Youngun Cho, MD were selected as two of only 60 pain fellows nationwide to participate in the American Society of Regional Anesthesia and Pain Medicine Advanced Neuromodulation Comprehensive Hands-on Workshop with Practical Case Management for the Future Implanters on April 18, 2018, immediately preceding the World Congress on Regional Anesthesia and Pain Medicine in New York City. Drs. Albasha and Cho received travel scholarships to attend the meeting.

Drs. Cheryl D. Bernstein, Franklyn P. Cladis, Peter J. Davis, Andrew Herlich, Steven L. Orebaugh, Jerome Parness, Doreen E. Soliman, Erin Sullivan, and Ajay D. Wasan were all named in Pittsburgh Magazine’s 2018 “Best Doctors” list. The list is compiled by Best Doctors® and derived from the Best Doctors in America® database, which includes the names and profiles of more than 40,000 of the best doctors in the United States. Physicians are included in the database after an exhaustive peer review. Doctors cannot buy listings. Only those who earn the consensus support of their peers and meet additional qualification criteria are included. Drs. Herlich, Orebaugh, Parness, Sullivan, and Wasan were named Best Doctors in the specialty of anesthesiology; Drs. Cladis, Davis, Herlich, Parness, and Soliman were named Best Doctors in the specialty of pediatric anesthesiology; Dr. Bernstein was named in the specialty of neurology; and Dr. Wasan was named in the specialty of psychiatry.

Philip Carullo, MD was selected by Pennsylvania Medical Society (PAMED) as one of their “Top Physicians Under 40” for 2018. This PAMED award annually recognizes the best of the best early career physicians in Pennsylvania. Candidates are high achievers who inspire others and work to advance medicine and/or their community, either through employment or volunteer work.

The grant “A Pilot Study Investigating the Post-Operative Analgesic Effect of NSS-2 BRIDGE Device in Subjects Undergoing Major Abdominal Oncologic Surgery” (principal investigator Jacques E. Chelly, MD, PhD, MBA and co-investigator David L. Bartlett, MD (Department of Surgery)) received funding from the Shadyside Hospital Foundation.

Diana DeAndrade, MD received a $1,000 travel grant from the American Society of Echocardiography (ASE) to attend the ASE Annual Meeting on June 22-26, 2018 in Nashville, TN.

Trent Emerick, MD, MBA was named Co-Associate Program Director of the Pain Medicine Fellowship, a role shared with Associate Program Director John Hache, MD.
Carolyn Garver, RN, CRNP, MSN received the 2018 American Association of Nurse Practitioners (AANP) State Award for Excellence. This prestigious award is given annually to a dedicated nurse practitioner in each state who demonstrates excellence in their area of practice. Carolyn was recognized for this achievement during the 2018 AANP National Conference at the Colorado Convention Center in Denver, June 26-July 1.

Shiv K. Goel, MD was selected as Interim Chief of Anesthesiology at UPMC Shadyside, beginning July 1, 2018, as Robert Boretsky, MD stepped down as chief after 11 years of tremendous work and dedication.

Mark E. Hudson, MD, MBA was appointed as the UPMC Richard J. Kuwik Endowed Professor of Anesthesiology by Chancellor of the University of Pittsburgh Patrick Gallagher, effective May 1, 2018. Appointment to a named professorship is one of the highest honors that any university can bestow upon a faculty member. Dr. Hudson’s appointment recognizes and rewards the quality and impact of his work, which has earned deep and widespread respect. It also expresses the University’s confidence that Dr. Hudson will continue to bring many additional accomplishments and contributions to the discipline of Anesthesiology, the University, and society.

Grace Lim, MD, MS was recognized as an outstanding mentor in the University of Pittsburgh School of Medicine’s Scholarly Research Project program. The program is a longitudinal experience for Pitt medical students to engage in a research project throughout the four years of their curriculum under the mentorship of a faculty member. In recognition of their excellence in mentorship, Dr. Lim and other outstanding mentors were invited to participate in a panel discussion for the Dean’s Summer Research Program Retreat on the topic “Making the Most Out of the Relationship with Your Mentor” on June 12, 2018.
**AWARDS, ACCOLADES, AND NEWS**

**Dr. David Metro** served as Marshal for the University of Pittsburgh School of Medicine graduation ceremony on Monday, May 21, 2018 at the Soldiers & Sailors Memorial Hall & Museum.

**NPR’s Ari Shapiro** interviewed Dr. Ajay Wasan for the segment “Questions and Answers About Opioids and Chronic Pain.”

**Drs. Grace Lim and Ajay D. Wasan** won awards for their research projects “Big Data Analytics for Treatment Decision-Making” (PI: Ajay Wasan) and “Ketamine to Reduce the Burden of Postpartum Pain (PI: Grace Lim). Each project received an award in the amount of $75,000 through the Pain Research Challenge, administered by the Clinical and Translational Science Institute (CTSI) at the University of Pittsburgh. Awards are funded through the Virginia Kaufman Endowment Fund.

**David G. Metro, MD, FASA** was appointed to the University of Pittsburgh School of Medicine Affiliated Faculty Promotions and Appointments (AFPA) Committee for a three-year term effective March 1, 2018. The AFPA Committee rigorously applies the criteria and standards of the University and the School of Medicine to all Clinical Prefix faculty who are candidates for appointment or promotion. Service on a promotion committee is one of the most important duties faculty perform on behalf of their colleagues and in support of the School’s mission.

Two articles in the *Pittsburgh Post-Gazette* and the *Pittsburgh Tribune-Review* described efforts to develop medical marijuana guidelines led by **Ajay D. Wasan, MD, MSc**.

The Patient-Centered Outcomes Research Institute (PCORI) authorized funding for the project “Implementing Contextual Factors Assessment in Clinical and Research Settings.” Carol Greco, PhD, Associate Professor of Psychiatry, University of Pittsburgh School of Medicine is the project’s principal investigator (PI) and **Dr. Ajay Wasan** is a co-PI on the project.

**FELLOWS OF THE AMERICAN SOCIETY OF ECHOCARDIOGRAPHY**

Ryan Ball, MD and Kathirvel Subramaniam, MD, MPH were appointed Fellows of the American Society of Echocardiography in FY18. The FASE designation is a peer-review process that recognizes dedicated American Society of Echocardiography members with an extraordinary commitment to the field of cardiovascular ultrasonography, designating those with proven professional contributions, a diverse skill set, and knowledge of all aspects of cardiovascular ultrasound. Their appointments were recognized in the ASE 2018 Scientific Sessions Final Program and on the ASE website among other highly-certified practitioners.
OUR MISSION: to be a national leader in anesthesiology and perioperative and pain medicine through a culture of compassion, teamwork, learning, discovery, and innovation.

OUR VISION: to continuously strive for excellence in clinical care, teaching, research, biomedical innovation, and philanthropy

FISCAL YEAR 2018 AT A GLANCE

TOTAL ANESTHESIOLOGY CASES 315,063
  NON-PAIN CASES 233,770
  CHRONIC & ACUTE PAIN VISITS 81,293
OBSTETRIC DELIVERIES 11,504
FACULTY FULL-TIME EQUIVALENTS (FTEs) 207
TOTAL ORs COVERED 226
TOTAL ANESTHETIZING LOCATIONS 319
CRNA FTEs 392
GRADUATING SRNAs 37
RESIDENTS & FELLOWS 107
ACTIVE CLINICAL TRIALS 19
TOTAL NIH AWARDS $3,469,678
TOTAL AWARDS $4,284,263