

## Department of Anesthesia, Critical Care and Pain Medicine

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2018–2019 Biennial Report



## Our Mission:

Improve the quality of our patients' lives by providing compassionate, state-of-the-art care and relief of pain.

Advance the science of anesthesia by generating new knowledge.  
Educate the next generation of leaders in anesthesia.

Support personal and professional fulfillment of our departmental members.

## Department of





# Anesthesia, Critical Care and Pain Medicine







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Alan Lisbon, MD  
Executive Vice Chair

## Editor's Note

This biennial report of the Department of Anesthesia, Critical Care and Pain Medicine highlights the work and achievements of the department and its faculty, residents, and staff for the academic years 2018–2019. The past two years have been a time of tremendous growth with expansion of clinical volume, research, and educational opportunities. I hope you find the report interesting and informative.

– Alan

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**Daniel S. Talmor, MD, MPH**

Department Chair  
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## Welcome

Welcome to the Department of Anesthesia, Critical Care and Pain Medicine! This biannual report documents just some of the many impressive accomplishments of the department over the past two years. These accomplishments underscore the remarkable work of our team. Together we provide skilled and compassionate clinical care, inspiring education and innovative research. Our department members are leaders in the management and continuous improvement of high quality, effective, patient-centered care. As chair, and a longtime member of the department, I offer my personal appreciation and admiration for the expertise, collegiality and dedication of our impressive team of physicians, nurses, and support staff.

Our shared departmental vision is to:

- contribute significantly to the further development and success of Beth Israel Deaconess Medical Center and its network of hospitals.
- deliver state-of-the-art and efficient service in perioperative anesthesia, critical care, and pain management.
- lead the way to improving perioperative patient care through the collaborative application of best practices.
- develop innovative training programs that attract the finest applicants from Harvard Medical School and other top programs nationally.
- be recognized nationally and internationally as a leader in the advancement of anesthesiology through education, research, innovation, and participation in specialty societies.
- be accountable in a measurable way for the value the department brings to our patients and the medical center.

The department has significant strengths. First and foremost, our faculty is clinically excellent. They provide cutting-edge clinical care, supporting the most complex surgical services. They are among the hardest-working physicians in the medical center. We take huge pride in our individual achievements, our work as a department, and in the medical center. The intense loyalty and dedication among our staff produces results. The clinical outcomes of our cases are second to none across all three areas of service: operative anesthesia, critical care medicine, and pain medicine.

*(Continued on page 2)*





Through our work over the last years, we are poised to ensure that these high standards are extended across the new Beth Israel Lahey Healthcare (BILH) network of hospitals. Over the last two years we have assumed responsibility for anesthesia and pain medicine services at Beth Israel Deaconess–Plymouth and Anna Jaques Hospitals. By the time you read this, we will have assumed care responsibilities at Mount Auburn Hospital, the New England Baptist Hospital and the three hospitals of Cambridge Health Alliance. The department is leading the way for the integration of hospital-based clinical services throughout the BILH network. As the network expands, we will expand to provide high-quality and cost-effective care at our new affiliates.

Our educational programs are nationally renowned and continue to attract excellent candidates. Our clinical research programs have benefited greatly from the formation of our Center for Anesthesia Research Excellence (CARE), which has allowed us to grow clinical research across the department. Over the last year, we have endowed a new Center for Inflammation under the leadership of Dr. Simon Robson. Our researchers in the field of pain medicine are nationally recognized, and in all areas we have significant and increasing external funding.

The Division of Pain Medicine is one of the oldest and most respected academic pain practices in the nation. Over the last year, we have also seen an increase in services at our affiliates. The Pain Medicine Fellowship training program is widely considered the best in the nation. The division has recruited several new physicians and implemented a comprehensive plan to provide all of the non-surgical care in the Spine Center.

The Department of Anesthesia founded the first Intensive Care Unit (ICU) at BIDMC in 1969. Since then, our department has provided stable and responsible leadership for the surgical ICUs. Over the last two years we have led development on the new BIDMC Neuro ICU, increased ICU services at BID–Plymouth and begun to provide critical care coverage at BID–Milton. Our Critical Care group continues to build on its research success with multiple, ongoing clinical and translational research projects.



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## Our Community Sites

We provide anesthesia, critical care and pain medicine services and oversee day-to-day operations of the ORs at our BIDMC Boston main campus and community hospital partners: BID–Milton, BID–Needham, BID–Plymouth, and Anna Jaques Hospital in Newburyport, Massachusetts. We also provide pain services at our BID HealthCare locations in Lexington, Chestnut Hill, and Chelsea.

All academic clinical departments are challenged by accountable care, declining clinical revenue, an evolving training environment, and flat or contracting NIH budgets. Anesthesia is especially sensitive to all of these. In the past, our specialty (and departments) pioneered the patient safety movement, founded the specialties of critical care, and pain medicine, introduced simulation to medicine, and led the integration of non-physician providers in the workforce. As a specialty and as a department, we will continue to adapt and lead in this changing environment. Within the medical center, the Anesthesia Department is recognized as a team player that provides outstanding clinical service. We have taken the lead in collaborative process improvements across the spectrum of perioperative medicine, and in developing and improving patient care processes for optimal outcomes. Outside the hospital, we are recognized as a national leader in innovation, both in clinical care as well as in the science of perioperative health care delivery.

The Beth Israel Deaconess Department of Anesthesia, Critical Care and Pain Medicine continues to provide world-class clinical care, training and education, research, and leadership in an environment of collaboration and collegiality. Whether you are an alumnus, colleague, potential applicant, or interested friend, I hope that by perusing these pages you will learn more about our diverse programs, activities, and accomplishments.

– Danny



# Harvard Faculty



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**Benjamin Moor, MD**

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**James O'Rourke, MD**

**Aimee Reilly, MD**

**Christopher Walters, MD**

**Natallia Yaromenka, MD**

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**Katherine Bourne, MD**

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**Andrey Filippov, MD, PhD**

**Jessica Heath, MD**

**Mark Kats, MD**

**Robert Kirkman, MD**

**Steven Parker, MD**

# Clinical Anesthesia



**Peter J. Panzica, MD**

Vice Chair, Clinical Anesthesia

Assistant Professor of Anaesthesia

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“The only constant is change. It is an exciting time to be at BIDMC, with the accelerated consolidation of health care systems in the Boston area.”

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The Clinical Anesthesia Program provides anesthesia services for all operating rooms, labor and delivery, and non-operating room procedural areas at Beth Israel Deaconess Medical Center.

At BIDMC, we staff 40 operating rooms (ORs) between Boston’s East and West campuses, located in three main suites (19 on Main–West, 11 in Feldberg–East, and 10 in the Shapiro Ambulatory Suite–East). Non-OR procedural areas include three sets of gastrointestinal endoscopy (GI) suites, three electro-physiology (EP) suites, two angiography suites, an endovascular procedure suite, and CT, MRI, and ECT suites. Clinical anesthesia divisions include cardiac, vascular, thoracic, orthopedic, neurosurgical, transplant, ambulatory, regional, GI, office-based, pre-admission testing, and obstetrics.

Clinical leaders spent a substantial amount of time this past year with architects planning the new, state-of-the-art tower on the West Campus. This will be connected to our current OR space, doubling the square footage of our OR footprint on the West. There will be seven new large ORs, four catheter labs and an additional hybrid OR to add to the current three we have now, as well as plenty of support space. We anticipate this new space will be operational in 2022.

Governance of perioperative services at BIDMC is by the Operating Room Executive Committee (OREC), a subcommittee of the Medical Executive Committee. OREC is responsible for strategic planning for the operating rooms, and meets biweekly. This committee is chaired by the Chiefs of Anesthesia and Surgery, and the Director of Perioperative

Nursing (Dr. Danny Talmor, Dr. Elliot Chaikoff, and Elena Canacari, RN, respectively), with representation by members of the Anesthesia Department. A subcommittee of OREC—the Perioperative Operations Committee—is responsible for the day-to-day operations of the ORs and also meets biweekly. This committee is chaired by the Vice Chair of Clinical Anesthesia, the Chief of General Surgery, and the Director of Perioperative Nursing (Dr. Peter Panzica, Dr. Mark Callery, and Elena Canacari, RN, respectively). Our BIDMC clinical campuses are directed by Dr. Eswar Sundar (East Campus) and Dr. Adam Lerner (West Campus).

Our presence in the community has more than doubled with the addition in fall of 2018 of anesthesia coverage at BID–Plymouth and Anna Jaques Hospital in Newburyport, in addition to our long-standing coverage





at BID–Needham and BID–Milton. Anna Jaques Hospital and BID–Plymouth both require in-house coverage for OB anesthesia and both provide pediatric care. We also cover the ICU and Pain Clinic at BID–Plymouth. In the near future, there are plans for continued expansion and integration at New England Baptist Hospital, Mount Auburn Hospital, and Cambridge Health Alliance locations, so our presence in the community will continue to grow. OR integration happens in concert with senior hospital leadership to make the best use of our systems OR resources—namely driving lower-acuity care out to the community. We have helped create effective OR governance in the community and connected their ORs to the main campuses with a robust IT system after creating common definitions and accountability for OR metrics and efficiencies.



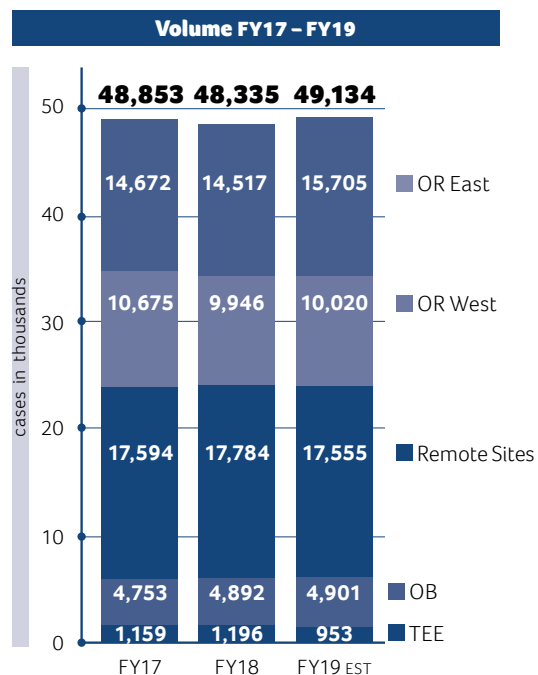
Adam Lerner, MD  
Clinical Director, West Campus



Eswar Sundar, MBBS  
Clinical Director, East Campus

The Anesthesia Department is expanding to support additional space and growing volume at our Boston campus and our community hospitals. With the addition of 10 new staff to our department, we have a total of 123 attendings, 63 certified registered nurse anesthetists (CRNAs), and house staff of 54 residents, 12 interns, and 18 fellows.

The only constant is change. It is an exciting time to be at BIDMC, with the accelerated consolidation of health care systems in the Boston area. Ours is the fastest-growing system in the region, and this brings on certain challenges and opportunities. Our Anesthesia Department is well positioned and trusted to help guide these changes and create our own successful future through clinical excellence, innovation, collaboration, and value-based care.



# Clinical Anesthesia at BID–Milton



**Sheila R. Barnett, MBBS, BSc**  
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- Scott D. Zimmer, MD  
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- Victoria Derevianko, MD  
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- Andrey Rakalin, MD  
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- Simon X. Zhang, MD  
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Instructor in Anaesthesia
- Megan L. Krajewski, MD  
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- Sara E. Neves, MD  
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## Pain Faculty

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- Lindsay Gusioria, NP

## BID–Milton CRNAs

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- Kelley Balestracci, CRNA
- Joan Botelho, CRNA
- Traci Brown, CRNA
- Katherine Canina, CRNA
- Lori Cetrino, CRNA
- Elizabeth Demartini, CRNA
- Stacey Galvin, CRNA
- Erin Herrmann, CRNA
- Hope Mangili, CRNA
- Darcy McCabe, CRNA
- Marybethe Sabeti, CRNA
- Sachiko Sato, CRNA
- Elizabeth Stansberry, CRNA

## OR Support Tech

- Ramiro Mejia-Helpps

“The importance of teamwork in the community setting cannot be overemphasized.

Every member of the team makes invaluable contributions every day.”



Beth Israel Deaconess Hospital–Milton (BID–Milton) is a 100–bed, acute care community hospital with 24-hour emergency services, an eight–bed ICU, and over 250 physicians on staff. The BIDMC Anesthesia Department has provided anesthesia at BID–Milton since 2015, pain management, shared coverage of the ICU, and oversight of the Pre–Admission Testing (PAT) clinic. Our group comprises 10 BIDMC Anesthesia physicians who rotate at BID–Milton, 15 BID–Milton–based nurse anesthetists, two BIDMC pain management anesthesiologists, a dedicated pain NP, and two NPs in the PAT clinic. BIDMC anesthesia intensivists also provide coverage in the ICUs alongside BID–Milton–based pulmonologists. Collectively, we provide high–quality, patient–centered care in the PAT Clinic, Pain Clinic, the ICU, endoscopy suites, and the operating rooms. We work with our nursing and surgical colleagues to

continuously enhance patient safety, evidence–based care, and efficiency.

In the Operating Room and Endoscopy Suites in 2018, the hospital opened 12 new inpatient beds and a new dedicated robotic operating room, allowing expansion of surgical specialties in several key service lines. In particular, we have seen an increase in joint replacements, including revisions and complex procedures, robotic cases in multiple disciplines, and bariatric, minimally invasive surgery. Orthopedic surgery volume, especially for knee and hip joint replacements, continues to be a major contributor to operating room volume. It is common to perform six to nine joint replacements in a single day, with over 90% of cases receiving spinal anesthesia. The Orthopedic Committee, co–led by orthopedics and anesthesia, is developing new multidisciplinary pathways to ensure appropriate hydration and



preemptive multimodal pain management. Evaluating quality, including satisfaction, length of stay, and re-admissions will be a major focus for 2019. Hip fracture patients also represent a common add-on case for the team. Working together with our hospitalist and surgeon colleagues, we have now expedited most of these cases to the operating room within 24 hours of presentation, and over half receive spinal anesthesia. Rapid transition to the operating room is a major predictor of outcome for these patients, so this transition is particularly gratifying for our teams and speaks to our commitment to providing exemplary care for our patients. Robotic surgery is another area that has expanded at BID-Milton — we are now performing 20-25 cases per month. The Anesthesia team joins the monthly robotic committee activities, and, in addition to participating in quality review of cases, we have also created new protocols for positioning, eye care, and multimodal analgesia. Bariatric surgery is our other major service line that has expanded this last year. Working with the Bariatric Division at BIDMC, we have adopted Enhanced Recovery After Surgery (ERAS) protocols that aim to ensure early pain reduction and nausea recovery after surgery.

While intraoperative anesthetic excellence is always our goal, we have also turned increasing attention to the perioperative care of our patients. Our preoperative assessment system is modeled after BIDMC-Boston; patients with complex medical histories are evaluated in person by our nurse practitioner in the PAT clinic in advance of surgery, and cancellations on

the day of surgery are rare.

Endoscopy is a particularly busy area for anesthesia at BID-Milton. We run three to four endoscopy suites per day, providing care for outpatients and inpatients and caring for 450-plus patients each month. Working alongside nursing, we have streamlined care, providing efficient service with high patient and provider satisfaction.

Within our own group, we continue to look for opportunities to improve patient care and the quality of anesthetic care. In 2018, we introduced a new electronic record for anesthesia (Shareable Ink) and a new community-wide electronic system, Meditech Expanse. The implementation of both systems was successful, and we are now working toward incorporating more standardized protocols and post-operative assessments into the electronic record to advance our efforts toward comprehensive perioperative care. Our Anesthesia Department is represented by both MDs and CRNAs on several major perioperative committees for the hospital, including Medical Staff, Operating Room Executive, Surgical Steering, Orthopedic Steering Committee, Robotic Surgery Committee, and the ICU committee. Participation is an important aspect of perioperative care for our patients and our teams. One of our CRNAs summed up our approach in this area: “Being part of a multidisciplinary committee has allowed me to give Anesthesia a voice and show active participation in improving patient care.”

BID-Milton is all team-based care — where the MDs regularly work with

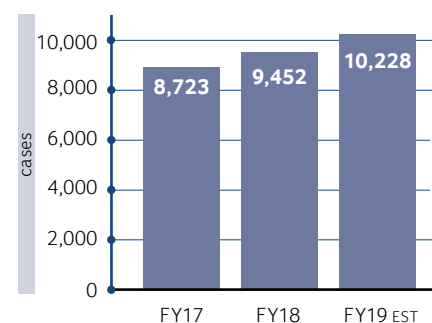
three to four CRNAs in the ORs or in the endo suites. We encourage flexibility and open communication to ensure our patients get the best care we can provide.

Our Pain Service continues to provide tremendous care for patients in the community during a time of steadily increasing patient volume. In the next year, we will add more clinic time and space for our busy pain clinicians. Pain is always challenging for patients and providers, and we are fortunate to have a committed team at BID-Milton dedicated to this area. The pain team has developed a strong partnership within our community and continues to strive to provide exemplary, comprehensive pain management services.

### The Community Setting

Working in a community setting brings different challenges compared with a major academic hospital, and we continue to learn from our community partners. The importance of teamwork in the community setting cannot be overemphasized. To run ten locations efficiently and safely, every member of the team makes invaluable contributions every day, whether by demonstrating clinical excellence, efficiently setting up for the next case, or simply entering orders on time. It all counts.

**BID-Milton Volume FY17 – FY19**



# Clinical Anesthesia at BID–Needham



**Rikante O. Kveraga, MD**

Site Chief, BID–Needham  
Assistant Professor of Anaesthesia

“We are the smallest BID community hospital, but great things are happening here! Everyone feels like part of a family, and we take the very best care of our patients—who often tell us they’re treated like family and not just a number.”



## Faculty

Vimal K. Akhouri, MD, MBBS  
Assistant Professor of Anaesthesia

Amanda K. Anastasi, MD  
Assistant Professor of Anaesthesia

Lauren K. Buhl, MD, PhD  
Instructor in Anaesthesia

Hyun Kee Chung, MD  
Instructor in Anaesthesia

Galina V. Korsunsky, MD  
Instructor in Anaesthesia

Cindy M. Ku, MD  
Instructor in Anaesthesia

Lisa J. Kunze, MD, PhD  
Assistant Professor of Anaesthesia

Robert S. Leckie, MD  
Assistant Professor of Anaesthesia

Soumya Mahapatra, MD  
Instructor in Anaesthesia

## Pain Faculty

M. Moris Aner, MD  
*Director, Chronic Inpatient  
Pain Services*  
Assistant Professor of Anaesthesia

Jatinder S. Gill, MBBS, MD  
Assistant Professor of Anaesthesia

Cristin A. McMurray, MD  
Instructor in Anaesthesia

## Nurse Practitioner

Katrina Robertson, NP

## OR Support Tech

Adam Carlson

Beth Israel Deaconess Hospital–Needham (BID–Needham) is a 58-bed community satellite hospital affiliated with BIDMC in Boston. The surgical pavilion has a state-of-the-art “open concept” pre-anesthesia holding area, a post-anesthesia care unit, and six ORs with two new operating suites to accommodate growing surgical volume. One OR suite is a dedicated cystoscopy room, and two are laparoscopic suites.

In an effort to distribute volume appropriately within the BID system, a Clinical Integration Committee, with members from BIDMC and BID–Needham, has worked since 2015 to transfer lower-acuity volume from BIDMC to BID–Needham, leading to consistently increased volume year after year. Volume at BID–Needham has increased 42% since the committee was formed.

Care teams of MDs and CRNAs, who manage complex and high-acuity patients at BIDMC, bring their expertise to the community,

tailored to the needs of a fast-paced outpatient setting.

## Pre-Admission Testing

BID–Needham uses a pre-admission system that reaches out to all patients having elective surgery. They gather in-depth medical histories, provide patient education, and set patient expectations. This system leads to very low day-of-surgery cancellation rates.

## Patient Satisfaction

We have implemented a variety of subspecialty-specific multimodal analgesia pathways. These include a number of innovative peripheral nerve blocks that enhance the entire post-surgery recovery.

For total joint replacement surgery, we have established great continuity in care with regard to pain management. With the hospital’s support, we developed a program in which a pain nurse practitioner sees joint replacement patients in PAT and prepares them for their experience, particularly with regard to postoperative pain. On the day



of surgery, she sees them again in preop and then follows up with them every day until they are discharged. This continuous interaction helps the department achieve consistently higher-than-average scores on pain management in a very challenging patient population.

In the area of patient satisfaction with ambulatory surgery, month after month, greater than 95% of patients coming to BID–Needham would be very likely to recommend having surgery here.

### Training

The high volume of orthopedics at BID–Needham offers an excellent opportunity to develop a rotating Regional Anesthesia Fellowship in combination with BIDMC Boston. Currently there is a practice management rotation for residents nearing graduation at BID–Needham. They gain experience supervising and working with CRNAs, managing a fast-paced OR, and learning more about the intricacies of running an efficient OR similar to that found in private practice.

### Quality and Safety Innovations

The Department of Anesthesia at BID–Needham has developed several innovative programs in recent years, including:



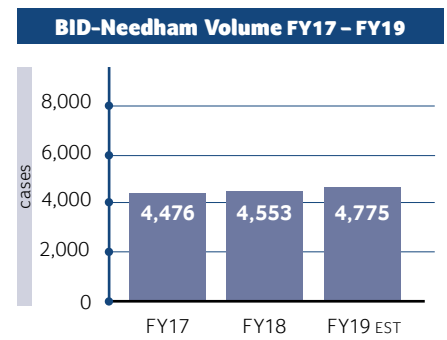
- multimodal analgesia for patients having laparoscopic surgery and uro-gynecological procedures
- perioperative care pathways for major joint replacements
- innovative iPad-based electronic health records

In addition, a department poster titled “Improving Pain Management by Focusing on Causes of PACU Discharge Delays and Preoperative Medications” received third place in the Foundation for Anesthesia Education and Research poster contest at the 2017 American Society of Anesthesiologists Practice Management conference.

All of these accomplishments are even more significant as they have accompanied a period of rapid growth in BID–Needham’s clinical volume and services.

### SERVICES PROVIDED

- Minimal-access laparoscopic surgery, including colorectal surgery
- Plastics and reconstructive procedures
- Orthopedic sports medicine
- Total and complex joint replacements
- Hand, ankle, and podiatry sports medicine
- Adult otolaryngology
- Cancer surgery
- Urological procedures for men and women
- Women’s health and gynecologic procedures
- Limited pediatric otolaryngology medicine



# Clinical Anesthesia at BID–Plymouth



**Erin Burns, MD**  
Site Chief, BID–Plymouth

### BID–Plymouth Attendings

- Ben Kaon, MD
- Benjamin Moor, MD
- Neil W. Oliwa, MD
- James O’Rourke, MD
- Aimee C. Reilly, DO
- Christopher Walters, MD
- Natallia Yaromenka, MD

### ICU Faculty

- Alan Lisbon, MD  
*Medical Director, BID–Plymouth ICU*  
Associate Professor of Anaesthesia
- Somnath Bose, MD, MBBS  
Instructor in Anaesthesia
- Melanie R. Loberman, MD  
Instructor in Anaesthesia

- Kadhiresan R. Murugappan, MD  
Instructor in Anaesthesia
- Brian P. O’Gara, MD, MPH  
Instructor in Anaesthesia
- Todd W. Sarge, MD  
Assistant Professor of Anaesthesia
- Daniel P. Walsh, MD  
Instructor in Anaesthesia

### BID–Plymouth CRNAs

- Maria Vaz, CRNA  
*Chief CRNA*
- Randy Barnhard, CRNA
- Victoria Boehm, CRNA
- Katherine Canina, CRNA
- Karolyn Caron, CRNA
- Dayna Cary, CRNA

- John Cona, CRNA
- Elizabeth Demartini, CRNA
- Steven Demartini, CRNA
- Kevin Doherty, CRNA
- Brian Fenn, CRNA
- Penne Traci Greer, CRNA
- Benjamin Prieur, CRNA
- Linda Stewart, CRNA
- Shelby Sullivan, CRNA
- Amy Townsend, CRNA
- Tara Traczyk, CRNA
- Peter Tsinzo, CRNA

### OR Support Tech

- Maureen Vercellone

“We embrace the mission of delivering the highest quality care in an efficient and caring manner. Our anesthesia and OR team work cooperatively to ensure the greatest patient safety and satisfaction.”



BID–Plymouth is a 153–bed community hospital located 43 miles south of Boston. In 2018, BID–Plymouth was again chosen as a Leapfrog Top General Hospital.

The BID–Plymouth Department of Anesthesia is part of the Associated Physicians of Harvard Medical Faculty Physicians network and works closely with our tertiary care partner hospital in Boston to provide comprehensive anesthetic and pain management care to our patients. The Plymouth Department of Anesthesia is comprised of eight physicians, 14 CRNAs, and several nurse practitioners providing care in pre-admission testing and pain management.

### Services provided

Anesthesia care is provided in the operating rooms, The Birth Center, Pain Management Center, cardiovascular lab, endoscopy suites, interventional radiology, critical

care unit, and the emergency room. Anesthesiologists are available in the hospital 24 hours a day to meet urgent or emergent needs of the expanding South Shore community.

- **Obstetric services:** In 2018, BID–Plymouth had 823 deliveries. The obstetric volume increased about 10%, while many other hospitals in MA experienced decreased obstetric volume. In response to this increase in volume, a new 12–bed postpartum unit was constructed.
- **Orthopedic and sports medicine:** BID–Plymouth has a large number of orthopedic cases, including joint replacements and sports medicine. The hospital currently has two Mako robots in use for joint replacement surgery. Joint replacements are done under spinal anesthesia whenever possible. We also perform complex spine surgeries on a regular basis. The hospital is on a pathway to becoming a Joint Commission



Center for Excellence in Orthopedics. The anesthesia department is quite active with ultrasound-guided preoperative nerve blocks. We commonly perform adductor canal blocks, iPACK blocks, brachial plexus blocks, popliteal fossa blocks, and fascia iliaca blocks. We use multimodal pain control wherever possible to limit narcotic use while providing excellent pain control and patient satisfaction.

- **Cancer surgery**, including breast reconstruction, with utilization of ultrasound guided pectoralis blocks for postoperative pain management.
- **Major vascular surgery**, including carotid endarterectomy, done via ultrasound-guided cervical plexus blocks and sedation. We perform

open and endovascular aortic surgery and vascular bypass procedures.

- There is a new **thoracic surgery** program within the last year, and we offer thoracic epidurals for thoracotomy patients.
- There is a new **neurosurgery** program, and craniotomies are now being performed at BID-Plymouth.
- **Pediatric (outpatient) and adult ENT surgery**
- **Active general and colorectal surgery program.** The Anesthesia Department participates in ERAS protocols using multimodal peri-operative care pathways and TAP blocks using Exparel to decrease postoperative pain.
- **Urologic procedures**
- **Podiatry procedures**
- **Gynecological procedures**
- **ICU direction and management**

An ECT program is planned for the latter half of 2019 to better serve the needs of our local community.

We performed approximately 6,600 operative procedures annually in eight ORs, along with staffing four endoscopy suites daily performing around 8,000 cases for 2018. Our Pain Management Center has about 4,000 patient encounters annually.

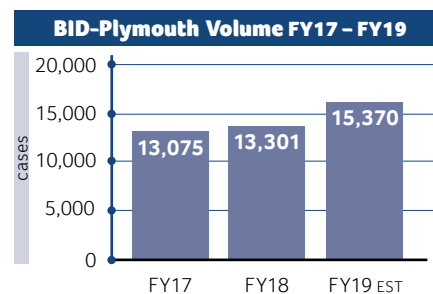
### Accomplishments

The community of Plymouth has been greatly affected by the current opioid epidemic. For the past several years, BID-Plymouth has led a successful collaboration in the Commonwealth of Massachusetts toward



early intervention when patients present in the emergency room after a drug overdose. This intervention is carried out not only in the emergency room but after the patient is discharged from home. This program has helped highlight the potential pitfalls associated with unnecessary use of opioids in the hospital environment. To that end, the Anesthesia Department is committed to regional anesthesia whenever possible and beneficial, as well as multimodal non-narcotic alternatives to minimize or eliminate narcotic consumption while still providing excellent post-operative pain control.

The Anesthesia Department oversees the preadmission testing center, including adoption of current evidence-based guidelines for preoperative testing. We are in the process of developing a multidisciplinary preoperative risk stratification program for our joint arthroplasty surgical patients and will use this program to improve the management of more complicated patients.



# Clinical Anesthesia at Anna Jaques Hospital



**Chad Anderson MD**

Site Chief, Anna Jaques Hospital

“It is a pleasure to provide services in our home community hospital. Our dedicated team at AJH is committed to high-quality care that keeps patients close to home.”



### Anna Jaques Attending

- Katherine Bourne, MD
- Vladimir Eisenberg, MD
- Jennifer Evansmith, MD
- Andrey Filippov, MD, PhD
- Jessica Heath, MD
- Mark Kats, MD
- Robert Kirkman, MD
- Steven Parker, MD

### Anna Jaques CRNAs

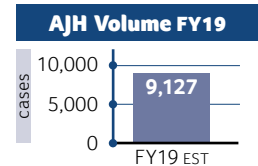
- Robert Martin, CRNA  
*Chief CRNA*
- Nancy Dunn, CRNA
- Ross Cerami, CRNA
- Judy Graham-Garcia, CRNA
- Beth Hughes, CRNA
- David Kelleher, CRNA
- Katherine Morse, CRNA

Barbara Quirk, CRNA

Erin Todd, CRNA

### OR Support Tech

Melissa McCartney



Anna Jaques Hospital (AJH) is a 120-bed community hospital located 40 miles north of Boston. The Anesthesia Department is comprised of 6.5 MDs, six CRNAs, and one anesthesia support tech. We cover 9,500 cases per year across five ORs and three endoscopy suites. There are 700 OB deliveries annually in our Designated Baby-Friendly facility. AJH is also an American College of Surgeons Verified Level III trauma center. We have 24/7 in-house anesthesia coverage.

It’s been an exciting year for Anna Jaques Hospital. On November 1, 2018, the private anesthesia group merged with Associated Physicians of Harvard Medical Faculty Physicians (APHMFP) to become part of the BID anesthesia family. We were able to retain most of the previous staff members and have recruited several excellent physicians and CRNAs as we continue to build our department. In addition, several BIDMC staff are credentialed at AJH and regularly bring their subspecialty expertise from Boston as we continue to advance anesthesia practice in the community model.

On March 1, 2019, Anna Jaques Hospital became a founding member

of Beth Israel Lahey Health. As one of the eight community hospitals in this new network, AJH is committed to keeping care in the community while utilizing the resources of the tertiary care centers when appropriate. The Anesthesia Department at AJH is well positioned with APHMFP to take advantage of the breadth of our new network and opportunities available.

In 2018, we built on the success of our Mako robotic partial knee replacements and began to offer Mako total knee replacements. Our total joint volume continues to grow, and we have implemented standardized care pathways to improve postoperative function and decrease length of stay. Our ultrasound-guided regional nerve block program also continues to grow, and, in 2018, we introduced long-acting liposomal bupivacaine for our interscalene blocks. This has been a success for our total shoulder patients as well as rotator cuff repairs. We have also instituted a daily perioperative huddle. This is comprised of anesthesia, nursing and PAT, with the goal of decreasing the next day’s inefficiencies and delays.





## Clinical Divisions





**Feroze Mahmood, MD**

Director, Cardiac Anesthesia

Director, Perioperative Echocardiography

Professor of Anaesthesia

“Our division is considered the national leader in 3D imaging and research.”

## Cardiac Anesthesia

The Division of Cardiac Anesthesia provides clinical services to patients undergoing a wide array of cardiac surgeries, electrophysiological procedures and structural heart disease procedures. In addition to their clinical responsibilities, our faculty members participate in diverse clinical and administrative responsibilities at the department and hospital level. Notably, Dr. Balachundhar Subramaniam is the Director of the Center for Anesthesia Research Excellence (CARE), Dr. Sugantha Sundar assumed the role of Professionalism Officer for the medical center, Dr. Adam Lerner is the Clinical Director of the West Campus and Dr. John Mitchell is the residency program director.

### Clinical Update

The cardiac surgical program performed more than 1,000 cardiac

surgical cases annually over the past three years, including coronary revascularization procedures, and complex valvular and aortic arch surgical cases. We are also one of the busiest “structural heart disease” centers in the Northeast, with a case mix that includes percutaneous aortic valve replacement (TAVR), the Mitraclip® procedure, percutaneous atrial and ventricular septal defect closures, and valve-in-valve therapy. Our division exclusively provides the imaging services for these complex structural heart disease interventions. This variety of cases and technologies provides an incredible training opportunity for our residents and fellows, and consolidates our reputation as a world-class tertiary care medical center for cardiac surgery.

The clinical cardiac surgical pro-

## team

**Ruma R. Bose, MD, MBBS**

*Program Director, Adult Cardiothoracic Fellowship*  
Assistant Professor of Anaesthesia

**Qi C. Ott, MD**

Instructor in Anaesthesia

**Sugantha Sundar, MBBS**

Assistant Professor of Anaesthesia

**Megan L. Krajewski, MD**

Instructor in Anaesthesia

**Robert S. Leckie, MD**

Assistant Professor of Anaesthesia

**Adam B. Lerner, MD**

Assistant Professor of Anaesthesia

**John D. Mitchell, MD**

Associate Professor of Anaesthesia

**Balachundhar Subramaniam, MD, MPH**

Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

**Barry J. Kelly, MD**

Instructor in Anaesthesia

**Shahzad Shaefi, MD, MPH**

Assistant Professor of Anaesthesia

**Aidan Sharkey, MD**

Instructor in Anaesthesia



gram at BIDMC is considered a national leader in quality and innovation. Thanks to the excellence of our team, we have exceeded all national quality benchmarks established by the Society of Thoracic Surgeons (STS) and Centers for Medicare and Medicaid Services. Some key metrics included on these evaluations are compliance with perioperative antibiotics, beta adrenergic blocking drug administration, allogenic blood product use, length of stay, re-admission rates and mortality. Our expanding heart failure service and ventricular assist device (VAD) program also provide state-of-the-art care and give staff and trainees exposure to the types of complex cases that require a deep understanding of the nuances of device operation and their perioperative management.

Division members regularly lead and participate in multi-disciplinary conferences related to scheduling of structural heart and electrophysiological procedures, and heart failure service. The skill and professionalism of our division members play a vital role in the success of both our clinical and administrative initiatives, and we are highly respected by cardiac surgeons and cardiologists. We expect a steady and sustained growth in our cardiac surgical volume over the coming years with continued opportunities to enhance our clinical involvement and performance.

### Research

Expanding the evidence base in cardiac research is one of the primary components of our mission, and we are fortunate to have

several world-class and prolific researchers on our team. The scope of research ranges from clinical echocardiography, three-dimensional printing, delirium, hyperoxia, and neo-angiogenesis to multiple educational projects. Dr. Shahzad Shaefi has received funding from the Foundation for Anesthesia Education and Research (FAER), the Department of Defense, the National Institute on Aging, and the National Institute of General Medical Sciences. His work focuses on the detrimental effects of perioperative hyperoxia as well as potential protective effects of hypoxia. Dr. Balachundhar Subramaniam

Cardiac			
Procedures	FY17	FY18	FY19 <sup>EST</sup>
Pump Cases	883	925	940
Structural Heart Cases	215	232	254
<b>Total</b>	<b>1,098</b>	<b>1,157</b>	<b>1,194</b>





### Ruma Bose, MD,

has received

the Kaplan Leadership Development Award and grant from the Society of

Cardiovascular Anesthesiologists (SCA), for developing a structural heart disease (SHD) curriculum for the cardiothoracic fellowship. The curriculum is a multi-modal competency-based curriculum for SHD meant for the cardiothoracic anesthesia fellowship.



The timeline for development and implementation is 6 months to one year, with the goal to have it completed for the first SHD fellow joining in November. The anesthesiologist in SHD cases must have an expertise in real-time three-dimensional echocardiography and functions as a trail guide to a multidisciplinary team consisting of an interventional cardiologist and cardiac surgeon, in addition to providing anesthetic care for these high-risk patient populations. A clear understanding of the different elements of SHD, from diagnosis and workup to treatment and post-operative disposition is essential in providing the best possible care to our SHD patients. Our curriculum aims to incorporate these essential components to train experts in SHD anesthesia.

has also received funding from multiple sources for his clinical research. He is involved in multiple clinical trials regarding postoperative delirium and has mentored junior faculty through the auspices of the Center for Anesthesia Research Excellence (CARE). He is currently funded by NIH, Edward Lifesciences, and Mallinckrodt. The Echo Lab, as part of the Valve Research Group, is active in multiple clinical research projects. These include three-dimensional imaging, three-dimensional printing/hemodynamic testing of patient-specific models of mitral and aortic valves, neo-angiogenesis with targeted delivery of drug-tagged nanoparticles, and ischemic myocardium. This year, Dr. Qi Cui Ott won the departmental John Hedley-White research grant on gender-related differences in an operating room environment. Dr. Ruma Bose was awarded the Society of Cardiovascular Anesthesiologist's Kaplan Leadership Grant for her proposal to develop a structural heart disease fellowship curriculum. Besides these, multiple original research articles, case reports, reviews, and book chapters were authored by members of the division. We plan to continue to

expand and diversify our research portfolio and establish ourselves as the leading cardiac anesthesia research center in the world.

### Education

Our division offers three positions for a 12-month cardiac anesthesia fellowship. We receive over 100 applications from excellent candidates each year for these highly sought-after positions. This year, Dr. Ruma Bose assumed leadership responsibilities for the cardiac anesthesia fellowship as the program director, taking over for Dr. Shaefi. We have added the Tufts Medical Center rotation for our fellows to enhance their heart failure and cardiac transplant management experience. In addition to their training in perioperative echocardiography, the cardiac anesthesia fellows are involved in clinical management and imaging of structural heart cases, which is a particular clinical strength of our fellowship program. All our fellows attend the Society of Cardiovascular Anesthesiologists (SCA) Echo Week conference and present their research and clinical projects at the SCA Annual Scientific Sessions. Dr. Andaleeb Ahmed's research abstract was judged the best abstract at the recent meeting, and he won the Kaplan Young Researcher Award for his research project. Yannick Berabeau's abstract on 3D printing of patient-specific mitral valves was also judged as one of the best abstracts of the meeting. We have introduced syllabi for Fundamentals of Echocardiography and Cardiopulmonary Bypass for resident and fellows. We plan to introduce a multi-modality compre-



hensive cardiac anesthesia rotation and fellowship curriculum.

Under the leadership of Dr. Ruma Bose, our division is the first in the country to introduce a six-month-long Structural Heart Disease (SHD) fellowship dedicated to management of patients undergoing structural heart disease interventions. Our first SHD fellow will be starting their fellowship later this year. We have also initiated a faculty-focused educational program for development of proficiency in perioperative use of ultrasound. Multiple faculty have attended the longitudinal series of lectures and hands-on sessions as part of this educational initiative.

Our faculty have represented the division at multiple national and international meetings and educational symposia. Notably, Dr. Mahmood was the course director of the SCA Echo Week, while Drs. Krajewski and Panzica served on the organizing program committee of the SCA Echo Week and Dr. Shaefi served on the program committee of the SCA annual meeting. As a leader in echocardiographic education, our division has organized multiple hands-on 3D workshops for cardiac anesthesia groups from multiple academic medical centers. We have continued this tradition of excellence and consolidated our reputation as one of the leading centers for ultrasound education research in general and echocardiographic training in particular.

### Quality Assurance

Our division is committed to pursuing continuous quality improvement



Nyman CB1, Mackensen GB2, Jelacic S2, Little SH3, Smith TW4, Mahmood F5. Transcatheter Mitral Valve Repair Using the Edge-to-Edge Clip. *J Am Soc Echocardiogr.* 2018 Apr;31(4):434-453. PMID: 29482977



This invited review article co-authored by Professor of Anaesthesia, **Feroze Mahmood, MD** explains in detail the various procedural steps of performing percutaneous mitral valve interventions. It is the first article that comprehensively addresses these steps, which use edge-to-edge leaflet plication with the MitraClip, currently the only Food and Drug Administration-approved device specifically for primary and degenerative lesions. Thanks to the team efforts of our interventional cardiology, cardiac surgery and cardiac anesthesia divisions, BIDMC is considered a leading center for the innovation in structural heart disease management. This article is important since it sets standards for other medical practitioners to follow.

in order to maintain and enhance our clinical services. Overall, the division members are involved in multiple quality assurance projects at the departmental and hospital levels. Dr. Ott is spearheading the electrophysiology (EP) laboratory on-time start project in collaboration with the EP staff. In addition to serving on the OR efficiency committee, Dr. Lerner has participated in the intraoperative blood conservation and wastage reduction project. Our division members regularly participate in the cardiac surgical infection control committee, Society of Thoracic Surgeon (STS) quality metrics data meetings, and

early extubation and fast-tracking protocols. In collaboration with the structural heart disease team, we have initiated protocols to reduce operating room turnover and recovery room length of stay, and the majority of the TAVRs are performed under monitored anesthetic care. Dr. Aidan Sharkey and Dr. Meghan Krajewski represent the division in the structural heart scheduling and the ventricular assist device planning committees, respectively.

We look forward to a year of continued clinical growth and of our division members in various fields of cardiac anesthesia.





**Ala Nozari, MD, PhD**

Director, Neuroanesthesia and Neurocritical care  
Co-director, Neuroscience Intensive Care Unit  
Program Director, Neurocritical Care Fellowship  
Associate Professor of Anaesthesia

“Teamed with renowned neurosurgeons and neurointensivists, skillful neurosurgical nurse practitioners, perioperative nurses and other clinical and support staff, we provide state-of-the-art perioperative care for major CNS disorders with subtle or far-reaching impacts on the patient’s quality of life.”

## Neuroanesthesia

Anesthesiologists from the Division of Neuroanesthesia provide comprehensive perioperative care for patients undergoing a wide array of complex intracranial and spine procedures at Beth Israel Deaconess Medical Center (BIDMC). At BIDMC, approximately 2,500 intracranial and spine surgeries are performed annually. The Medical Center has an international reputation for the surgical treatment of movement disorders, epilepsy, and cerebral aneurysms. Our neurosurgeons, specialized in functional neurosurgery, place the largest number of deep brain stimulators in Boston. A multidisciplinary team of specialists is important to the overall success of this program. BIDMC is a high-volume center for patients with neurovascular disease and offers

world-class treatment using open and endovascular techniques. Interventional neurosurgical procedures continue to expand and now include clot-retrieval procedures for acute ischemic stroke. The volume of patients presenting for these emergency cases continues to increase, as significant benefit for select patients has been demonstrated. In addition, the evolving technology for pipeline stent and coil embolization procedures has decreased the number of patients who would otherwise require invasive, open neurovascular procedures.

Members from the division serve as attending faculty in our high-acuity Neurosciences Intensive Care Unit (NICU). As a tertiary-care regional referral center, the NICU treats patients with a wide variety of neurologic disease.

## team

Vimal K. Akhouri, MD, MBBS  
Assistant Professor of Anaesthesia

Amanda K. Anastasi, MD  
Assistant Professor of Anaesthesia

Ruma R. Bose, MD, MBBS  
Assistant Professor of Anaesthesia

Somnath Bose, MD, MBBS  
Instructor in Anaesthesia

Lauren K. Buhl, MD, PhD  
Instructor in Anaesthesia

Victoria M. Derevianko, MD  
Instructor in Anaesthesia

Rikante O. Kveraga, MD  
Assistant Professor of Anaesthesia

Akiva Leibowitz, MD  
Instructor in Anaesthesia

Melanie R. Loberman, MD  
Instructor in Anaesthesia

Haobo Ma, MD, MS  
Instructor in Anaesthesia

Soumya Mahapatra, MD  
Instructor in Anaesthesia

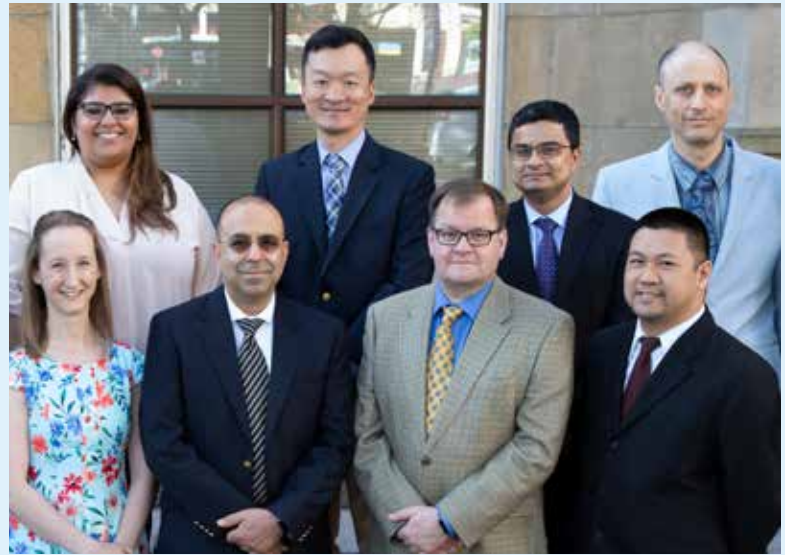
Achikam Oren-Grinberg, MD, MS  
Assistant Professor of Anaesthesia

Ameeka Pannu, MD  
*Associate Program Director,  
Anesthesia Critical Care Fellowship*  
Instructor in Anaesthesia

Richard J. Pollard, MD  
*Director, Neuroanesthesia Fellowship*  
Assistant Professor of Anaesthesia

M. Leo Tsay, MD  
Instructor in Anaesthesia

Simon X. Zhang, MD  
Instructor in Anaesthesia



## Education

Members of the division play an active role in resident education; residents rotate through neuroanesthesia during their first two years, with increasing exposure to difficult cases. Senior residents can elect to spend an extra month on service. In addition, the division has hosted foreign residents looking to complete an observership in neuroanesthesia. The group also organizes an annual resident lecture series that covers core topics in neuroanesthesia. A journal club is used to introduce several of the most important articles in neuroanesthesia on a weekly basis. Members of the group maintain an up-to-date list of educational resources, both online via the Anesthesia Intranet.

The division also organizes hospital-wide educational events meant to encourage clinicians from various specialties

with similar clinical interests to engage in collaborative discussions to improve patient care. The first of these was a neurophysiologic monitoring symposium. Upcoming events include electroencephalography in the perioperative setting and a Harvard-wide neuroanesthesia resident and fellow journal club.

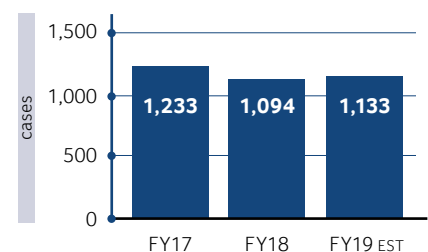
First-year residents spend one month in the neurosurgical suite. This month is meant to be an introduction to neurosurgical anesthesia, and teaching is directed at reinforcing the basic principles of the subspecialty. In their second year, residents complete another one-month rotation. During this month, the complexity of the cases increases and there is exposure to neurocritical care. The second-year rotation also includes an “airway rotation,” during which residents gain familiarity using advanced airway techniques.

Members from the division are active in national neuroanesthesia and neurocritical care societies and have been invited to present lectures for these meetings.

## Fellowship programs

Two fellowships have been established within the division: neurocritical care and neuroanesthesia. The Division of Neuroanesthesia offers a one-year, non-ACGME accredited fellowship position in advanced neurosurgical anesthesiology. This is a comprehensive fellowship that provides an opportunity for fellows to gain experience in all aspects

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of neuroanesthesia, in addition to neurocritical care. Participation in a research project is also expected. These projects are facilitated through close mentorship from faculty members, who are accomplished physician-scientists.

For anesthesiologists who have completed a fellowship in critical care medicine, the department offers an additional one-year fellowship in neurocritical care. This fellowship, which is accredited by the United Council for Neurologic Subspecialties, leads to board eligibility for the subspecialty of neurocritical care. This fellowship consists of eight months spent in our dedicated NICU and four months of elective rotations, which include a wide range of options. Neurocritical Care was recently recognized by the American

Board of Medical Specialties, and a new subspecialty certification exam will be offered to eligible diplomates of the American Board of Anesthesiology, administered by the American Board of Psychiatry and Neurology.

### Research

Division faculty members are involved with research that focuses on **traumatic brain injury, intracranial hypertension, spinal cord injury, and lung/brain interactions**. The Brain and Lung Injury Study Group (BALI), supported by the Center for Anesthesia Research Excellence (CARE), is focused on better understanding how mechanical ventilation practices affect brain injury. This work examines how titration in positive end-expired pressure influences intracranial

pressure and has resulted in the publication of a paper that explored how cerebral hemodynamics are affected by mechanical ventilation. Furthermore, our group collaborates with members from the departments of neurosurgery and pharmacy on retrospective and prospective studies on the effects of a common inodilator, milrinone, on cerebral vasospasm and delayed neurological injury. Other research projects within the division include airway compromise after high cervical spine procedures, pain management after large spine procedures using dantrolene, and assessment of vocal cord paralysis as a predictor of failed extubation after cerebral infarcts.

The Division is starting an exciting project supported by CRICO (Controlled Risk Insurance Company) to **reduce perioperative and postoperative adverse events through in site debriefing and spaced practice of speaking up. Reducing peri- and post-operative adverse events through in-situ debriefing and spaced practice of speaking up.** Laura Rock MD, Rebecca Meinhert MD, Ala Nozari MD, PhD, 2019.

The goal of this grant is to develop speaking-up skills in the context of correct site identification in orthopedic and neuro spine surgery and of identifying and managing patient deterioration in the NICU. The long-term goal of the feasibility study is to prevent adverse events, especially wrong-site surgery in the OR, and improve management of a deteriorating patient in the ICU.





**Philip E. Hess, MD**

Director, Obstetrical Anesthesia  
Program Director, Obstetrical  
Anesthesia Fellowship  
Associate Professor of Anaesthesia

“Our division’s superb level of quality has been rewarded with the Society for Obstetric Anesthesia and Perinatology (SOAP) Center of Excellence designation for 2019.”

## Obstetrical Anesthesia

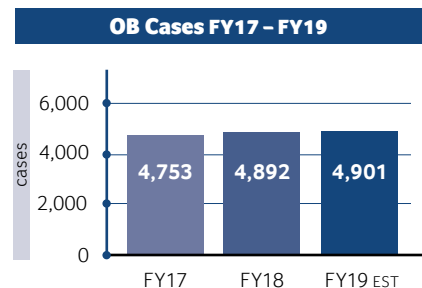
The obstetric services at Beth Israel Deaconess Medical Center (BIDMC) are a major tertiary referral center and the second-largest delivery unit in Massachusetts. The Division of Obstetric Anesthesia includes 13 full- and part-time staff that provide clinical, academic, and administrative services to women who are pregnant beyond 20 weeks of gestation, with a principle focus on managing the anesthetic care of women in the peripartum period. Modern obstetric anesthesia provides a broad range of care, from pain relief services during labor and anesthesia for cesarean delivery to emergent care for very high-risk patients. We strive to meet the expectations of every patient every time.

In addition to providing services for labor and delivery, the division is involved in the care of the parturient during other times. We provide a consultative service for pregnant

patients who have complex medical conditions and assist in the management of patients with postpartum complications, such as massive hemorrhage, congestive heart failure, or neurologic deficits.

A core principle of the division is interdisciplinary coordination and teamwork. We help spearhead medical teamwork in the hospital and nationally. We strive to ensure that the care of the pregnant patient is seamless across every hospital service.

Over the past year, the division of Obstetric Anesthesia was very ac-





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tive clinically, providing 5,073 anesthetics to antepartum, intrapartum, and postpartum patients. Over 90% of the women who deliver at BIDMC receive labor analgesia, including 3,731 patients who received analgesia for their labor pain and 1,638 who had a cesarean delivery (some of whom were in labor and received labor analgesia), and dozens of additional cases of peripartum care. A significant component of the service is devoted to providing anesthesia for cesarean delivery. Parturients can be scheduled for cesarean delivery, or proceed to cesarean after labor on an urgent or emergent basis. Cesarean delivery can be accomplished with spinal anesthesia, epidural anesthesia, or occasionally general anesthesia. Approximately 30% of women delivered by cesarean this year, and our general anesthesia rate remains below 1%.

The division also maintains a comprehensive QA program. Virtually

100% of patients are seen on the first postpartum day and QA data is recorded for each visit. Our QA dashboard allows the division to focus improvement efforts with greater precision. We met and exceeded all quality goals as set by MassHealth maternity and the Joint Commission perinatal care measures. We also provided the highest-quality post-cesarean section pain control via multimodality approaches, including neuraxial opioids, epidural analgesia, parenteral pain medication, and transversus abdominus plane block and quadratus lumborum block, if indicated. We provided formal consultation prior to delivery to over 1,000 women for high-risk conditions, including severe scoliosis, hematologic conditions, and cardiac, pulmonary, and neurologic diseases, as well as supra-morbid obesity.

Our division's superb level of quality

has been awarded with the Society for Obstetric Anesthesia and Perinatology (SOAP) Center of Excellence designation for 2019. It is the first year that SOAP is granting the Center of Excellence designation and only 39 institutions received this prestigious honor. The award, which lasts for four years, recognizes OB/GYN anesthesia in the areas of quality of personnel, equipment, protocols, policies, cesarean delivery management, labor analgesia management, recommendations and guidelines implementation, and quality assurance.

A growing volume of our care consists of patients with pathological adherent placenta, often due to previous surgery. Our division is an important component of the New England Center for Placental Disorders, a program at BIDMC designed to provide comprehensive care to women with abnormal placentation.



This multidisciplinary team included specialists in maternal-fetal medicine (high-risk pregnancy), newborn medicine, nursing, urology, and, of course, obstetric anesthesia.

### Research

The division is actively involved in research activities to enhance knowledge of the care of the pregnant patient. These research activities include investigations to improve the educational program and better understand the physiologic changes of pregnancy, and studies to improve the safety and clinical care of the parturient. Members regularly publish peer-reviewed articles, chapters, and reviews. The division has a strong presence at the Society for Obstetric Anesthesia and Perinatology.

Currently active studies include:

- **Dexmedetomidine after cesarean for the treatment of nausea and shivering**

We are assessing the use of a

very small intravenous dose of dexmedetomidine (a mild sedative) for prevention of postoperative shivering after cesarean delivery. Shivering is a common and disconcerting side effect of delivery and spinal anesthesia.

- **Evaluating the use of point-of-care ultrasound in the efficacy of epidural blood patch in postpartum patients**

We are trying to determine whether ultrasound has positive or negative predictive value among women with a post-lumbar puncture headache (low cerebral spinal fluid pressure), by measuring the ocular nerve sheath diameter, as well as the lumbar cerebral spinal fluid volume and spread of blood.

- **Prospective evaluation of the effects of IV ketorolac on platelet function post-cesarean delivery**

We are evaluating the effect, if any, of a small dose of ketorolac (a common non-steroidal anti-inflammatory medication) used after cesarean delivery on platelet function.

- **Randomized controlled trial of panniculus retraction methods for cesarean delivery**

This study, conducted in cooperation with members of the Department of Obstetrics and Gynecology, examines the impact of two methods of retraction of the panniculus in morbidly obese patients undergoing cesarean delivery. In addition to the surgical impact, we are measuring the pulmonary function of these patients before and after retraction.

### Education

A core function of the Division of Obstetric Anesthesia is the education of students, trainees, and ourselves. The Division trains medical students from countries all around the world as part of the HMS clerkship. In addition, the division provides 100% of the residency training in obstetric anesthesia, as required by the Accreditation Council for Graduate Medical Education (ACGME). We are one of three ACGME obstetric anesthesia fellowship training programs in the city. Finally, the division maintains ongoing group educational programs for the staff. These programs are designed to provide ongoing education and improve the capabilities of each member.

Clinical teaching is performed through organized and impromptu lectures, supervised hands-on training, and the open provision of reading materials. Residents are first trained in the subspecialty of obstetric anesthesia during the first six months of their residency. All first-year residents are assigned to an orientation week of OB anesthesia, where they learn the basic skills of neuraxial anesthesia and analgesia, and the management of a routine OB patient. The purpose of this introductory week is to allow the resident to gain confidence in their foundational skills so that they can learn advanced patient care during the subsequent required rotations. After orientation, all residents are assigned a basic obstetric anesthesia rotation. During this month-long rotation, the residents hone their techniques of neuraxial anesthesia and analgesia, learn how to man-

age a healthy parturient, and are exposed to high-risk cases. All residents go through a second, month-long rotation during their second year. In addition to providing additional training and education in the management of high-risk parturients, this month includes a one-week rotation in the Neonatal Intensive Care Unit. Residents learn about the care of the high-risk neonate in a level-3 NICU by participating in care with the neonatology attending and fellow. We also provide an elective third-year advanced rotation. On this rotation, the residents are expected to participate in the care of high-risk and complex parturients, conduct consultations, and learn the management of postpartum conditions or complications.

Recent innovations in education include a new teaching calendar system for resident education. Prior to the start of each month-long rotation, residents are sent a comprehensive list of topics. They are expected to present three of these

topics during the month as formal lectures. These, as well as all other talks, are then recorded on the wall calendar. This has dramatically increased the amount of lecture-driven education on the unit. A second innovation is the fellow lecture series.

### **ACGME-accredited Fellowship**

The Obstetric Anesthesiology Fellowship is accredited by the ACGME. In addition to dedicated obstetric anesthesiologists, faculty who provide education and consultation include intensivists, obstetricians, maternal fetal medicine specialists, neonatologists, and pathologists; these members are integral to the fellow's education program. The didactic curriculum for the fellowship program embraces lessons from fundamental physiology and pharmacology through the advanced science of genetic polymorphisms and molecular mechanisms of diseases during pregnancy. Fellows meet for a weekly didactic session with a faculty member. As a combined venture with the Anesthesia Depart-



ments at Harvard Medical School, an educational lecture is held every few months for all OB anesthesia fellows. Internationally, the fellow has an opportunity to have a one-week rotation in a labor and delivery unit in China, as a member of the "No Pain Labor and Delivery – Global Health Initiative" (NPLD) program. Dr. Yunping Li is one of the founding members of NPLD, which has sent hundreds of anesthesiologists, obstetricians, and nurses on missions.







**Lisa J. Kunze, MD, PhD**

Director, Orthopedic Anesthesia  
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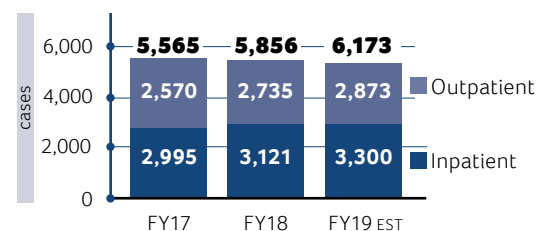
“The orthopedic anesthesia division saves lives and limbs. Whether we are taking care of a trauma patient or a rotator cuff repair, we improve the quality of patients’ lives by helping them get back to moving, working, and enjoying life.”

## Orthopedic Anesthesia

Orthopedic Anesthesia became a separate division at Beth Israel Deaconess Medical Center in 2012 and encompasses all non-spine orthopedic anesthesia. While virtually every clinical anesthesia provider has been involved with the care of orthopedic surgical patients, there is a select group of 23 anesthesiologists who are the core orthopedic anesthesia group. These individuals have been key in the development and support of the elective total joint arthroplasty pathways and in the development and support of the perioperative analgesia pathways for orthopedic anesthesia. There are many individuals from the Department of Anesthesia, Critical Care and Pain Medicine and other perioperative services who provide exceptional support to the efforts of the orthopedic surgical patients and

the efforts of the division. Special appreciation goes to the Regional Anesthesia Division members who have been invaluable in optimizing analgesia for the orthopedic patients. The preoperative nurses and the anesthesia nurse practitioners have been key in facilitating preoperative patient preparation, thus improving efficient block placement prior to surgery. Preoperative testing nurse practitioners and physicians, the Orthopedic Surgery Department, and the nurse naviga-

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tors have all provided collaborative assistance, which has improved the care of the orthopedic patients.

### Quality Improvement

Quality improvement efforts in total joint arthroplasty patients have been successful and ongoing. These efforts include the evaluation of patients in PAT, where they are also evaluated by a physical therapist and case manager. Over the past year, PAT has worked with the surgeons to reduce unnecessary tests in these patients, reducing cost to the patient and hospital. The ERAS Enhanced Recovery after Anesthesia and Surgery protocol for the elective total joint arthroplasty patients was expanded this year to include use of preoperative protein drink and Gatorade or other clear liquid in the hours prior to surgery. These patients are doing the work of an athlete to overcome the physiological demands of these surgeries, and they need to be in a fed and hydrated state. These supplements are provided by the Department of Orthopedic Surgery while the patients are in PAT.

We continue to successfully use tranexamic acid (TXA) in joint replacement patients, and preliminary discussions with the orthopedic trauma surgeons regarding use of TXA are promising. Spinal anesthesia continues to be used for a significant percentage of patients having elective total knee or hip arthroplasty. Complications related to the use of neuraxial anesthesia have been quite rare. The switch to primarily oral, multimodal anal-

gesia following surgery was made several years ago and continues to be standard practice. The use of multimodal analgesia continues to be high in sports medicine, foot and ankle, oncology, and hand surgeries as well. Further efforts continue to reduce the use of opioids during and after surgery.

### Patient care

There are many patients who present for elective total knee or hip



arthroplasty during 2018 who have severe cardiac and pulmonary comorbidities. Typically, these patients have a difficult perioperative course and the risk of mortality is often estimated to exceed 5%. Due to coordinated efforts of PAT, the surgeons, members of the Cardiac Anesthesia Division, and the exceptional care from the core Orthopedic Anesthesia Division, most of these patients have done very well.

### Quality Improvement

Our division has numerous quality improvement efforts both ongoing

and planned. We continue to increase the use of spinal anesthesia for geriatric patients with hip fractures based on evidence that hospitals performing more than 25% of these surgeries with spinal anesthesia have better surgical and outcome rates.

We plan to analyze data from quality improvement efforts for joint arthroplasty patients with an eye toward optimizing our processes. In addition, we are developing a consult anesthesia service within our orthopedic group to manage complex ASA 3-4 (ASA Physical

Status classification) patients having elective surgery. We currently perform this function informally but are formalizing the effort by developing a multidisciplinary group to help identify high-risk patients. ACL reconstruction patients often experience significant pain and have a prolonged length of stay in the Post Anesthesia Care Unit (PACU). We are determining best practices to address this issue and developing a care plan for these surgeries. In order to strengthen our education program we are creating a more formalized curriculum for our residents.









**Galina V. Korsunsky, MD**

Director, Regional Anesthesia and Acute Pain Service

Program Director, Regional Anesthesia Fellowship

Instructor in Anaesthesia

“The Division of Regional Anesthesia and Acute Pain Service has the most energetic, enthusiastic and overall awesome members who happily share their expertise with patients and colleagues locally, nationally and internationally.”

## Regional Anesthesia

The Division of Regional Anesthesia and Acute Pain Service at Beth Israel Deaconess Medical Center was established in 2008 to improve patient care, safety, and comfort and has continued to provide high-quality care to patients across all surgical subspecialties.

Our goals are to expand use of regional anesthesia to provide high-quality patient care, develop residents and fellows as experts in a wide range of regional anesthetics and acute pain management, help anesthesia faculty maintain their proficiency with regional anesthesia techniques, and serve as consultants to our surgical and medical colleagues in managing acute pain.

The Division consists of 13 faculty members and a full-time nurse practitioner. We perform the majority of the blocks for surgical pro-

cedures and serve as consultants in managing acute pain. One staff member is assigned with a resident or fellow each day as a block team to place all needed blocks. Subsequent anesthetic care is performed by a second anesthesia team. This dedicated block service is present on both the East and West Campuses. This model has greatly increased the amount and quality of regional anesthesia performed at BIDMC. The development of the regional anesthesia team has increased patient and surgeon satisfaction and increased requests for regional anesthetics.

Regional			
Procedures	FY17	FY18	FY19 <sup>EST</sup>
Primary	1,174	1,115	1,156
Epidural	586	601	572
Placed for Post-Op	2,763	2,064	2,937
Rescue	88	106	125
<b>Total</b>	<b>4,611</b>	<b>3,886</b>	<b>3,790</b>



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**Nurse Practitioner**  
Regina Champagne, NP  
*Acute Pain Service*

**Fellow**  
Nadav Levy, MD



The volume of regional anesthetic cases has gradually increased over the past few years. We have expanded regional blocks for vascular patients, working closely with the vascular surgeons to improve patient care. We now offer erector spinae plane blocks to thoracic and breast surgery patients and have incorporated regional anesthetics into the ERAS protocol for bariatric patients. We have also extended our services to our community hospitals, ensuring standardized quality patient care.

Our volume on Acute Pain Service has substantially increased. We often care for complex pain patients, working to improve their care while decreasing the use of opioids. Together with the Chronic Pain Service, we have developed guidelines on management of perioperative patients on Suboxone and chronic opioid therapy. Nurse Practitioner, Regina Champagne, is in the

forefront of educating nurses and orthopedic services on perioperative pain management of complex patients.

### Education

The regional anesthesia rotation, completed by CA2 and CA3 residents, continues to be one of the most popular residency rotations. First-year anesthesia residents are introduced to regional blocks during their first pain management rotation. Our graduates are proficient in the use of neuraxial anesthesia and ultrasound-guided regional anesthesia for a wide variety of surgical procedures. We also introduced a more formal training in the Education Lab with computer-assisted peripheral block models, thoracic and lumbar epidural models with modifiable difficulty, dedicated ultrasound, and video tutorials to ensure junior residents have an appropriate level of basic regional anesthesia knowl-

edge and skills prior to starting their rotation.

Our division has continued to be the main organizer of the ultrasound course for the Harvard Anesthesiology Update and has presented similar refresher courses nationally and internationally. The Regional/Acute Pain Service fellowship







traditionally consists of six months of advanced regional anesthesia training combined with six months of work as an attending anesthesiologist. Our fellows take an active part in resident education as well as research projects. We have seen an increasing interest in our fellowship from all across the country as well as from overseas.



### Research Projects

- **Ultrasound Guided Erector Spinae Block for Thoracic Surgery** A study to determine the efficacy of ultrasound-guided erector spinae plane block for thoracic surgery procedures. Dr. Matyal, Dr. Urits.
- **Virtual Reality in the Operating Room:** A study using Immersive Relaxation as an Adjunct to Anesthesia: VR vs standard of care in hand surgeries to reduce effective dose of an anesthetic. Dr. O’Gara, Dr. Levy, Dr. Zimmer, Dr. Korsunsky.
- **Defining the QA Framework to Assess Implementation Success of Future Interventions to Reduce Thoracic Epidural Analgesia Failure Rates.** A retrospective analysis of the last 2 years (+/- 1000 placements), design and implement an intervention. Dr. Nadav Levy, Dr. Korsunsky.
- **TAP blocks placed by surgeons in Robotic surgery.** An abstract presented at SSAT in June 2019. Dr. Akhouri working with Moser.

### Quality Improvement Projects

- **ERAS Implementation for Laparoscopic Sleeve Gastrectomy.** Division members: Dr. Korsunsky, Dr. Ku, Dr. Stephanie Jones, and Regina Champagne, together with our surgical colleagues developed ERAS protocol for bariatric patients undergoing laparoscopic sleeve gastrectomy procedure. The ERAS protocol included use of TAP blocks for these patients in order to minimize opioid analgesia as part of the overall protocol goal. Ms. Champagne took an active role in developing a patient handout and educating patients and nurses about the protocol and its benefits. Since implementation of the protocol, the average length of stay has decreased by 40% and the incidence of postoperative nausea has significantly decreased.
- **Hospital policy implementation.** Dr. Korsunsky and Ms. Champagne worked with the Medical Director of the Medication Safety and Information Management Committee to **establish a hospital-wide Guidelines for Anti-thrombotic Therapy in Patients Undergoing Diagnostic or Therapeutic Neuraxial or Peripheral Nerve Procedures**
- **Erector Spinae Plane block for breast surgery patients to minimize use of opioids.** Dr. Nadav Levy and Dr. Korsunsky are looking at the effectiveness of the ESPBs to minimize opioid analgesia in this patient population. Since the start of the project, the use of the opioids has significantly decreased and patient satisfaction has increased.







**John B. Pawlowski, MD, PhD**

Director, Thoracic Anesthesia  
Co-Director, Shapiro Simulation  
Center at BIDMC

Assistant Professor of Anaesthesia

“This year, the Thoracic Anesthesia team has led educational and technical courses on airway anatomy and erector spinae blocks, as well as helped to design Enhanced Recovery After Surgery (ERAS) protocols that will make thoracic surgery safer and more comfortable for patients.”

## Thoracic Anesthesia

The Division of Thoracic Anesthesia provides anesthesia services to thoracic surgery and interventional Pulmonology (IP) patients in a variety of BIDMC locations and affiliated community sites. The combined volume of cases from January 2018 to December 2018 was 1,713, with 615 thoracic procedures and 1,098 interventional pulmonology cases. These services include general and regional anesthesia, use of conventional and jet ventilation, and management of complex airways and advanced lung disease. Over the past few years, the Thoracic Anesthesia Group has provided anesthesia care for an increasing number of IP and thoracic surgery procedures. During this time, we have adopted high-frequency jet ventilation as our usual mode of ventilation during rigid bronchoscopy cases.

These are exciting and innovative times for the Thoracic Anesthesia Division. We have recruited talented new anesthesiologists to handle increased volume, particularly in robotic surgery. Six of the 13 members are new this year. The new clinicians and continued assistance from the Block Team allow us to perform regional procedures via a multimodal approach to pain management. With input from our surgical colleagues, we are designing and improving newer pain treatments, such as the implementation of ultrasound-guided erector spinae blocks. These innovations will make thoracic and interventional pulmonary procedures safer and less painful in the future.

While this expansion involves challenges, we are gratified by the



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level of cooperation and planning demonstrated by our team with each new venture. For example, the robotic thoracic surgical program is now entering its fifth year with one of the best safety and efficacy records in the country. These results are a product of extensive preparation, training, and simulation of the potential complications associated with robotic surgery. The nurses, doctors, and technicians from the multidisciplinary team meet frequently to discuss quality improvement. This level of support, respect, and enthusiasm from every member of the combined multidisciplinary thoracic surgery and interventional pulmonology team is a major contributor to our continued success.

We are currently developing a robotic thoracic surgery program, including innovative robotic safety programs to plan and train for potential crises in robotic thoracic surgery. Most of the robotic cases have been for thymectomy, lobectomy, or wedge procedures.

Several innovations and systemic improvements have made thoracic surgery safer and more comfortable for patients. The Block Team either supervises or conducts most of the regional techniques to control pain. In the case of thoracotomies, 74% receive thoracic epidural catheters. Two percent of video-assisted thoracic surgery (VATS) patients receive epidurals, usually when either pleural decortication or pleurodesis is planned. The pathway for VATS provides multimodal pre-medications and intraoperative intercostal blocks to relieve pain

in these patients. In addition, both paravertebral and erector spinae blocks have been employed to reduce pain as well as lower the requirements for opioid medications in the postoperative period. The total amount of opioid medication used in thoracic surgery and IP has dropped dramatically with the advent of multimodal pain therapy. In 2018, 79 erector spinae blocks were performed.

Use of electronic blood cross-matching has been extended to the thoracic patients and often obviates





for treatment of tracheobronchomalacia. Drs. Gangadharan and Wilson provide options in posterior tracheobronchoplasty that allow patients to breathe during exercise without the suffocating feeling of airway collapse. Anesthetic management has been adjusted so a bronchial blocker is used to provide lung isolation, while the operative area is under continuous bronchoscopic observation. This allows the anesthesiologists to provide instant feedback about the success of the surgical buttressing. This timely communication avoids the need for later additional interventions and “repair” sutures.

As our network expands to places like the Lahey Clinic and Mount Auburn Hospital, we welcome new surgeons, anesthesiologists, nurses and interventional pulmonologists to our team to provide more choices of facilities and experts for patients who have diseases of the chest.

the need for additional needle sticks and visits to the blood bank. To improve storage of bronchoscopes and avoid cross-contamination of instruments, the anesthesia technicians, led by Ed Plant, built a miniature sealed cabinet, complete with fan and HEPA filter to exceed Joint Commission regulations. These improvements and innovations make everyone safer and lower the risk of spreading infection.

The increase in nurses, scrub technicians, and anesthesiologists has enabled us to expand procedures to all locations on our Main Boston campus. IP procedures, including

pleuroscopy, now occur on both our East and West campuses. We are rising to the challenge to provide superb care to an aging population of patients with progressive diseases — several IP patients have been so ill as to require ECMO (extracorporeal membrane oxygenation) in order to tolerate the procedure or facilitate recovery. These complex cases test the abilities and knowledge of the whole team and require regular educational and planning meetings.

The Chest Disease Center attracts patients from around the country

## Education

The Thoracic Division is integrally involved in the educational mission of the Department through teaching of medical students, residents, staff, and allied health professionals. Local instruction occurs with anesthesia resident lectures, simulations, and virtual bronchoscopy sessions. All of the IP fellows in New England come to BIDMC for a one-day orientation and demonstration session. This includes lectures on anesthesia and on the practice of airway skills—both taught by anesthesiologists. A regular monthly session in virtual bronchoscopy, airway anatomy, and double-lumen tube



and bronchial blocker placement became a regular monthly session that is now required before any of the residents rotate on Thoracic Anesthesia. Local CME courses on bronchoscopy, anesthesia practices, and airway workshops include anesthesiologists from BIDMC. The 2018 Harvard Anesthesiology Update workshop included several lectures, workshops and luncheon discussions on the subjects of thoracic surgery and IP.

Teaching also occurs on a national level with invited Grand Rounds presentations and surgical and anesthesia demonstrations of tracheoplasty cases at other teaching hospitals. The issue of robotic surgical safety was examined by a chartered team during the Faculty Hour program and has expanded into a series of lectures and panels. Most recently, one of the Thoracic Anesthesia group presented at a conference in Nashville, Tennessee.

Several initiatives to improve efficiency and outcomes of thoracic surgery have been performed this



year. Under the leadership of Dr. Sidhu Gangadharan, the PIQI project is an ambitious plan to list and time present workflow items done from the time the patient is brought awake into the operating room until that patient is asleep and ready for the surgical incision. With

focus on essential maneuvers and the most time-consuming tasks, an educational program was created to train staff in a faster, more effective way to prepare the patient. That project is in the stage of data analysis. In addition, our group has started a process to review the peri-operative management of all of the thoracic surgery patients, and we expect new carepaths in the coming months.

### Research

The Division is engaged in research throughout the year. Current projects include:

- Indocyanine Green Dye for Sentinel Node Biopsy in VATS Patients
- Lung Volume Reduction Study Using Bronchial Valves
- Robotic Bronchoscopy; Rheoplasty Project







**Jason S. Wakakuwa, MD**

Director, Transplant Anesthesia

Assistant Professor of  
Anaesthesia

“We care for  
the sickest patients  
and help to give  
the gift of life.”

## Transplant Anesthesia

The Division of Transplant Anesthesia is comprised of nine anesthesiologists who are responsible for the intraoperative care of patients undergoing liver transplant surgery, as well as operations in the immediate postoperative period. The team is available 24 hours a day to see both transplant patients and other patients requiring our specific expertise, such as trauma patients with major IVC injuries. We also care for most patients undergoing hepatic resections and major hepatobiliary surgeries. Kidney transplants, pancreas transplants, donor nephrectomies, and dialysis access procedures are covered by members of the Department of Anesthesia as a whole. In 2018 there were 65 kidney transplants, 30 liver transplants, six combined liver/kidney

transplants, and nine pancreas transplants. The division director serves as a liaison between the transplant surgeons and the Anesthesia Department. The Chief of Transplant Surgery at BIDMC, Robert Fisher, MD, reestablished the Live Donor Liver Transplant Program in the Medical Center, and over the past two years there have been seven live donor liver transplants performed. We anticipate this will increase to 10 cases per year and are fully prepared to provide excellent anesthesia care in these challenging cases.

### Education

Our Division has retained a stable and committed core group of faculty members over the past several years who are actively involved in the academic mission of the de-

## team

Jessica M. Cassavaugh, MD, PhD  
Instructor in Anaesthesia

Matthias Eikermann, MD, PhD  
Professor of Anaesthesia

Galina V. Korsunsky, MD  
Instructor in Anaesthesia

Feroze Mahmood, MD  
Professor of Anaesthesia

John D. Mitchell, MD  
Associate Professor of Anaesthesia

Sara E. Neves, MD  
Instructor in Anaesthesia

Satya Krishna Ramachandran, MD  
Associate Professor of Anaesthesia

Shahzad Shaefi, MD, MPH  
Assistant Professor of Anaesthesia

Eswar Sundar, MBBS  
Assistant Professor of Anaesthesia

Sugantha Sundar, MBBS  
Assistant Professor of Anaesthesia



partment. We are regularly invited to speak at grand rounds lectures and society conferences throughout the country. In addition, we organize and conduct a biannual block of resident lectures devoted to transplant anesthesia, including topics such as pathophysiology, intraoperative management, surgical considerations, and case presentations. Beginning in 2017, a joint Liver Anesthesia Transplant Fellowship program was established with the Lahey Medical Center. This new venture allows clinical fellows to participate in the care of transplant patients in two very different clinical settings. The fellows will also be able to gain experience in intraoperative transesophageal echocardiography (TEE), which will be done in conjunction with the Division of Cardiac Anesthesia.

### Research

The division faculty members are committed to improving the evidence base in transplant medicine through collaborative research investigations. We have worked on

studies conducted by the Divisions of Transplant Surgery and Hepatology. These included the use of intraoperative carbon monoxide

in kidney transplant recipients and the treatment of liver transplant recipients with a Hepatitis C monoclonal antibody.







**Robina Matyal, MD**

Director, Vascular Anesthesia  
Leonard Bushnell Chair  
of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

“It’s a new era with different types of cases, risk stratification, and management for patients presenting for vascular surgery. This requires a new approach to risk and perioperative management.”

## Vascular Anesthesia

The Vascular Division is a dedicated team of anesthesiologists using their demonstrated skill and dedication to care for this unique population. Perioperative management of patients undergoing vascular surgery is a clinical challenge, and vascular anesthesiologists require specific skill sets to manage these patients. They are expected to have an expertise in transesophageal echocardiography (TEE) and transthoracic echocardiogram (TTE), ability to perform ultrasound-guided regional block and, when required, safely transition from sedation to a general anesthetic with maximal invasive monitoring. The staff members caring for this challenging patient population bring experience, motivation, enthusiasm, and compassion to their clinical work.

The Division of Vascular Anesthesia continues to provide services for patients undergoing open and endovascular vascular surgery. Simultaneous with their clinical responsibilities, Division members participate in research, teaching, and quality improvement initiatives. The clinical volume has remained stable, and the vascular surgery division remains one of the busiest clinical services in the city. Our extensive clinical experience allows us to provide a state-of-the-art teaching environment for residents and fellows. The case mix of vascular surgery cases range from open thoraco-abdominal aortic aneurysm repair surgery to endovascular procedures to transcarotid arterial flow reversal procedures with combined open and endovascular steps under cardiac and neuro monitor-





## team

Olaoluwakitan Awolesi, MD  
Instructor in Anaesthesia

Ruma R. Bose, MD, MBBS  
Assistant Professor of Anaesthesia

Jessica M. Cassavaugh, MD, PhD  
Instructor in Anaesthesia

Galina V. Korsunsky, MD  
Instructor in Anaesthesia

Cindy M. Ku, MD  
Instructor in Anaesthesia

Akiva Leibowitz, MD  
Instructor in Anaesthesia

Feroze Mahmood, MD  
Professor of Anaesthesia

Kadhiresan Murugappan, MD  
Instructor in Anaesthesia

Sara E. Neves, MD  
Instructor in Anaesthesia

Ameeka Pannu, MD  
Instructor in Anaesthesia

Richard J. Pollard, MD  
Assistant Professor of Anaesthesia

Deborah S. Reynolds, MD  
Assistant Professor of Anaesthesia

Maximilian S. Schaefer, MD  
Visiting Scientist in Anaesthesia

Shahzad Shaefi, MD, MPH  
Assistant Professor of Anaesthesia

Aidan Sharkey, MD  
Instructor in Anaesthesia

Balachundhar Subramaniam, MD, MPH  
Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

Daniel P. Walsh, MD  
Instructor in Anaesthesia

Simon X. Zhang, MD  
Instructor in Anaesthesia

ing. Endovascular procedures are performed in the "hybrid" operating rooms with the capability to support procedures under fluoroscopy or open surgical procedures. These procedures require the highest level of vigilance, monitoring, and resuscitation, providing our staff and residents a unique clinical experience.

### Education

We are developing a comprehensive curriculum for residents on vascular rotation that includes pre-learning with preparation of common topics and simulator-based training so

they are well prepared and every exposure with the patient is more educational for the residents and meaningful for the patients. We have set up specific learning expectations for this rotation, and the Division members and residents are expected to adhere to this curriculum. We consistently strive to maintain balance between the service and educational components of our daily operation. Our perioperative ultrasound-teaching program is also thriving. Most of the new vascular faculty members are comfortable with all aspects of invasive monitor-

ing, including perioperative TEE and TTE. The team members run many national and international courses for teaching perioperative ultrasound. We teach both 2D and 3D TEE to our residents and staff, and for the past four years the group extended their ultrasound-teaching program to surgical residents. We concluded the first phase of perioperative ultrasound training for our faculty and recently published our multimodality ultrasound curriculum. This program is shared with multiple national and international anesthesia, cardiology, and surgical training programs.

We are attempting to place all our arterial lines using real time ultrasound guidance. The goal is to save time, enhance residents' skill sets in ultrasound, and above all increase patient comfort and decrease arterial access complications.

### Quality Improvement

Division members participate in multiple ongoing quality improvement projects throughout the year. Through multiple collaborative projects with our vascular surgery colleagues, preoperative work-up has been streamlined and simplified. For example, the availability of type-specific blood products as a prerequisite for elective carotid endarterectomy was eliminated, with resultant improved efficiency and cost savings. Through another collaborative project, we modified the protocol for the availability of four units of blood in the operating room for endovascular aortic aneurysm repair. We published our recommendations and project in the *Journal of Vascular Surgery*.

The endovascular repair of thoracic aortic aneurysm is associated with



## Robina Matyal, MD: First Endowed Leonard S. Bushnell Chair of Anaesthesia



Dr. Leonard Bushnell started the first ICU and Pain Service at BIDMC and had an enormous impact in the field of critical care medicine, both at BIDMC and nationwide. In 2019 it was announced that Robina Matyal, MD, Director of Vascular Anesthesia at BIDMC, is the first recipient of the Leonard Bushnell Chair of Anaesthesia at BIDMC. Daniel Talmor, MD, Chair of the Department of Anesthesia, Critical Care and Pain Medicine, lauded Dr. Matyal's many accomplishments: "She is an amazing educator, a stellar clinician, and has a broad spectrum of research. She is also incredibly generous in sharing that research and bringing new investigators into the fold." Dr. Matyal is a prolific researcher, with close to 100 publications, many of them in high-impact publications. Her current research focuses on optimizing perioperative care through translation of basic science research and perioperative education and use of ultrasound to epitomize a comprehensive bench-to-bedside model. She describes her philosophy regarding the relationship between research and patient care as "optimizing clinical care from bench to bedside."

many complications as it can compromise blood supply of various organs (e.g., kidneys and spinal cord). Meticulous preplanning can help ensure proper placement and adequate blood supply to these vital organs. We developed a methodology making a three-dimensional model of patient-specific thoracic aneurysm for preplanning and modifying the graft accordingly. With these well-established protocols and evidence-based management principles, our vascular surgery outcomes remain among the best in the country.

One of our current quality improvement initiatives is improving the operating room efficiency by focusing on on-time start, facilitating communication and preplanning between various team members, and improving workflow.

### Teaching

Members of our division are consistently rated among the best clinical teachers. Their teaching activities range from bedside teaching, formal lectures to the residents, and participation in national and international conferences. With more advanced and high-risk surgeries, the residents' clinical experience continues to improve. With more aortic surgery, the number of cases requiring cerebrospinal fluid drainage and neuromonitoring has also increased, further enriching our clinical and training experience. With multiple staff members certified in perioperative TEE and critical care ultrasound, residents also learn various aspects of rescue TEE, cardiac monitoring, and point-of-care ultrasound.

We are developing a more interactive way of teaching. The learning starts before the vascular surgery rotation with identified knowledge and skill expectations, simulator based practice and meeting minimum numbers, followed by learning specific topics with self-assessment tools and problem-based scenarios.

### Research

Multiple division members have participated in various clinical, basic science, and educational research projects. Our clinical research ranges from database analysis, use of ultrasound for cardiac and lung assessment, and three-dimensional printing of patient-specific thoracic aortic aneurysm for preplanning for various arterial branching re-anastomosis. Our basic science research on the role of neuro-peptide-Y in neuro-angiogenesis and its remote delivery through nanoparticles in a mouse model of acute cardiac ischemia recently finished with promising results, and we are preparing to apply for an innovation grant. We identified mitochondrial dysfunction and impaired fatty acid metabolism as a possible cause of postoperative atrial fibrillation after cardiac surgery. We published our findings in the *Annals of Thoracic Surgery*. We have presented our research at various annual scientific sessions at the American Society of Anesthesiologists (ASA), Society of Cardiovascular Anesthesiologists (SCA), American Heart Association (AHA), and Harvard Medical School.

Various members of the division serve on professional national and



Neuropeptide Y  
3-36 incorporated

into PVAX nanoparticle improves functional blood flow in a murine model of hind limb ischemia.



Eshun D, Saraf R, Bae S, Jeganathan J, Mahmood F, Dilmen S, Ke Q, Lee D, Kang PM, Maytal, R. *J Appl Physiol*. 2017 Jun 1;122(6):1388-1397.

This paper epitomizes the translational impact of our basic science research over the last decade. In this experiment we successfully tested the use of nanoparticles for targeted drug delivery. Using nanoparticles that were tagged with neuro-peptide Y, we demonstrated that when injected remotely these particles would travel to and deliver the drug to the ischemic myocardium. This technique offers potential therapeutic option to treat ischemic cardiomyopathy in diabetes, in which the large coronary vessels are generally unaffected and most of the coronary occlusions are located in the smaller vessels. The specific nanoparticle used in this study is designed to sense and deliver the tagged molecules in areas of myocardium demonstrating high oxidative stress and mediators of ischemia; thus limiting its systemic effects and concentrating it in ischemic regions and prolonging the duration of action.

international committees, editorial boards, and educational symposia. They have mentored multiple residents in abstract presentations at the ASA, SCA, AHA, and Society of Critical Care Medicine (SCCM) annual meetings.





**Patricia M. O'Connor, CRNA**  
Chief Nurse Anesthetist

“The Division of Nurse Anesthesia is a group of exceptionally skilled and compassionate caregivers proud to practice alongside our excellent anesthesiologist colleagues.”

## Nurse Anesthesia

We are a highly skilled group of 63 dedicated certified registered nurse anesthetists (CRNAs) who practice at the Beth Israel Deaconess Medical Center (BIDMC) and affiliated community sites. We plan to hire more CRNAs during 2019 and anticipate very active recruitment efforts in the coming years with the continued growth in our Department, patient volume, and sites. The CRNAs primarily provide clinical services along with anesthesiologists in the Department of Anesthesia, Critical Care and Pain Medicine. Working within a care team model, the nurse anesthetists provide perioperative anesthesia care for patients undergoing procedures from many subspecialties throughout the medical center and in community settings. The CRNAs have prescriptive authority, which

enables them to provide immediate pre- and post-operative orders. This improves efficiency, and quality of pain management for patients during their entire surgical experience.

In addition to their clinical role, the CRNAs are committed to education and training. They actively assist with resident, medical student, nursing, and nursing student training, and serve as clinical instructors to student nurse anesthetists rotating to the medical center from Northeastern University. In conjunction with Northeastern University, the Division has hosted CRNAs visiting from Liberia, providing a clinical enrichment opportunity and providing an important educational contribution in service of global health. The CRNAs also



## team

Judy Akpan, CRNA

Joseph Bertrand, CRNA

Lorrie-Jean Campbell, CRNA

Donnell Carter, CRNA

Minwook (Larry) Chong, CRNA

Beth A. Coolidge, CRNA

Timothy J. DeGuzman, CRNA

Israel Demenezes, CRNA

Patricia A. Demiglio, CRNA

Nicole Graham, CRNA

Donna M. Greene, CRNA

H. Rita Han, CRNA

Sarah E. Hayden, CRNA

Elizabeth Heckman, CRNA

James Hogan, CRNA

So-Min (Amy) Huang, CRNA

Carolyn H. Long, CRNA

Eileen Lyons, CRNA

Rebecca J. Peyev, CRNA

Jennifer L. Phelan, CRNA

Naira Qazi, CRNA

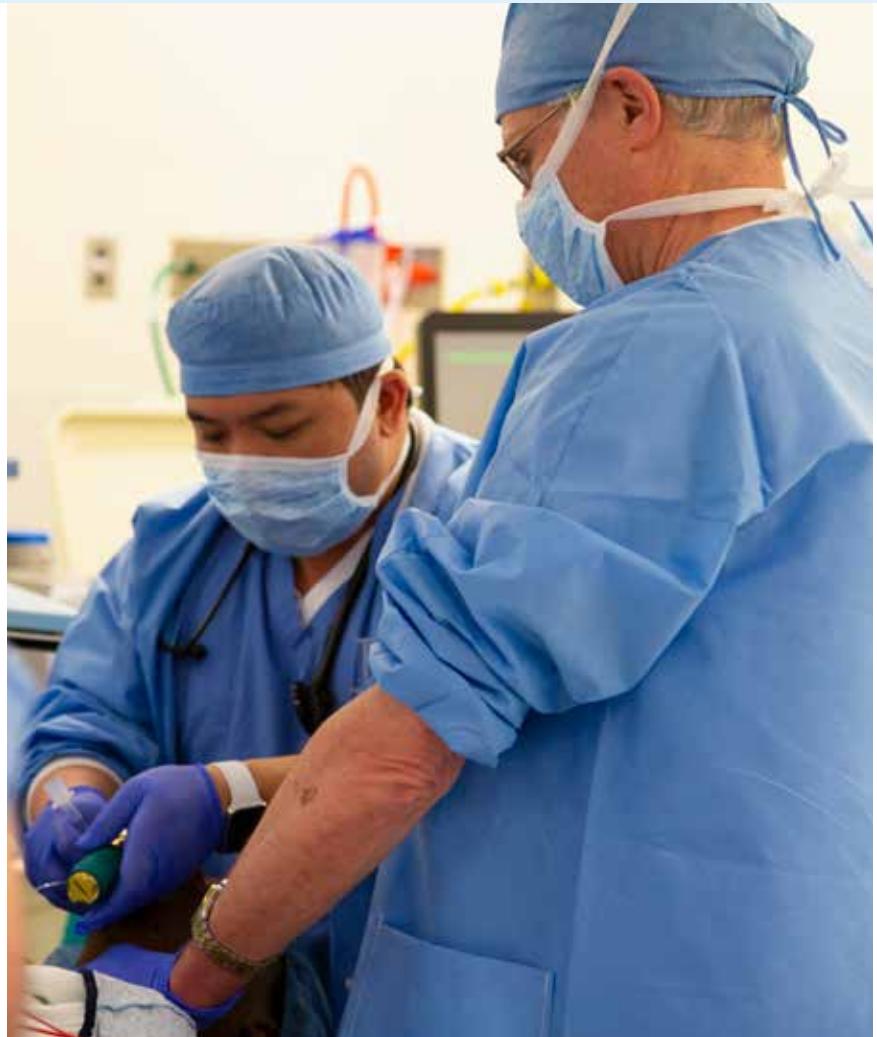
William G. Rice, CRNA

Jennifer Rollins, CRNA

Ashley Vaughn, CRNA

provide shadowing opportunities for BIDMC perioperative nurses. This program has become highly valued by the perioperative nurses and is now part of their orientation and training process. CRNAs also participate in a wide variety of hospital and department committees, including the multidisciplinary Faculty Hour, the Emergency Manual Committee, and the Advanced Practice Nursing Committee.

The Division of Nurse Anesthesia is a group of exceptionally skilled and compassionate caregivers dedicated to delivering high-quality, safe, and efficient anesthesia care to all patients. We are proud to practice alongside our excellent anesthesiologist colleagues and are fully prepared to meet the challenges of future departmental growth and innovation.







**Stephen D. Pratt, MD**

Director, Pre-Admission Testing and Patient Experience

Assistant Professor of Anaesthesia

“Witnessing the phenomenal teamwork and collaboration of our entire staff to prepare each patient for a successful, comfortable experience is very satisfying and rewarding.”

## Pre-Admission Testing

The BIDMC Pre-Admission Testing (PAT) unit is a state-of-the-art clinic that provides a private, patient-centered atmosphere with resources for blood drawing, electrocardiogram testing, complete physical evaluations, and targeted physical therapy assessments. The multidisciplinary PAT team includes dedicated anesthesiologists, perioperative advanced practice nurses, nurses, case managers, physical therapists, medical assistants, and administrative staff. The primary mission of the PAT clinic is to ensure that all patients are optimally prepared for their planned anesthesia and procedure. This includes management of complex medical conditions, patient education, laboratory or other testing, collection of required chart elements and, most importantly, an introduction to the medical center to maximize the patient-friendly experience.

Patients are assessed in one of three ways. All patients receive a telephone call from an experienced nurse in PAT to review health issues, confirm medications, and review preoperative instructions. For many, this is the only preoperative assessment that is needed. Those with a more complex medical history will be seen in the PAT clinic by an experienced nurse practitioner or physician anesthesiologist. During this visit, we perform a complete pre-anesthesia assessment, a history and physical exam and obtain appropriate testing (blood work, electrocardiogram). If indicated, a physical therapist or case manager might also see the patient. The medical staff spends hours ensuring that these complex patients are optimally prepared. They might contact a medical specialist to obtain records, arrange additional assessment of a significant condi-

## team

Sheila R. Barnett, MBBS, BSc  
Associate Professor of Anaesthesia

Lisa J. Kunze, MD, PhD  
Assistant Professor of Anaesthesia

Brendan P. Garry, MBBCh, BAO  
Assistant Professor of Anaesthesia

Randall S. Glidden, MD  
Assistant Professor of Anaesthesia

Deborah S. Reynolds, MD  
Assistant Professor of Anaesthesia

Richard A. Steinbrook, MD  
Associate Professor of Anaesthesia

Lior Levy, MD  
Instructor in Anaesthesia

### Nurse Practitioners

Joelle Chateaufneuf, NP

Norine M. Gentner, NP

Ina Harten, NP

Brian A. Hoell, NP

Joyce Larson, NP

Mary-Ellin Moore, NP

Norma Osborn, NP

Yolanda Perez-Shulman, NP

Virginia A. Sheppard, NP

Eileen M. Stuart-Shor, PhD, NP

Bethany W. Thomas, NP

tion, or create a plan for issues like perioperative management of anticoagulant medications or an implanted cardiac device. They might discuss the appropriateness of the planned procedure with the surgeon in light of a high anesthesia risk. The final preoperative assessment is a "waive," now referred to as an anesthesia review. These are complex patients who would generally come for a PAT visit, but this visit is waived because they have had a recent anesthesia assessment, live far away, or there are other extenuating circumstances. The charts of these patients are thoroughly reviewed by the PAT attending anesthesiologist and appropriate recommendations made when necessary.

The BIDMC PAT clinic is a new, open, bright and patient-centered environment. It is also a very busy clinic. We perform 70-80 RN telephone assessments a day (more than 17,000 a year), see on average 30 patients in the clinic each day,

and another six or more are reviewed by the attending as a waive. Many require a history and physical (~85%), blood draws (> 70%) or ECG (~45%). Despite high clinical volume, the PAT group is continually making efforts to improve the care we provide. We created a set of guidelines for pre-operative

testing that have led to a dramatic decrease in the number of chest X-rays we perform, saving money and decreasing patient radiation exposure. Two nurse practitioners are now charged with coordinating the anti-coagulation management for all surgical patients (not just those who come to PAT). They communicate with the surgeons, prescribing physicians and the patient to make sure that the plan is clear, safe, and well communicated. Our involvement in Enhanced Recovery after Surgery (ERAS) also continues to grow. Our instructions to patients now allow them clear liquids until two hours before arrival times and a growing number of surgical services are requesting that patients drink a carbohydrate solution before arrival to help with recovery. We continue to grow and evolve our practice in our ongoing efforts to ensure patients are optimally prepared for their surgery.

## Anesthesia Pre-Admission Testing

July 2018 - June 2019

**21,129**

Operating room cases booked

**17,661**

RN telephone assessments

**7,159**

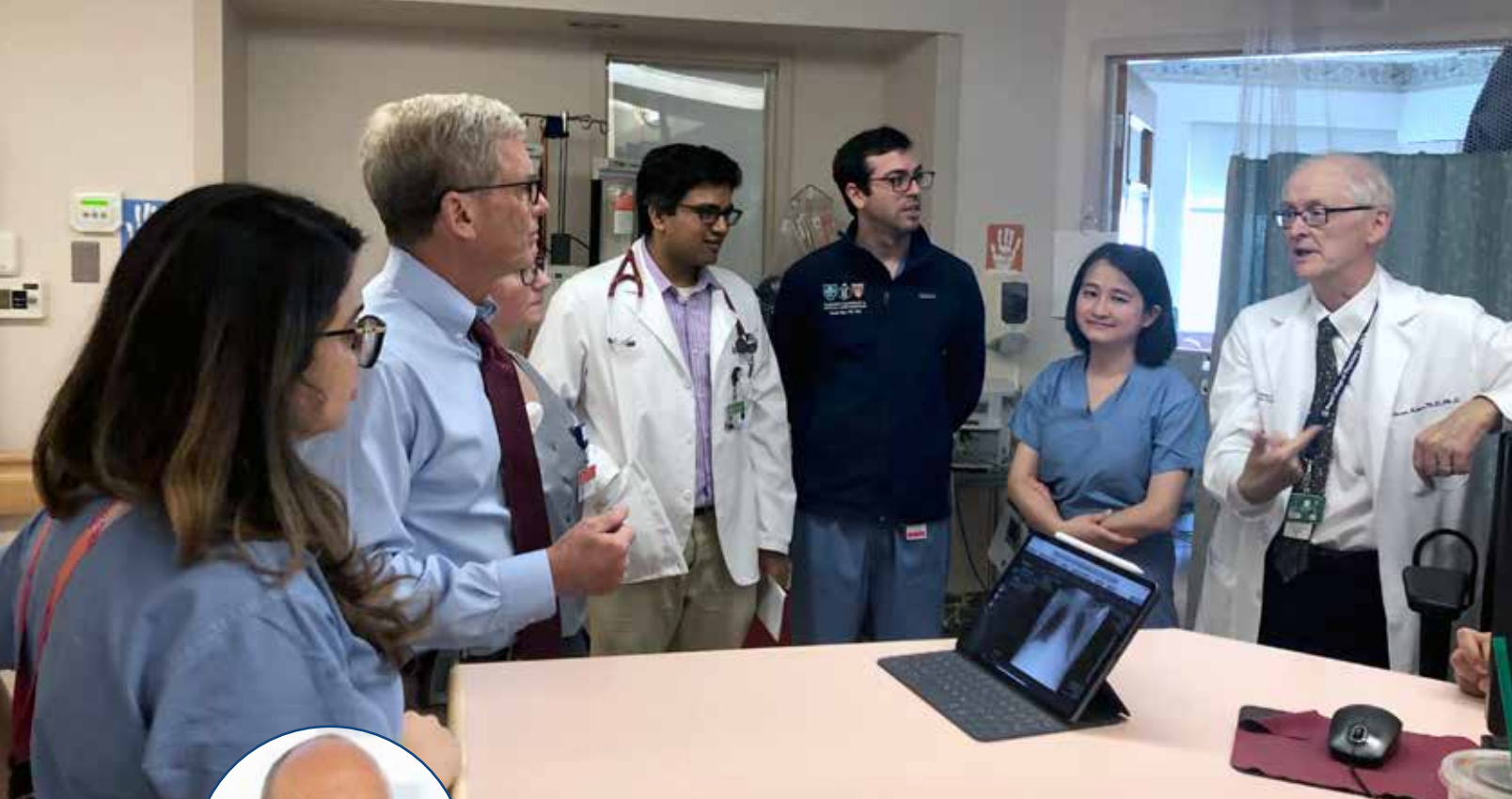
Pre-admission testing visits

**6,210**

PAT histories and physicals performed







**Todd W. Sarge, MD**

Director, Critical Care Medicine  
Assistant Professor of  
Anaesthesia

“The Anesthesia Critical Care division provides state-of-the-art care for the hospital’s surgical critical care patients 24/7 while also being recognized as leaders in the field for point-of-care echocardiography and ultrasound as well as clinical research in acute lung injury.”

## Critical Care

The Division of Critical Care is a major division in the department and provides critical care services in the four surgical intensive care units (ICUs) at Beth Israel Deaconess Medical Center (BIDMC):

**Trauma Surgical Intensive Care Unit (TSICU)** A 10-bed unit caring for trauma, thoracic, and acute care surgery patients admitted largely through the emergency room. Attending coverage of this unit is shared 50% with the Division of Surgical Critical Care.

**Surgical Intensive Care Unit (SICU)** An eight-bed unit caring for a variety of surgical patients including transplant, hepato-biliary, and general surgery. Attending coverage of this unit is shared 50% with the Division of Surgical Critical Care.

**Cardiovascular Intensive Care Unit (CVICU)** A 15-bed unit caring for

patients undergoing cardiac and vascular surgery. Attending coverage of this unit is solely provided by the Division of Anesthesia Critical Care.

**Neuroscience Intensive Care Unit (Neurosciences ICU)** An eight-bed unit caring for patients with neurology and neurosurgical patients. This unit dedicated to the care of neuroscience patients opened in June 2016, with coverage of this unit being shared 50% with the Departments of Neurology and Surgery.

All of the surgical ICUs are semi-closed, and patients are cared for by multidisciplinary critical care teams. The SICU and TSICU teams

Critical Care			
	FY17	FY18	FY19 <sup>EST</sup>
Procedures	1,029	990	974
Encounters	5,988	5,945	6,102
<b>Total</b>	<b>7,017</b>	<b>6,935</b>	<b>7,076</b>



## team

**Somnath Bose, MD, MBBS**  
Instructor in Anaesthesia

**Jessica M. Cassavaugh, MD, PhD**  
Instructor in Anaesthesia

**Matthias Eikermann, MD, PhD**  
Professor of Anaesthesia

**Megan L. Krajewski, MD**  
Instructor in Anaesthesia

**Akiva Leibowitz, MD**  
Instructor in Anaesthesia

**Alan Lisbon, MD**  
Associate Professor of Anaesthesia

**Melanie R. Loberman, MD**  
Instructor in Anaesthesia

**Kadhiresan Murugappan, MD**  
Instructor in Anaesthesia

**Sara E. Neves, MD**  
Instructor in Anaesthesia

**Ala Nozari, MD, PhD**  
*Co-Director, Neuroscience Intensive Care Unit*  
Associate Professor of Anaesthesia

**Brian P. O'Gara, MD, MPH**  
Instructor in Anaesthesia

**Achikam Oren-Grinberg, MD, MS**  
*Director of Critical Care Echocardiography*  
Assistant Professor of Anaesthesia

**Ameeka Pannu, MD**  
*Associate Program Director, Anesthesia Critical Care Fellowship*  
Instructor in Anaesthesia

**Shahzad Shaeefi, MD, MPH**  
*Program Director, Anaesthesia Critical Care Fellowship*  
Assistant Professor of Anaesthesia

**Daniel S. Talmor, MD, MPH**  
Edward Lowenstein Professor of Anaesthesia

**Daniel P. Walsh, MD**  
Instructor in Anaesthesia

consist of an attending critical care physician, a critical care fellow, and dedicated house officers from the Departments of Anesthesia, Surgery, and Emergency Medicine. The CVICU team consists of an attending critical care physician, a nurse practitioner/physician assistant, and an attending cardiac surgeon. The Neuroscience ICU team consists of an attending critical care physician, critical care fellow, neurology resident, and nurse practitioner. Overnight and on weekends, each unit is covered by a call resident (SICU/TSICU) or nurse practitioner/physician

assistant (Neurosciences ICU and CVICU). Each night of the week, a single anesthesia attending provides in-house coverage of all four surgical units and is assisted by an on-call fellow.

The division is actively involved in the ICU coverage of our community affiliates. Since October 2012, the division has provided coverage for the critical care unit at BID-Plymouth. Since February 2016, the Division has provided coverage for the critical care unit at BID-Milton. Both community hospitals contain mixed medical surgical ICUs and

cover the wide variety of intensive care patients seen at a community hospital through different staffing models. The ICU in BID-Plymouth is a closed unit and is staffed 24/7 by an intensivist and a team of advanced practice providers. Dr. Alan Lisbon serves as the medical director for the BID-Plymouth ICU. The ICU at BID-Milton is a closed unit that is covered 24/7 by an intensivist with overnight help from the hospitalist service at BID-Milton. Directorship of this unit is provided by Dr. Heidi O'Connor in the Pulmonary Critical Care Division of the Medicine Department, dem-





onstrating the close collaboration between the two ICU divisions from our respective departments.

Additional clinical services provided by the division include:

- Airway management and support for all ICUs and the hospital at large
- Code coverage of the West Campus
- Anesthesia for tracheostomies in all ICUs
- Anesthesia coverage of elective cardioversions
- Focused echocardiography support for in-hospital cardiac arrests using handheld echo devices
- Coverage of the West Campus post-anesthesia care unit.

### Education

Teaching in the Division of Critical Care takes place at all levels of training, from medical students through residents, fellows, and trainees. Teaching is accomplished through daily teaching rounds as well as a robust didactic program. In addition to resident rotations, the Anesthesia Critical Care Division hosts 12 residents per year from Harvard Medical School as an HMS elective entitled Respiratory-

Surgical Intensive Care. During this elective, students from HMS gain exposure to the daily management of critically ill patients in a surgical critical care setting in a Level 1 Trauma Center. The students actively participate in daily teaching rounds, procedures, and resident lectures with the goals of learning basic management principles in hemodynamic and neurological monitoring and manipulation, respiratory failure and mechanical ventilation, and renal and endocrine pathophysiology as well as with broader topics including ethics and end-of-life care.

### Basic Course

In 2011, the division began teaching the Basic Course to residents prior to their first ICU rotation. This course was designed to teach the principles of caring for the critically ill patient prior to the residents' arriving in the unit. The course has been extremely successful and has since expanded to include nurse practitioners and residents from Surgery, Medicine, Neurology, and Emergency Medicine. Currently, this course is run four to five times per year by critical care faculty from Anesthesia, Surgery, Emergency Medicine, and Pulmonary Medicine.

### Anesthesia Critical Care Fellowship

The centerpiece of the teaching program is the Anesthesia Critical Care Fellowship, a Council for Graduate Medical Education-accredited program that has been active since 1990. To date, 67 fellows have successfully graduated the program. The Fellowship is a 12-month training program that consists of nine months of rotations in the ICUs and three months of electives/research time. The fellowship is directed by Dr. Shahzad Shaefi and currently accepts four fellows per year through the match system. The goals of the fellowship are to ensure that by the completion of their 12 months of training, the fellows will be able to provide complete care for critically ill patients, lead a multidisciplinary critical care team, have a working knowledge of the administration and management of a critical care unit, be able to critically appraise the literature as it pertains to critical care medicine, and have a basic understanding of the principles of research in critical care medicine. A particular strength of the fellowship is training in bedside ultrasonography and echocardiography, and we believe that we remain well positioned to continue to receive the very best candidates.

In June of 2017, a new fellowship in Neuro-Critical Care was approved by the United Council for Neurologic Subspecialties and is co-directed by Dr. Ala Nozari in the Department of Anesthesia and Dr. Corey Fehnel in the Department of Neurology. Neuro-Critical Care fellows spend one year dedicated to managing

these very specialized critical care patients. Our first fellow in Neuro-Critical Care graduated in July 2018 and the second fellow is set to begin training in July of 2019.

### Critical Care Echocardiography and Ultrasound

Members of the division, and in particular Dr. Achikam Oren-Grinberg, have been extremely active in the field of education in critical care echocardiography and ultrasound. The division members founded the extremely successful Fundamentals of Critical Care Ultrasound course at the Society of Critical Care Medicine and have been active internationally with the World Interactive Network Focused on Critical Ultrasound organization. Locally, we continue to teach the Harvard CME course Ultrasonography for Intensivists and Emergency Medicine Clinicians, which has

been sold out for 10 years in a row. This year, the NBE held a new Examination of Special Competence in Critical Care Echocardiography (CCEeXAM) that was passed successfully by a number of our staff and a current fellow.

### Post-Graduate Education for Faculty

A number of staff in the Anesthesia Critical Care Division have completed the Program in Clinical Effectiveness course offered at the Harvard School of Public Health. This course is a summer program providing clinical investigators with fundamental training in clinical epidemiology and biostatistics, providing junior staff the quantitative and analytic skills needed for clinical research. Recently, Drs. Shaz Shaefi, Somnath Bose, and Brian O’Gara have completed the Program in

Clinical Effectiveness and continued their education to complete their Masters in Public Health.

### Leadership and Innovation and Faculty Hour Involvement

Over the past two years, the division has been involved in numerous faculty hour projects, including postoperative reintubation and ultrasound education. We have also led projects to improve the quality and compliance of critical care notes and documentation while improving work flow for residents and rounding. The project was led by Dr. Todd Sarge from our division and involved members from the Departments of Anesthesia, Surgery, Emergency Medicine, Internal Medicine, Health Information Management, and Harvard Medical Faculty Physicians Compliance. The results have led to improved documentation compliance with







current standards and significantly decreased resident time to generate notes as well as improved work flow and efficiency on rounds. This project, along with ongoing collaboration with our coders and billers, has led to a significant increase in revenue generation for the division over the past several years.

### Research

The critical care division is very active and productive in many areas of research. The division has been fortunate to receive several multi-

million-dollar grants in collaboration with academic centers around the country to investigate treatments for our critically ill patients and improve the quality of care provided in ICUs. Several important products of this research include a tool to monitor for risky states within each ICU based on staffing and acuity, data on use of neuromuscular blocking agents for patients with Acute Respiratory Distress Syndrome, and innovative approaches to ventilator management for patients in respiratory failure.

The following are a sample of ongoing research projects and interests of the division members:

- Dr. Daniel Talmor's fields of research include **intensive care outcomes, echocardiography in the ICU, and the optimal delivery of mechanical ventilation.**
- Dr. Matthias Eikermann is Vice Chair of Faculty Affairs for the Department of Anesthesia and has an extensive research background focusing on the **improvement of patient outcomes** such as postoperative respiratory complications, **appropriate use of neuromuscular blockade, and mobilization dosing for critically ill patients.**
- Drs. Matthias Eikermann, Shaz Shaefi, and Todd Sarge are conducting a multi-centered trial on the **effectiveness of Midodrine for weaning critically ill patients**



## Dr. Stephen Loring's Legacy Continues with Scholars Program

One of our Department's most distinguished faculty members, Stephen H. Loring, MD, retired this year after a long career of scholarly and educational accomplishment. Steve's impressive achievements span leadership, teaching, and research, including over 150 publications and extensive teaching of Harvard Medical School students in respiratory physiology. Steve has been with the Department since 1991 and served as the Scientific Director of Respiratory Therapy at Beth Israel Deaconess Medical Center at the same time. In 2009, he was promoted to Professor of Anaesthesia at Harvard Medical School.

In 2017, the Department founded the Loring Scholars Program. This five-year residency clinical/research track recruits up-and-coming clinician scientists and is designed to provide a pipeline of dedicated scholars in the field of anesthesia. The goal of the program is to build the next generation of investigators in perioperative medicine who will follow in Steve's footsteps and lead the field.

Steve's extraordinary record of accomplishment as a teacher and researcher are only part of the reason why he will be missed by his colleagues at BIDMC. He has been a thoughtful and patient mentor who has guided many careers and nurtured countless friendships. On a personal note, I have had the honor and pleasure of having Steve as my mentor and a fellow researcher in pulmonary physiology, and in particular in studies of the appropriate use of mechanical ventilation in patients with acute respiratory distress syndrome. I have never met anyone as generous with their time and teaching as Steve — he has trained a generation of clinicians from across the Harvard system in respiratory physiology. He has a wonderful ability to explain complex concepts simply and intelligently. The Loring Scholars Program in our Department will continue the legacy of this remarkable person and brilliant physician.

- Danny



from intravenous vasopressors and expediting discharge from the ICU.

- Dr. Brian O’Gara’s research interests include **prevention of postoperative decline and delirium as well as the use of inhaled anesthetics to prevent lung injury.**
- Dr. Somnath Bose is participating in several multi-centered research studies, including those examining **Post Intensive Care Syndrome (PICS)** after acute lung injury and **echocardiographic effects of fluids and vasopressors in sepsis.**
- Drs. Achikam Oren-Grinberg, Akiva Leibowitz, and Todd Sarge perform studies of **echocardiography in critically ill patients during cardiac arrest.**
- Dr. Todd Sarge collaborates extensively in numerous research projects related to **lung recruitment and mechanical ventilation and echocardiography.**
- Drs. Michael Cocchi and Todd Sarge have been studying cardiac arrest in the ICUs and are

collaborating on a research program to identify **risk factors for cardiac arrest in the ICU setting.**

- Dr. Ala Nozari is the Director of Neuroanesthesia and Neurocritical Care with extensive research interests in these fields, including **resuscitation research for cerebral and spinal cord injuries.**
- Drs. Shaz Shaefi and Brian O’Gara have been involved in research efforts to evaluate the **effects of hyperoxia on patients undergoing cardiopulmonary bypass as well as studying the connection between innate immune system failure and pneumonia following trauma.**

The division has been extremely successful at obtaining research funding. Currently, the division research efforts operate under the following grants:

- Prevention and Early Treatment of Acute Lung Injury – (PETAL Network;U01 NIH/NHLBI) – Dr. Talmor, Dr. Nathan Shapiro, and Valerie Banner-Goodspeed, MPH
- Addressing Post Intensive Care Syndrome among Survivors of

Acute Lung Injury (APICS-01) (Department of Defense) – Dr. Somnath Bose, Valerie Banner-Goodspeed, MPH

- Crystalloids Liberal or Vasopressors Early in Sepsis – Study of Treatment’s Echocardiographic Mechanisms (CLOVERS-STEM) (National Institutes of Health) – Dr. Somnath Bose
- DAMP-Mediated Innate Immune Failure and Pneumonia after Trauma: A five-year program project grant to provide greater understanding of the cellular and molecular innate immune mechanisms predisposing to pneumonia and lung injury in the traumatic patient population (Department of Defense) – Dr. Talmor and Dr. Shaefi, and Valerie Banner-Goodspeed, MPH

None of the division’s research efforts would be possible without the incredible efforts of our research team at the Center for Anesthesia Research Excellence, led by Valerie Banner-Goodspeed, and Ariel Mueller, who provides statistical support.





**Thomas T. Simopoulos, MD, MA**  
Director, Pain Medicine  
Co-Director, Spine Clinic  
Assistant Professor of Anaesthesia

“For more than two decades, our pain center has maintained a great reputation for state-of-the-art patient care as well as physician training and education.”

## Pain Medicine

At the William Arnold - Carol A. Warfield, MD Pain Center, our physicians offer compassionate and comprehensive care for patients with chronic and complex pain. We provide multiple modalities to address our patients' pain and return them to a fuller, more active life. Each patient is evaluated by a physician team, which orders tests and treatments appropriate to the patient's specific pain issues. The patient is then closely monitored to assess which treatments are most beneficial. Many of our patients have seen multiple specialists before they reach our clinic and are frustrated about their continuing pain. We approach these patients with the most advanced and sophisticated treatments and recognize and address the difficulties that living with chronic pain has caused in their lives. Our multidisciplinary clinical staff includes a pain psychologist,

anesthesiologists, neurologists, a physiatrist, a nurse practitioner, and a full-time team of nurses. In addition, we work closely with primary care physicians to ensure that we address any concerns about their patients, including opioid consultations.

To ensure the best, most thorough treatment for our patients, we coordinate care amongst radiology, physical therapy, integrative medicine, and surgical teams. We also treat patients with multiple comorbidities, including cancer pain, osteoporosis, abdominal and pelvic pain, and many other chronic painful medical conditions. As Beth Israel Deaconess Medical Center (BIDMC) has expanded into the community, our physician staff has grown in parallel. We have added four new pain specialists, includ-



## team

**M. Moris Aner, MD**  
*Director, Chronic Inpatient Pain Services*  
 Assistant Professor of Anaesthesia

**Sait Ashina, MD**  
 Assistant Professor of Anaesthesia  
 Assistant Professor of Neurology

**Viet L. Cai, MD**  
 Instructor in Anaesthesia

**Jatinder S. Gill, MBBS, MD**  
 Assistant Professor of Anaesthesia

**Susie S. Jang, MD**  
 Instructor in Anaesthesia

**Anthony C. Lee, MD**  
 Instructor in Anaesthesia

**Syed Hazique Mahmood, MD**  
 Instructor in Anaesthesia

**Cristin A. McMurray, MD**  
 Instructor in Anaesthesia

**Renee A. Moran, DO**  
 Instructor in Anaesthesia

**Jyotsna V. Nagda, MD**  
*Director, QA/QI in Pain Medicine*  
 Assistant Professor of Anaesthesia

**Julie Petro, MD**  
 Instructor in Anaesthesia

**Paragi H. Rana, MD**  
*Program Director, Pain Medicine Fellowship*  
 Instructor in Anaesthesia

**Joshua Smith, PhD, MPH**  
*Psychologist*  
 Instructor in Anaesthesia – Part time

**Cyrus A. Yazdi, MD**  
 Instructor in Anaesthesia

**Carol A. Warfield, MD**  
 Distinguished Lowenstein Professor  
 of Anaesthesia

**R. Joshua Wootton, MDiv, PhD**  
 Assistant Professor of Anaesthesia

### **Nurse Practitioners**

Lindsay Guisiora, NP

Michelle Kelley, NP

Katrina Robertson, NP

### **Integrated Medicine**

**Aditi Nerurkar, MD, MPH**  
*Director, Cheng-Tsui Integrated Health Center*  
 Instructor in Medicine

**Gloria Y. Yeh, MD, MPH**  
 Associate Professor of Medicine

**Jessica Butler**  
*Acupuncturist*

**Jamee Culbetson**  
*Tai Chi Instructor*

ing our Chief of Pain Medicine, Dr. Thomas Simopoulos. Both in conjunction with BIDMC's spine surgery group, and as a stand-alone specialty practice, we now see patients at all BIDMC locations in the greater Boston area, including the Chestnut Hill Square facility, BIDHC–Chelsea, BIDHC–Lexington, BID–Needham, and BID–Milton. We most recently added pain management services to Signature Health in Brockton, MA. Together our providers offer every pain patient cutting-edge care tailored to their individual needs with over 14,000 visits in the last year.

### **Comprehensive Headache Center**

The Comprehensive Headache Center, part of the Division of Pain Medicine and located at the Arnold – Warfield Pain Clinic, offers evaluation and treatment for all types of headaches, including chronic migraines and cluster headaches. Our Headache Center physician, Dr. Sait Ashina, is a neurologist who is board-certified in headache medicine. We use both traditional and integrated treatment options, such as Botox injections, medication management, biofeedback and acupuncture. Dr. Ashina works

with patients to develop treatment plans that are carefully monitored to ensure efficacy. Our Pain Fellows learn via both lectures and hands-on evaluation during treatment sessions. In this valuable component of the Pain Fellowship, future pain practitioners are introduced to the intricacies of headache treatment and hone their skills over the fellowship year.

Current treatment modalities include:

- Injection therapies and nerve blocks – lumbar, thoracic, and cervical epidural steroid injection





- tions, sympathetic blocks, selective nerve root blocks
- Botox therapies and comprehensive headache care
- Nerve ablation therapies – radio-frequency and cyanoalgnesia
- Implantable spinal cord stimulators, peripheral nerve stimulators and intrathecal drug delivery systems
- Minimally invasive lumbar decompression (MILD)
- Kyphoplasty
- Intradiscal procedures
- Acupuncture
- Psychological counseling
- Integrative medicine
- Meditation and biofeedback
- Physical therapy
- 10-session chronic pain program in conjunction with the Mind/Body Pain Management Program

**Education**

Our Pain Fellowship Program was chosen for the 2015 Pain Medicine

Fellowship Excellence Award from the American Academy of Pain Medicine—one of only two fellowship programs recognized that year. In 2018, we had 231 applicants for our seven fellowship slots. Dr. Paragi Rana is the Program Director of the Pain Medicine Fellowship and oversees the educational process. Both fellows and anesthesiology residents rotate through the Pain Center to participate in outpatient evaluation and see patients for acute and chronic pain management during inpatient rounds. In addition, they participate in didactic rounds several times each week, undergo training in fluoroscopic-guided procedures, take comprehensive patient histories, and conduct general physical, neurological, and musculoskeletal examinations. Fellows also see patients in our Comprehensive Headache Center doing initial evaluations with our pain psychologist, and at Boston Children’s Hospital gaining exposure to the evaluation and treatment of pediatric pain. Affiliated faculty members in the areas of pain psy-

chology, neurology, spine surgery, and physiatry teach our fellows multidisciplinary and multimodal approaches to pain treatment. The overall goal is to teach fellows the entire spectrum of pain management from pharmacologic options to interventional procedures, including alternative and complementary approaches.

In addition to our own physician group, all of whom have appointments at Harvard Medical School, guest lecturers from different specialties and backgrounds are brought in to foster a multidisciplinary approach to pain medicine. Pain Fellows also participate in the Department of Anesthesia, Critical Care and Pain Medicine Grand Rounds, special seminars, and clinical case conferences. Throughout the year, a comprehensive list of pain medicine topics is covered to meet the current ACGME-required curriculum.

**Research**

Moving the field of pain medicine forward through research is a central tenet of our mission. Pain Divi-

sion faculty design and implement a variety of research projects each year using intramural and extramural grants. Current studies include:

- **High-frequency 10 KHz implantable neuro-stimulation system for chronic low back pain programming optimization, using the conus medularis as a reference point.** This study investigates the efficacy of a neuro-stimulation spinal implant for controlling low back pain based on anatomic programming. Funded by Nevro Corp. Dr. Jaytinder Gill is lead investigator.
- **Development of a laser surgical device for endoscopic disc decompression.** Dr. Gill is lead investigator.
- **Long-term follow-up and outcome of epidural blood patches.** Dr. Gill is lead investigator.
- **Development and validation**

**of vertebral fracture severity scoring system.** Dr. Gill is lead investigator.

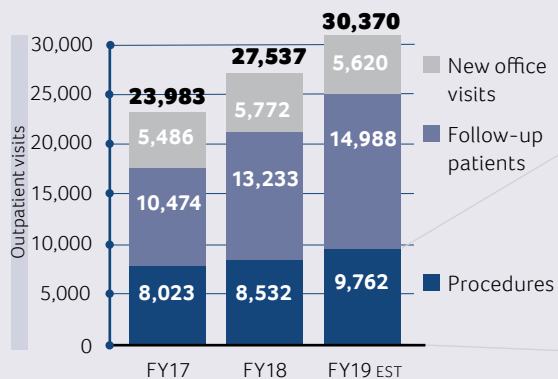
- **Spinal cord stimulator outcomes** with respect to trialing methods, equipment longevity, efficacy of high-frequency modes in complex regional pain syndromes, and explanation rates and opioid reduction. Dr. Thomas Simopoulos is lead investigator.
- **Multi-center clinical trial examining long-term outcomes for patients receiving new sustained release preparation of clonidine for the treatment of lumbar radiculopathy.** Funded by Solis. Dr. Gill is lead investigator.

In our Headache Division, research by Drs. Sait Ashina and Rami Burstein is leading to advancements in the pathophysiology and therapeutics of headache medicine. Current studies include:

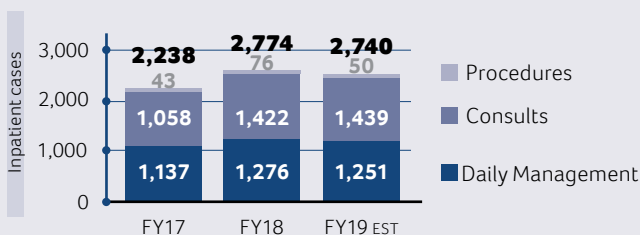


- **A systematic study of migraine in the U.S. population** to update the American Migraine Prevalence and Prevention Study. Goal is to assess patterns of consultation, diagnosis and treatment, barriers to care, risk factors, and history, among other factors. Funded by Eli Lilly.

**Pain Services Across Locations FY17 – FY19**



Procedures	FY17	FY18	EST FY19
Lumbar	2,755	2,726	3,588
Cervical	408	439	704
Radiofrequencies	278	237	392
Permanent placements of FSCS	49	63	59
Spinal cord trials	226	163	263
Blood patches	19	17	34
Discographies	6	0	0
Kyphoplasties	26	31	34
Other procedures	4,256	4,856	4,688
<b>Total</b>	<b>8,023</b>	<b>8,532</b>	<b>9,762</b>



**BIDMC provides pain services at our following locations and affiliates:**

Arnold-Warfield Pain Management Center, BIDMC's Spine Center, BIDMC West Procedural Center, BID-Milton, BID-Needham, Chestnut Hill, Chelsea Clinic, and Lexington Clinic.





Dr. Sait Ashina is lead investigator.

- **Photophobia during migraine:** sensory, autonomic, and emotional response to light. Goals are to identify neural mechanisms that cause migraine sufferers to seek out darkness during attacks, identify impact of light on sensory, affective, and autonomic neurological functions, and discover neural pathways where light alters these functions. Funded by NIH. Dr. Rami Burstein is lead investigator.

### Accomplishments

The Division of Pain Medicine at BIDMC underwent substantial expansion over the past several years, recruiting more physicians and support staff to deliver necessary care. We are now fully staffed at all pain care sites. Care at BID–Needham and BID–Milton has transitioned from pain consultation to actual pain medicine practice whereby patients can be closely monitored

by providers on a long-term and consistent basis. We have streamlined the Pain Clinic's workflow in all areas including prior authorizations, phone triage, appointment scheduling, billing, medical record scanning, and check-out. These enhancements have streamlined our day-to-day efficiency and allow us to improve patient access and patient experience at our Center.

To support our expanding clinical operations, we opened a new evaluation suite on the 6th floor at One Brookline Place. We brought the Cheng Tsui Integrative Medicine program to the Pain Center, where Dr. Aditi Nerurkar counsels and steers patients to appropriate complimentary care such as on-site meditation, acupuncture, and Tai Chi. We also expanded our clinical pain psychology services with the addition of Dr. Joshua Smith, PhD, who joins our Director of Pain Psychology, Dr. R. Joshua Wootton.

With the growth of our research portfolio, we established an official research office under the direction of Dr. Gill and recruited a coordinator, Ammar (Joseph) Al-Shammaa, BDS, MSc. The research office will provide a centralized location for management of our growing research programs.

### Quality, Safety, and Innovation

The Pain Division is in the process of significant strategic planning to promote future innovation and efficiency. We are evaluating clinical care pathways, operations, and services to better accommodate rapid expansion into multiple sites

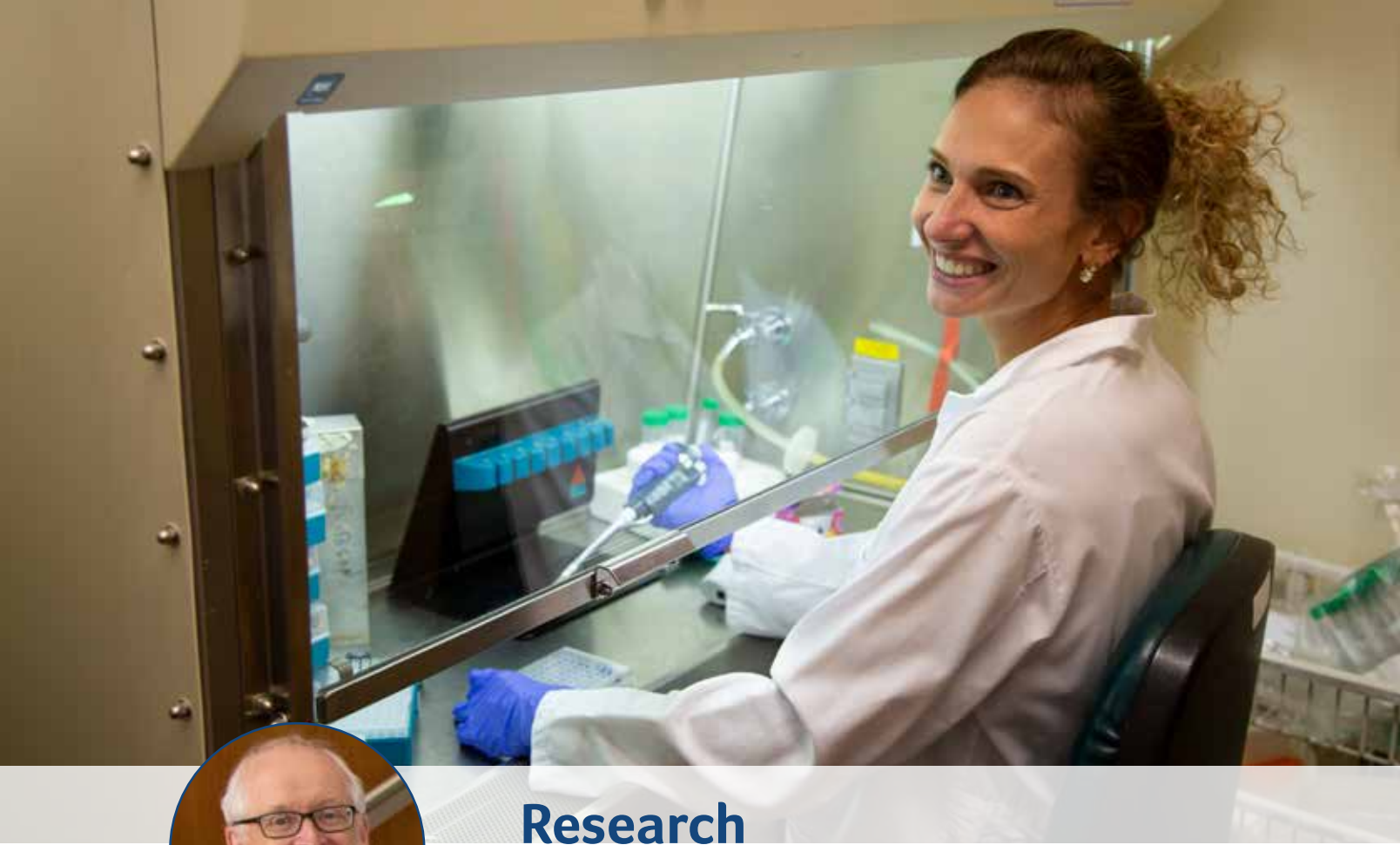
in the network. Twenty-five charts per month are reviewed for history, physical examination, and assessment with clinical care plan. Chart audits are performed on the sedation and consents to ensure complete documentation of necessary monitoring. Our Ambulatory Operations Division performs quarterly audits on approximately 20 charts for standard history, physical, and treatment plan. Adherence to universal protocol and consents are reviewed for completeness. Our fellows evaluate education, process improvement, and the patient care experience. This brings us necessary insight on the professional development for our fellows, the patient experience, and quality and efficiency of our day to day operations.

### Conclusion

The Arnold-Warfield Pain Center has experienced rapid growth in the past two years in patient volume, number of sites, and services offered. This growth included reestablishment of the Headache Center, expansion to the 6th floor at One Brookline Place, and the addition of an integrative medicine program. Our research program is expanding, and the new research office will allow us to more effectively seek out funding and collaborators for our cutting-edge studies. Both our administrative and clinical systems and processes have been streamlined for optimal effectiveness. Our efforts in the future will be focused on continuous quality improvement to ensure sustainability and allow for further growth in clinical care, research, and education.







## Research

**Simon C. Robson, MBChB, PhD**

Vice Chair, Research

Director, Center for Inflammation Research

Professor of Anaesthesia

Charlotte F. & Irving W. Rabb Distinguished Professor of Medicine

“Our goal in the Department is the development of collaborative and innovative research, within the spectrum of affiliated biomedical disciplines that will lead to advances in scientific knowledge, enhanced patient care, increased grant funding and greater international recognition.”

Research in the Department of Anesthesia, Critical Care and Pain Medicine at BIDMC and affiliates includes a wide range of investigations, from fundamental, basic mechanistic studies to translational research and important clinical trials.

Research Leadership is provided by Drs. Danny Talmor (Chair), Simon C. Robson (Vice Chair, Research), Rami Burstein (Vice Chair, Neuroscience), Matthias Eikermann (Vice Chair, Faculty Affairs), Balachundhar Subramaniam (Director, Center for Anesthesia Research Excellence), Alex Shtifman, Administrative Director of Research, and Valerie Banner-Goodspeed, MPH Anesthesia Research Program Manager.

The major vision of our group is to become one of the world’s innovative leaders in the areas of anesthe-

sia, critical care and perioperative medicine, inclusive of pain research, by 2021. This will involve planning, designing, and conducting innovative basic research with NIH funding and other support. The goal is to make a positive impact on clinical outcomes in critical care and perioperative medicine by implementing translational clinical studies to promote superlative perioperative care, control of inflammation, and linked pain management.

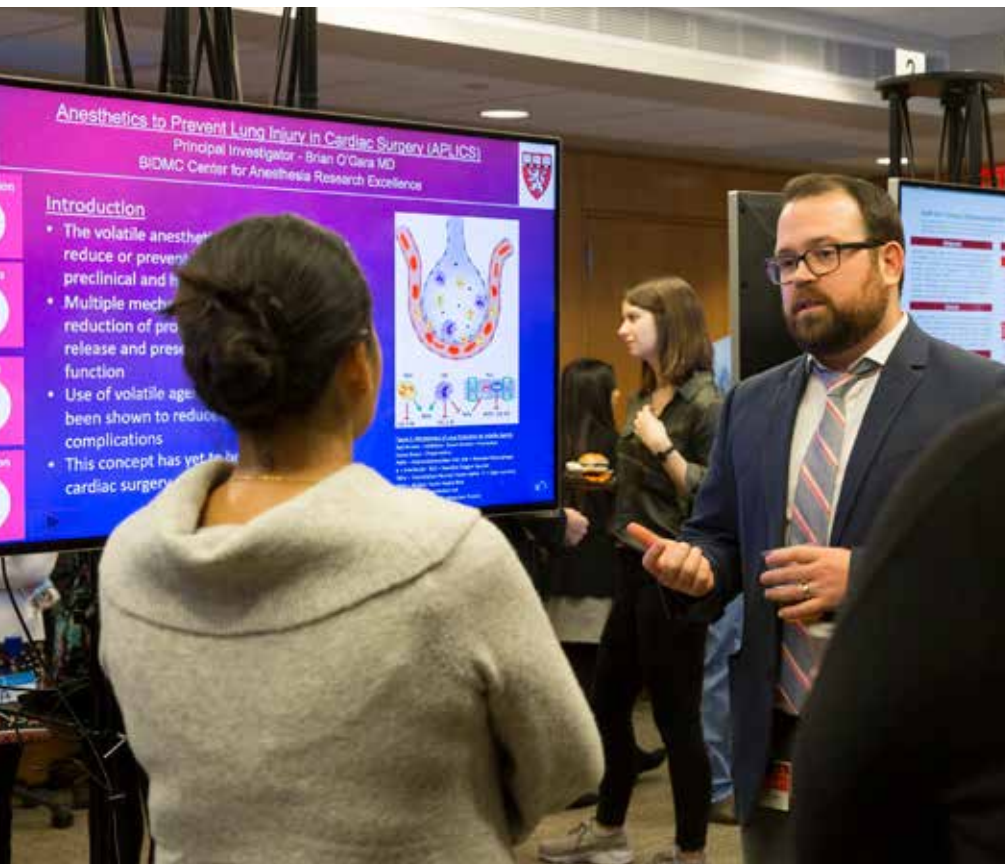
Research is conducted by internationally renowned and collaborative faculty in the Burstein, Levy, Talmor, Robson, Eikermann, Mahmood-Matyal, and Subramaniam labs. Clinical translational work is facilitated by the Center for Anesthesia Research Excellence (CARE), which serves as a one-stop shop to help department members conduct

successful clinical research under the guidance of Dr. Balachundhar Subramaniam and colleagues.

Dr. Stephanie Jones will continue to foster education by coordinating the training of the next generation of anesthesiologists, physician scientists, and researchers in areas of basic and clinical research. Currently the department has 40 research grants, including NIH (15), Department of Defense (3), Industry (13), Foundations (7), and two BIDMC internal grants. The total research revenue is over \$6.6 million annually, with \$4.1 million of it coming from the federal government.

Building on the major legacy of innovative discovery, the Department of Anesthesia Research Programs provide key insights into anesthesia outcomes, critical care, and

pain management in the setting of surgery and disease. The vision of the Chair and other departmental leadership has been to support all researchers from idea generation through study completion and publication. Consistent with this goal, departmental faculty and trainees are actively involved in a wide array of ongoing clinical and laboratory research projects. Research in the department is internationally recognized for its contributions to experimental neurosciences with the focus on mechanisms of anesthesia, pain, and headache, as well as clinical research in cardiovascular pathophysiology and delirium, purinergic signaling, and inflammation. The department is developing future leaders in research through mentorship, intensive research training, and education.



## RESEARCH LABS

### Department of Anesthesia, Critical Care and Pain Medicine

#### Burstein Lab

**Rami Burstein, PhD**

*Vice Chair, Neuroscience*

John Hedley-Whyte Professor of Anaesthesia

#### Center for Inflammation Research

**Simon C. Robson, MBChB, PhD**

*Vice Chair, Research*

*Director, Center for Inflammation Research*

*Professor of Anaesthesia*

Charlotte F. & Irving W. Rabb Distinguished

*Professor of Medicine*

**Maria Serena Longhi, MD, PhD**

*Deputy Director,*

*Center for Inflammation Research*

*Staff Scientist, Immunology*

*Assistant Professor of Anaesthesia*

#### Eikermann Lab

**Matthias Eikermann, MD, PhD**

*Vice Chair, Faculty Affairs*

*Professor of Anaesthesia*

#### Levy Lab

**Dan Levy, PhD, MSc**

*Associate Professor of Anaesthesia*

#### Mahmood-Matyal Lab

**Feroze Mahmood, MD**

*Director, Cardiac Anesthesia*

*Director, Perioperative Echocardiography*

*Professor of Anaesthesia*

**Robina Matyal, MD**

*Director, Vascular Anesthesia*

*Leonard Bushnell Chair of*

*Anaesthesia at BIDMC*

*Associate Professor of Anaesthesia*

#### Subramaniam Lab

**Balachundhar Subramaniam, MD, MPH**

*Director, Center for Anesthesia*

*Research Excellence*

*Ellison "Jeep" Pierce Chair of*

*Anaesthesia at BIDMC*

*Associate Professor of Anaesthesia*

#### Talmor Lab

**Daniel S. Talmor, MD, MPH**

*Chair of Anesthesia, Critical Care and*

*Pain Medicine*

*Edward Lowenstein Professor of Anaesthesia*





**Balachundhar Subramaniam, MD, MPH**

Director, Center for Anesthesia Research Excellence

Ellison “Jeep” Pierce Chair of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

“We coexist, evolve and transform. We can move mountains if we do so consistently.”

## CARE Center for Anesthesia Research Excellence

The Center for Anesthesia Research Excellence (CARE) is a departmental resource established to facilitate all aspects of clinical research within the Department of Anesthesia, Critical Care and Pain Medicine. CARE brings together the department’s research resources to simplify and streamline the research process for investigators and monitor compliance with clinical research regulations. CARE works closely with the Committee on Clinical Investigations, the Office of Sponsored Programs, the Clinical Trials Office, and the Harvard Catalyst’s Clinical Research Center at BIDMC. By bringing together expertise in all aspects of clinical research from study start-up, to execution, close-out, and publication, CARE helps the Anesthesia Department members make their research endeavors more efficient and successful.

The core function of CARE is to facilitate the smooth flow of proposals from the design phase to publication and funding. The range of services include: idea development; IRB approval assistance; funding support assistance (targeting departmental, industry, foundations, and/or federal project funding); research assistants and coordinators to assist in the execution of research work; a statistical and data analysis core; and writing support for the final publication. CARE provides additional support for research students’ entry, credentialing, and training.

CARE works across all anesthesia divisions to provide research and compliance education, manage internal grants, foster collaboration, provide mentorship, and promote independence.

## team

**Valerie M. Banner-Goodspeed, MPH**  
Program Manager, Anesthesia Research  
Research Associate in Anaesthesia

**Xinling (Claire) Xu, PhD**  
Biostatistician

**Ariel L. Mueller, MA**  
Biostatistician II  
Resident Program Coordinator, CARE

**Ammar (Joseph) Al-Shamma, BDs, MSc**  
Clinical Trials Specialist

**Thy Nguyen, BA**  
Clinical Research Coordinator

**Samantha Proeschel, MS**  
Clinical Research Coordinator

**Benjamin Hoenig, BS**  
Clinical Research Assistant II

**Julia Larson, BS**  
Clinical Research Coordinator

## PIs using CARE

**M. Moris Aner, MD**  
Assistant Professor of Anaesthesia

**Sait Ashina, MD**  
Assistant Professor of Anaesthesia  
Assistant Professor of Neurology

**Valerie M. Banner-Goodspeed, MPH**  
Research Associate in Anaesthesia

**Somnath Bose, MD, MBBS**  
Instructor in Anaesthesia

**Matthias Eikermann, MD, PhD**  
Professor of Anaesthesia

**Jatinder S. Gill, MBBS, MD**  
Assistant Professor of Anaesthesia

**Philip E. Hess, MD**  
Associate Professor of Anaesthesia

**Cullen D. Jackson, PhD**  
Instructor in Anaesthesia

**Feroze Mahmood, MD**  
Professor of Anaesthesia

**Robina Matyal, MD**  
Leonard Bushnell Chair of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

**John D. Mitchell, MD**  
Associate Professor of Anaesthesia

**Ala Nozari, MD, PhD**  
Associate Professor of Anaesthesia

**Brian P. O'Gara, MD, MPH**  
Resident Program Director, CARE  
Instructor in Anaesthesia

**Qi C. Ott, MD**  
Instructor in Anaesthesia

**Richard J. Pollard, MD**  
Assistant Professor of Anaesthesia

**Simon C. Robson, MBChB, PhD**  
Professor of Anaesthesia  
Charlotte F. & Irving W. Rabb Distinguished  
Professor of Medicine

**Shahzad Shaeefi, MD, MBBS**  
Assistant Professor of Anaesthesia

**Thomas T. Simopoulos, MD, MA**  
Assistant Professor of Anaesthesia

**Balachundhar Subramaniam, MD, MPH**  
Director, Center for Anesthesia Research Excellence  
Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

**Daniel S. Talmor, MD, MPH**  
Edward Lowenstein Professor of Anaesthesia

## Education

Education lectures presented by CARE staff are held during Faculty Hour and are open to faculty and trainees. The topics are determined through a periodic survey of the faculty and trainees in the department. These lectures are archived and available for investigators and trainees within the departmental

Intranet site. Examples of topics are statistics, power calculations, sample size estimates, grantsmanship, IRB application process, research consenting, and source documentation.

The clinical research support staff benefits from continuing education on topics that include clinical issues, research conduct, research

consenting, and compliance.

Monthly department-wide research rounds provide an opportunity for researchers to share their works in progress. This facilitates communication and collaboration for trainees, peers, and young investigators across division and labs.

Periodic Grand Rounds are conducted for the entire department,

## Balachundhar Subramaniam, MD: First Endowed Ellison "Jeep" Pierce Chair of Anaesthesia



Ellison C. Pierce Jr., MD, who was called the "father of the anesthesia safety movement," was a pioneer who played a significant role in reducing the rate of anesthesia-related fatalities. Early this year, Bala Subramaniam, MD, was named the first recipient of the chair endowed in Dr. Pierce's name. "Bala's work is the embodiment of how a busy clinician with a career in research can impact patient care," said Dr. Daniel Talmor, Chair of the Department of Anesthesia, Critical Care and Pain Medicine. Dr. Subramaniam, the Director of the Center for Anesthesia Research Excellence (CARE), is both an excellent clinician and a highly skilled investigator with over 60 publications in peer-reviewed journals. His studies have focused on such areas as glycemic control and blood pressure control in the OR, and a recent lead-authored paper of his published in the February 2019 issue of *JAMA* found that intravenous acetaminophen significantly reduced the incidence of post-operative delirium. "Bala's research has started to focus on what happens to the patient after anesthesia, which is really the critical issue," said Dr. Talmor.



updating them of ongoing research and successes. This increases both the visibility of our research program and awareness of the depth of knowledge and expertise present and accessible in our department.

### Successes

CARE has supported over 100 researchers since its inception, including anesthesia faculty and trainees as well as faculty from other departments. Currently the department has 40 research grants from numerous sources and total

research revenue of over \$6.6 million annually, including \$4.1 million in federal funding.

### Investigator Development

CARE established a dedicated resident research track, the Loring Research Scholars, which provides an additional year of training dedicated to research. This is an ACGME-approved program with incentives for successful applicants. This track tailors research training and enhances the clinician-investigator pool within anesthesiology.

In the past two years, four faculty members completed the Harvard School of Public Health Program in Clinical Effectiveness, and all are continuing to finish their Masters in Public Health. CARE administers the departmental John Hedley-Whyte Award within the HMS Eleanor and Miles Shore Fellowship Program. Currently two awardees are receiving mentorship and operational support from CARE to advance their selected research projects.





## Center for Inflammation Research



**Simon C. Robson, MBChB, PhD**

Vice Chair, Research

Director, Center for Inflammation Research

Professor of Anaesthesia

Charlotte F. & Irving W. Rabb Distinguished  
Professor of Medicine



**Maria Serena Longhi, MD, PhD**

Deputy Director,  
Center for Inflammation Research

Staff Scientist, Immunology

Assistant Professor of Anaesthesia

We are a group of basic scientists, immunologists, and clinicians dedicated to prevention, treatment, and cure of inflammatory diseases through innovative research into how innate immune responses factor into the pathogenesis of inflammation and development of novel therapeutic approaches.

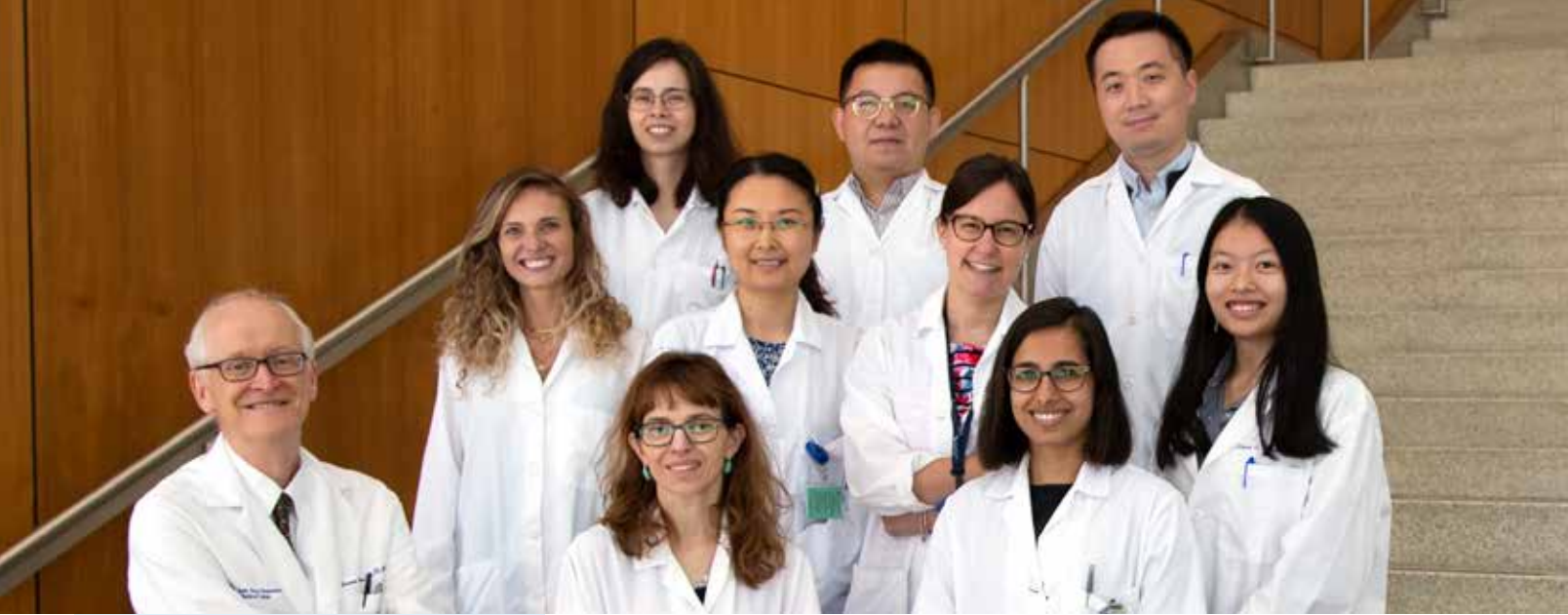
Inflammation comprises an innate response to injury, caused by trauma, infection, or alterations in cell phenotypes, that is marked by vascular responses with capillary dilatation, leukocytic infiltration, redness, swelling, heat, loss of function, and pain. Inflammation can be a protective mechanism initiating the elimination of noxious agents, infections, and damaged or transformed, malignant tissue.

When inflammation is not effectively regulated, damage is perpetuated. Unlike acute inflammation that follows a minor injury and rapidly

resolves, chronic damage can occur as a result of steady, persistent levels of inflammation that can contribute to the development of disease, such as in hepatitis and inflammatory bowel disease. Unfettered inflammation can damage blood vessels and result in organ dysfunction, as in cirrhosis, or stricture formation in the intestine, and also to metabolic disease, diabetes, and cancer.

ATP is a major metabolite on which all life depends that serves as the energy currency of the cell. This biochemical substance can be released at high levels from platelets or immune cells, or from apoptotic injured cells. Extracellular ATP provokes inflammation and plays a significant role in promoting immune responses. However, ATP is converted into the nucleoside product adenosine through the expression of an enzyme CD39 on regulatory immune cells and the vasculature as well as on certain





## teams

### Dr. Robson's Team

Dusan Handziar, MD, PhD  
Instructor in Medicine  
MGH Staff Scientist  
Project: Hyperoxia, autotaxin, and lung injury

Shahzad Shaeefi, MD, MPH  
Program Director, Anesthesia Critical Care Fellowship  
Assistant Professor of Anaesthesia  
Staff Scientist/co-supervised with Dr. Leo Otterbein  
Project: Oxygen bioavailability and the impact on mitochondrial health

Shilpa Tiwari-Heckler, MD  
Postdoctoral Research Fellow  
Project: Innate mechanisms of immunosuppression following trauma – with Dr. Serena Longhi

Eva Csizmadia  
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cancer cells. This derivative adenosine blocks immune responses and promotes blood supply and healing. This purinergic signaling is one of our main areas of interest. In addition, we undertake innovative basic science and translational research in vascular biology, immunity, and immunometabolism.

Our focus over the past two decades has been on the discovery, characterization, and investigation of mammalian ectonucleotidases. These are vascular, myeloid, and regulatory lymphoid cell expressed ectoenzymes that hydrolyze extracellular nucleotides, such as ATP and ADP, to adenosine and derivatives. CD39 and other gene family members, expressed on the vasculature and regulatory immune cells, are crucial in the maintenance of homeostasis and in the control of inflammation and immune responses in transplanted organs as well in native organs, such as the lungs and liver.

CD39 and family members are highly relevant to the control of inflammation in human disease and provide innovative therapeutic targets in inflammatory diseases and cancer. Pertinent examples

include CD39 and related proteins that solubilize or couple to biodegradable polymers/liposomes, or are expressed in transgenic manner, to boost generation of adenosine. Select investigational agents may be administered systemically to ameliorate inflammatory responses as in ischemia reperfusion injury, graft rejection, and systemic inflammatory states following trauma and surgery.

Purinergic signaling is also a central component of the dysregulated inflammation in cancer. Immune escape of cancer involves heightened suppressive responses to extracellular nucleotides and adenosine, which are also tightly regulated by the ectonucleotidases CD39 and CD73. Therefore, pharmacological blockade of CD39 and CD73, as with neutralizing antibodies or small molecules, can augment host cellular responses and alter vascular homeostasis to specifically target experimental cancers. This bolstering of immunostimulatory effects, by overcoming immune exhaustion and augmenting responses to release of ATP post-chemotherapy, has potential clinical benefits in cancer and other states of immune exhaustion.

Research activities are focused around specific identified translational research challenges that are addressed from conception through to clinical impact by multidisciplinary teams that include practicing clinicians, academics from the basic and translational sciences, and external stakeholders. These can include representatives from biotechnology, philanthropic organizations, and the BIDMC Development office as well as patients and family donors.

The Center is structured around the following program areas that integrate newly formed areas of faculty development and translational clinical research within the Anesthesia Department.

**Inflammation:** Dramatic advances in immunology over the past decades have led to better understanding, and in several instances enhanced control, of many acute and chronic inflammatory processes (as with the new developments in the immunotherapy of cancer). The plan is to develop new knowledge in the area of purinergic and innate regulation of vascular inflammatory responses, immune cell reactivity, and pain. These studies focus on mitochondrial mediators, extracellular nucleotides, xenobiotics, oxygen, and related heme oxygenase-mediated pathways. Expertise in inflammation exists mainly at the single investigator level, although new programs are evolving in trauma and critical care.

**Translational Studies:** Initial focus has been on the validation of novel treatments to abrogate immune

exhaustion and thereby enhance anti-pathogen (hepatitis C and others) or anti-tumor inflammatory responses. Lymphocyte exhaustion is also an important component of sepsis and chronic critical illness. Innate immune failure might predispose to development of pneumonia in mechanically ventilated patients.

Our plan is to develop a research agenda that links and coordinates diverse but complementary disciplines in anesthesia and to focus on detecting, diagnosing, investigating, and treating disease with an intent to integrate these discoveries with newly developing Biotechnological ventures (Purinomia and Tizona)



CD39 limits P2X7 receptor inflammatory signaling and attenuates sepsis-induced liver injury. Savio LEB, de Andrade Mello P, Figliuolo VR, de Avelar Almeida TF, Santana PT, Oliveira SDS, Silva CLM, Feldbrügge L, Csizmadia E, Minshall RD, Longhi MS, Wu Y, Robson Simon C. & Coutinho-Silva Robson. (Joint senior authors; SCR correspondence). *J Hepatol.* 2017 Oct;67(4):716-726. doi: 10.1016/j.jhep.2017.05.021. Epub 2017 May 26.



Sepsis is a leading cause of death in intensive care units worldwide and represents a major public health issue because of the high numbers of deaths of economically productive people and the associated major morbidity observed in survivors. This collaborative manuscript, published in one of the premier hepatology-GI journals (IF-18.9), and related work, have explored the pathogenetic linkages between severe sepsis and liver injury, which result in progressive cholestasis, hepatic decompensation, and death.

In a small animal experimental model of abdominal sepsis (cecal ligation and puncture), we have established that purinergic signaling by extracellular ATP (eATP) resulted in P2X7-receptor activation. These pathways on myeloid cells exacerbated systemic and hepatic inflammation by augmenting proinflammatory cytokine production. The ectonucleotidase CD39 (ENTPD1), known to be the dominant ecto-enzyme scavenging eATP to generate adenosine, limits this P2X7 activation and results in adenosine A2A receptor stimulation, which downregulates inflammatory stress. In this paper, we show that septic CD39<sup>-/-</sup> mice exhibit higher levels of inflammatory cytokines and show more pronounced liver injury than wild type mice. Combinations of pharmacological P2X7 blockade with adenosine A2A receptor stimulation completely inhibit cytokine production, the activation of inflammatory signaling pathways, and protect both septic wild type and CD39<sup>-/-</sup> mice against liver injury in this model. We conclude that CD39 attenuates sepsis-associated liver injury by scavenging eATP and ultimately generating adenosine. We have proposed that boosting of CD39 bioactivity would suppress P2X7 responses and trigger adenosinergic signaling to limit systemic inflammation and restore liver homeostasis in acute phases of sepsis. Translational research aspects are ongoing.

This work has formed the basis of work submitted by Dr. Simon Robson in Project 3# (CD39 and Extracellular Nucleotide Signaling Mediate Inflammation and Immune Failure) to DoD award - W81XWH-16-1-0464 (Hauser).



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## Current Grants and Funding

Our group has been funded by NIH, the DOD, AASLD, AHA, and other national and international groups as well as industry.

R21CA221702-01A1

Robson/David Avigan (PDs/PIs)

National Institutes of Health

Directed purinergic signaling as immunotherapy in leukemia

Tizona SRA

Robson (PI)

Evaluation of anti-CD39 antibodies for enzymatic inhibition and functional blocking (in vitro)

W81XWH-15-PRMRP-FPA (DOD)

Hauser (Program Leader) - Robson (Project Leader)

DAMP-Mediated innate immune failure and pneumonia after trauma

R01AI132389

Kroemer (PI)

UPIT: Unleash the potential of intestinal transplantation

With Georgetown University

R01DK108894-02

Longhi (PI)

Immunomodulatory effects of bilirubin are mediated through the aryl hydrocarbon receptor, O2 and purinergic pathways

AASLD Pilot Research Award

Longhi (PI)

Regulation of aryl hydrocarbon receptor signaling in autoimmune hepatitis

R01DK103723-04

Gulbransen (PI)

Role of enteric glia in the death of neurons during gut inflammation

With OSU

R01DK104714-03

Wegiel (PI)

Role of biliverdin reductase during sterile inflammation in the liver

Robson (PI)

Helmsley Charitable Trust

Biological impact of bacterial purines on gut immune function in Crohn's Disease

TI 988/1-1

Shilpa Tiwari-Heckler

DFG (German Research Foundation) fellowship

Natural Killer T (NKT) cell mediated tissue injury is modulated by CD39 in models of non-alcoholic fatty liver disease

and evolving intellectual property at BIDMC.

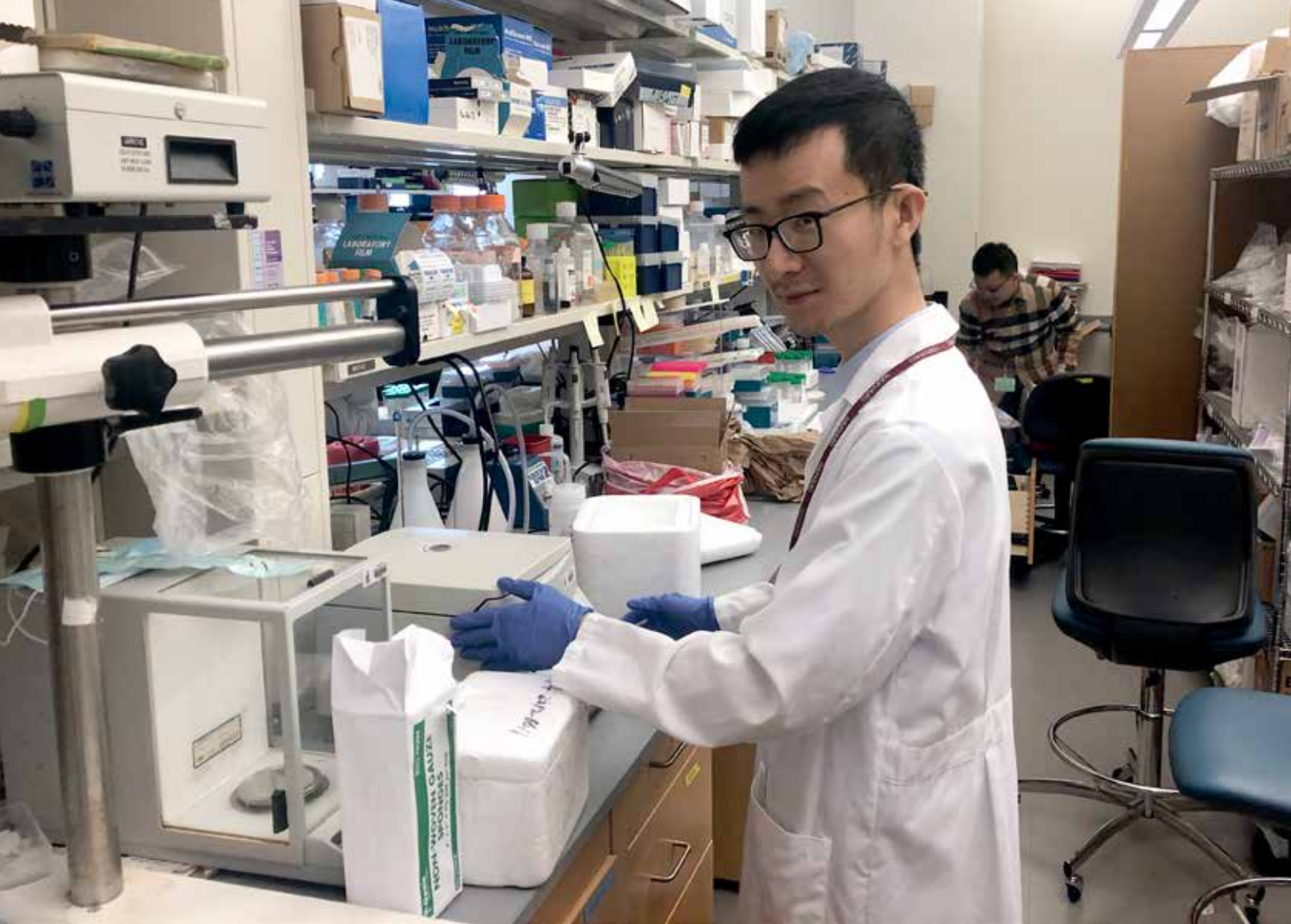
**Education:** We use departmental -focused (NIH Anesthesia Center Grant and T32/KL2) resources to foster education and training in bio-medical research in our focus areas to students, residents, trainees, fellows, and faculty. The emphasis is on experimental models of human inflammatory disease and the application of innovative discoveries to translational studies. This effort also uses currently available resources within other Departments at BIDMC, the interinstitutional T32 award, and facilities at Harvard Catalyst, which serve to bring together the "intellectual force, technologies, and clinical expertise of Harvard University and its affiliates and partners to reduce the burden of human illness."

Our coordinated research portfolio provides a platform for the development of training programs that cross disciplines and place the focus on innovation, discovery, and translation. This program area will continue to develop relevant research and therefore prepare future generations of academic physicians and scientists.

## Awards

2019 AAI Early Career Faculty Travel Grant to Maria Serena Longhi (Abstract title: Endogenous antisense RNA and dysregulation of CD39 expression in inflammatory bowel disease, AAI Annual Meeting, May 9-13, 2019, San Diego, CA)

2019 AAI Trainee Abstract award to Marta Vuerich (Abstract title:



Human CD39 overexpression or APT102 recombinant apyrase administration enhances Treg and Tr1 cell immunity in inflammatory bowel disease, AAI Annual Meeting, May 9-13, 2019, San Diego, CA)

2019 AAI Trainee Poster award to Shilpa Tiwari-Heckler (Abstract title: Enhanced adenosinergic signaling and immune cell exhaustion after trauma, AAI Annual Meeting, May 9-13, 2019, San Diego, CA)

2019 Anesthesia Week Prize for best poster, runner-up, Bench Research category award to Paola de Andrade Mello (Poster title: Potential therapeutic application of

anti-CD39 monoclonal antibodies, Anesthesia Week - Beth Israel Deaconess Medical Center, Feb 14, 2019, Boston, MA)

2019 Invited membership Robson, Simon C. – Subcommittee of Professors at Harvard Medical School.

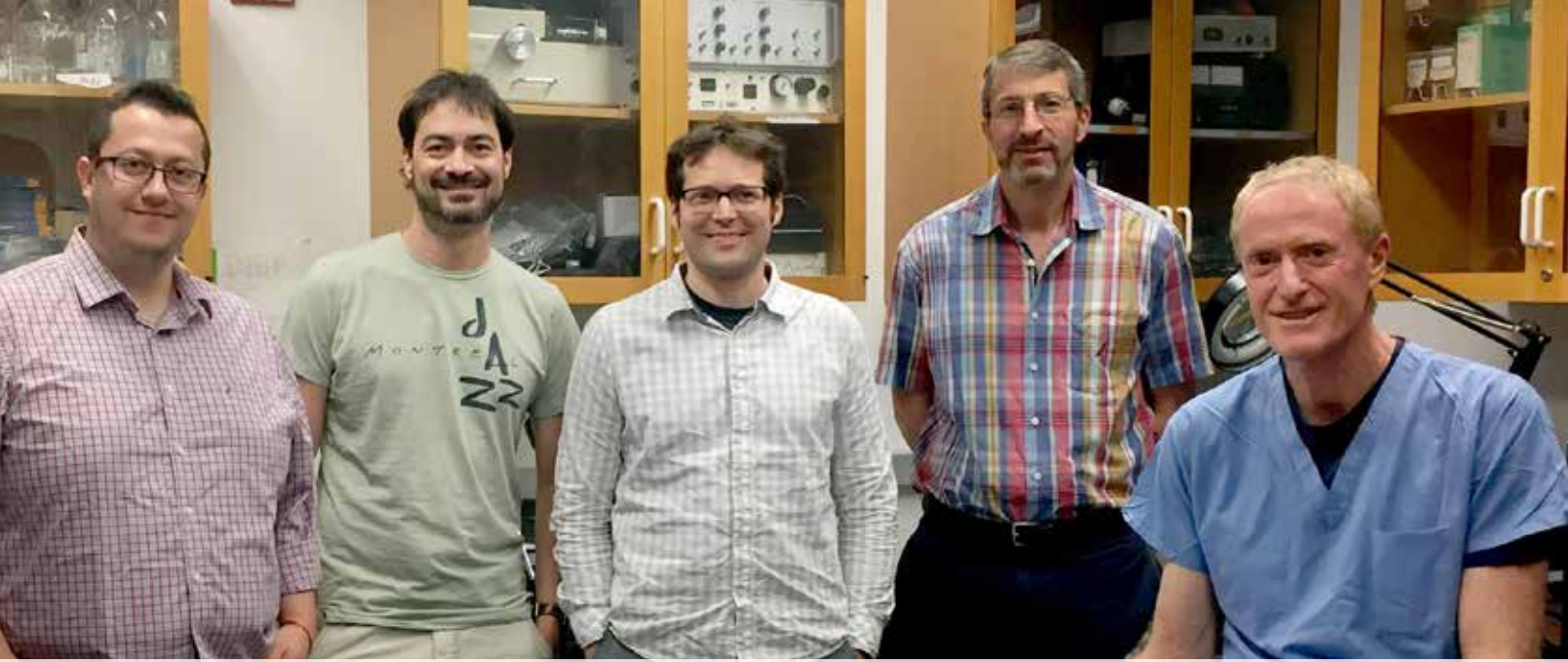
### Conclusion

Our mandate for the next five years is to develop basic research within anesthesia focused on understanding the mechanisms of inflammation and immunobiology in concert with established and new collaborations. We provide synergy within other divisions and sections of anesthesia and with collabora-

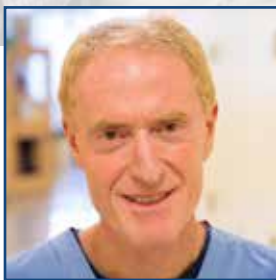
tors in divisions in medicine and the Departments of Surgery and Radiology. We apply discoveries at the bench to the ongoing development of translational clinical studies. Lastly, our goals are to enhance teaching and education by continuing current successful models and further develop new training and fellowship programs within anesthesia.

We coordinate these goals with current resources in the Center for Anesthesia Research Excellence (CARE) to further facilitate research endeavors and ensure they are successful and compliant with research regulations.





## Burstein Lab



**Rami Burstein, PhD**

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John Hedley-Whyte  
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### Team

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We are a group of scientists and clinicians dedicated to easing the burden of migraine on patients by unraveling its many pathophysiologicals and creating novel approaches for treatment. We conceive, design, and execute parallel clinical and pre-clinical studies that embody the power of true translational research in headache medicine. This is achieved by combining molecular, genetic, epigenetic, cellular, immunological, anatomical, physiological, behavioral, and psychophysical techniques, with clinical and therapeutic approaches.

**Basic headache research** focuses on the pathophysiology of neural

pathways that underlie migraine pain and their modulation by molecules with potential therapeutic effects. Studies utilizing anatomical, physiological, pharmacological, molecular, behavioral, and genetic approaches include characterization of plasticity developing during migraine in peripheral nociceptors innervating the meninges, dorsal horn trigeminothalamic circuits mediating cephalic pain of intracranial origin, and thalamocortical neurons that convey nociceptive signals from the meninges to cortical areas involved in perception of pain, vision, sound, and smell, as well as memory, motor, affective, and cognitive functions.

Our recent research focuses on (a) onset of migraine as related to neuronal, inflammatory, environmental, and behavioral triggers and their effects on the trigeminovascular system; (b) how post-ictal headache begins and ends after focal and generalized seizure; (c) the mechanism by which aura induces activation along pain pathways



underlying migraine headache; (d) how light exacerbates migraine headache; (e) the thalamus's role in migraine and how it transforms different colors of light into pain; (f) the hypothalamus's role in migraine and the ways it generates negative emotions and a variety of sympathetic, parasympathetic, physiological, and endocrine changes during migraine; (g) the intracranial origin of extracranial pain and the extracranial origin of intracranial pain; (h) the cerebellum and its role in occipital headache, vestibular migraine, vertigo, dizziness, motion sickness, and potentially vomiting; (i) the mechanisms of Botox; (j) the mechanism of CGRP monoclonal antibodies. These studies are conducted in collaboration with Drs. Rodrigo Nosedá (Anesthesia), Andrew Strassman (Anesthesia), Aaron Schain (Anesthesia), and Agustin Melo-Carrillo (Anesthesia).

#### ***Clinical research on headache:***

To ensure that research is relevant to the clinical condition and experience of migraine in patients, we also conduct translational studies in the Clinical Research Center. Our clinical studies focus on (a) the multiple aspects of photophobia in migraine patients; (b) inflammatory role in headaches of extracranial origin and chronic muscle tenderness; (c) the relationship between epileptic seizures and post-ictal headache; (d) identification of the most effective ways to terminate status migrainosus; (e) the therapeutic and physiological effects of celecoxib, a liquid COX2 inhibitor; (f) the identification of

## **16 Grants awarded in 2017-2020**

- 2012-2020** R37 NS079678-01 (RB) National Institute of Neurological Disorders and Stroke, NIH, PI, "Photophobia during migraine: sensory, autonomic and emotional responses to light."
- 2015-2020** R01 NS095655 (RB, DB) National Institute of Neurological Disorders and Stroke, "Post-Traumatic Headache (PTH) in Children: Alterations of Brain Function, Blood Flow and Inflammatory Processes."
- 2016-2021** R01 NS094198 (RB) National Institute of Neurological Disorders and Stroke, NIH "Cortical mechanisms of headache: beyond CSD."
- 2017-2022** R01 NS104296 (RN) National Institute of Neurological Disorders and Stroke, NIH "Pathophysiology of occipital headache."
- 2005-2020** Allergan, PI, "Botulinum Toxin mechanism of action in migraine headache."
- 2016-2018** Allergan, PI, "Novel concepts for BoNT-A mechanisms of action: role in altering the molecular environment in which pain fibers exist (pre-clinical)."
- 2016-2020** Allergan, PI, "Novel concepts for BoNT-A mechanisms of action: role in altering the molecular environment in which pain fibers exist (clinical)."
- 2019-2021** Allergan, PI, "Atogepant (small molecule CGRP antagonist mechanisms of action in migraine prevention."
- 2018-2020** Allergan, PI, "OnabotulinumtoxinA mechanisms of action in preventing migraine aura headache."
- 2018-2020** Allergan, PI, "Efficacy of combination therapy with onabotulinumtoxinA and Atogepant in preventing activation of the trigeminovascular pathway."
- 2016-2018** Teva Pharmaceutical Industries, Ltd., PI, "Mechanisms of action of TEV-48125 anti-calcitonin gene-related peptide (CGRP) monoclonal antibody (mAB) - Part 1 neuronal."
- 2016-2019** Teva Pharmaceutical Industries, Ltd., PI, "Mechanisms of action of TEV-48125 anti-calcitonin gene-related peptide (CGRP) monoclonal antibody (mAB) - Part 2 environmental."
- 2016-2018** Teva Pharmaceutical Industries, Ltd., PI, "Mechanisms of action of TEV-48125 anti-calcitonin gene-related peptide (CGRP) monoclonal antibody (mAB) - Part 3 Male vs. female."
- 2016-2019** Teva Pharmaceutical Industries, Ltd., PI, "Mechanisms of action of TEV-48125 anti-calcitonin gene-related peptide (CGRP) monoclonal antibody (mAB) - Part 4 Activation by CGHRP."
- 2015-2018** Trigemina (Targeted neurological therapies), PI, "Can intranasal oxytocin inhibit peripheral and central trigeminovascular neurons after their activation by topical application of inflammatory soup to the dura."
- 2017-2020** Dr. Reddy Laboratories "Can Celecoxib reverse inflammatory responses in the meninges."



responders to treating migraine with CGRP monoclonal antibodies, a new class of migraine prophylactics; (g) the pathophysiology of occipital headache; (h) the consequences of repeated migraine attacks on brain areas involved in pain modulation and affective and cognitive functions; and (i) the mechanisms of post-concussion headache in adolescents. These studies were conducted in collaboration with Drs. Messoud Ashina (BIDMC, Anesthesia), David Borsook (Children's Hospital), Pamela Blake (Memorial Herman Houston), Brian Grossberg (Hartford Headache Center), and William Austin and Lisa Geferer (MGH Plastic Surgery).



Neural mechanism for hypothalamic-mediated autonomic responses to light during migraine. Nosedá, R, Lee AJ, Nir RR, Bernstein CA, Kainz VM, Bertisch SM, Buettner C, Borsook D, Burstein R. *Proc Natl Acad Sci USA* 2017;114(28): E5683–E5692.



Migraineurs avoid light because it intensifies their headache. However, this is not the only reason for their aversion to light. Studying migraineurs and control subjects, the authors found that lights triggered more changes in autonomic functions and negative emotions during, rather than in the absence of, migraine than in control subjects, and that the association between light and positive emotions was stronger in control subjects than migraineurs. Seeking to define a neuroanatomical substrate for these findings, we showed that, in rats, axons of retinal ganglion cells converge on hypothalamic neurons that project directly to nuclei in the brainstem and spinal cord that regulate parasympathetic and sympathetic functions and contain dopamine, histamine, orexin, melanin-concentrating hormone, oxytocin, and vasopressin. Although the rat studies define frameworks for conceptualizing how light triggers the symptoms described by patients, the human studies suggest that the aversive nature of light is more complex than its association with headache intensification.





## Eikermann Lab

### Matthias Eikermann, MD, PhD

Vice Chair, Faculty Affairs  
Professor of Anaesthesia

#### Team

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Visiting Scientist in Anaesthesia  
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Instructor in Anaesthesia  
Stephanie D. Grabitz, MD  
Katharina Platzbecker, MD  
Peter Santer, MD  
Karuna Wongtangman, MD

#### Medical Students

Lea Albrecht  
Friederike Althoff  
Maximilian Hammer  
Stephanie Pham

### Grants awarded: 2019

Industry: Merck, Pfizer  
Foundations: ResMed  
Philanthropic donations: Buzen family

Our vision is to eliminate long-term decline in well-being of our patients after surgery and trauma. We strive to develop individualized, patient-centered care plans that integrate cutting-edge research achievements. Our efforts focus on the interface of clinical research and implementation science and address outcomes that matter to daily living and quality of life after surgery and critical care.

### General overview

We are a group of researchers who conduct studies using a broad spectrum of research methods, including retrospective and prospective observational studies, interventional clinical trials, and pharmaco-physiological interaction studies. The traditional focus of our work is on postoperative respiratory complications, such as the requirement of mechanical ventilation in the intensive care unit after surgery. We have shown that various anesthesia-related factors predict adverse respiratory outcomes. In a series of studies, we identified and defined safe prac-

tices for intraoperative mechanical ventilation, body positioning, fluid and blood transfusions, and anesthetics commonly used to provide surgical anesthesia. We showed that some drugs used to provide surgical anesthesia are more effective than others to avoid respiratory complications. We created and validated two generations of prediction tools for postoperative respiratory complications (SPORC and the recently published SPORC2) and other adverse outcomes. The identification of predictors of adverse outcomes and definition of easily applicable prediction tools allow for perioperative risk assessment and identification of patients that may benefit from prevention measures. As a next step, we are working on implementing our prediction model for postoperative respiratory complications into Talis, our clinical documentation software. This will allow for stratified risk assessment so real-time decision support can be provided to clinicians.

An area of growing importance lies in the identification of surgical patients at increased risk of ischemic





Association of Preoperatively Diagnosed Patent Foramen Ovale with Perioperative Ischemic Stroke. Ng PY, Ng AK, Subramaniam B, Burns SM, Herisson F, Timm FP, Rudolph MI, Scheffenbichler F, Friedrich S, Houle TT, Bhatt DL, Eikermann M. *JAMA*. 2018 Feb 6;319(5):452-462.



This study suggests that the presence of a patent foramen ovale (PFO) – a hole in the chambers (atria) of the heart – doubles the risk of stroke occurring within 30 days of non-cardiac surgery. Prior to the study, PFO had already been shown to increase the risk of a second stroke in people who had a history of stroke. By analyzing records from more than 150,000 patients who underwent surgery from 2007-2015, the authors found that 3.2% of patients with a PFO had a stroke compared with 0.5% of patients without a PFO. Given that up to one in five people in the general population has a PFO, this finding provided the data to call for urgent research to study therapeutic strategies to eliminate the devastating post-operative complication of stroke. Our department is currently developing new strategies to make sure all patients with diagnosed PFO receive a “PFO-flag” in their electronic medical record (similar to other diseases such as obstructive sleep apnea). Further, we have created and validated a prediction score for stroke after surgery. These follow-up actions will help clinicians implement an individualized perioperative preventive therapy in patients with high predicted risk of stroke.

stroke after surgery. We have identified key risk factors (migraine and a patent foramen ovale) of ischemic stroke in patients undergoing surgery and created and validated the “STRAS” instrument to help us identify patients prior to surgery who have a high risk of postoperative stroke, knowledge that will allow for adequate preventive treatment. Our goal is to eliminate the risk of stroke attributed to surgery.

Our team uses a variety of research strategies. We created and maintain valid electronic hospital research databases from two Harvard Hospitals, the Massachusetts General Hospital and Beth Israel Deaconess Medical Center. This allows us to utilize data from more than half a million patients who underwent surgery at competing Harvard Hospital networks during the last decade. The availability of com-

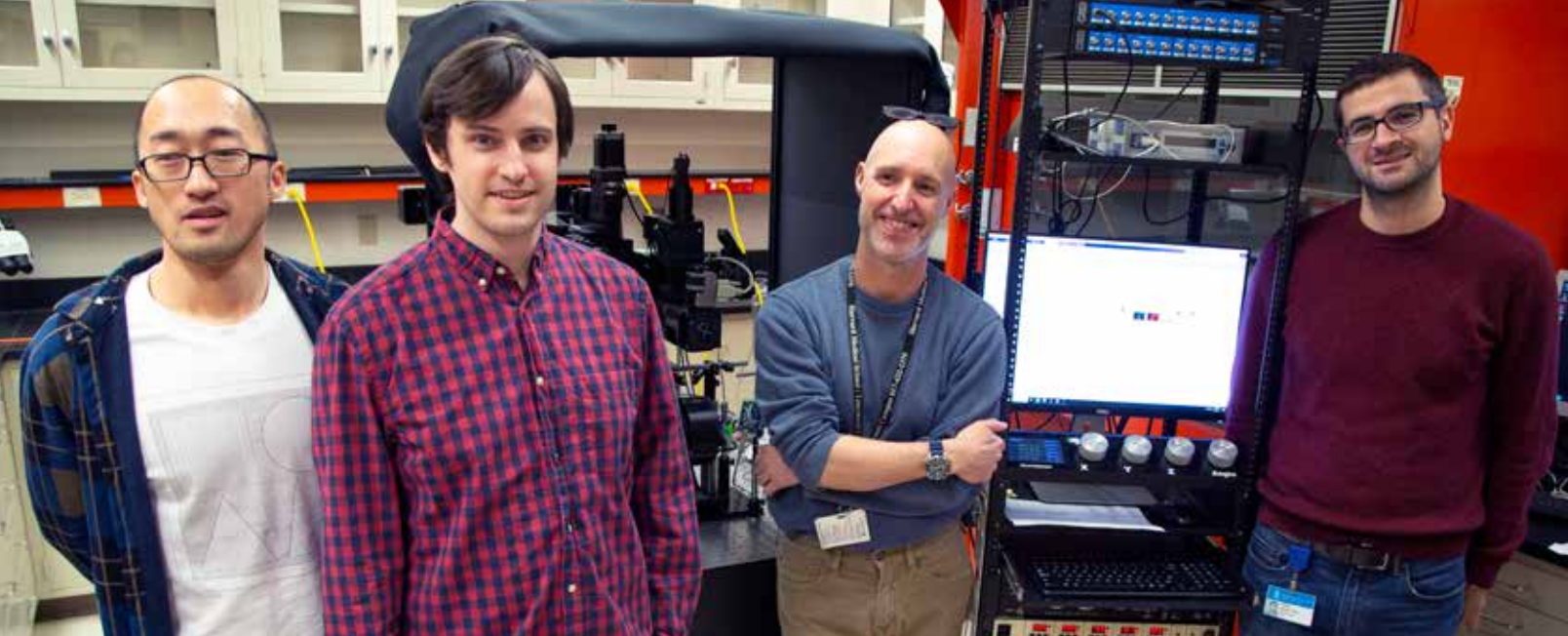
prehensive preoperative data capturing comorbidities and medication history, in combination with a highly granular intraoperative record and postoperative treatment, discharge, and readmission information, enable our team to investigate the value of perioperative care. Endpoints of interest include clinical outcomes (e.g. respiratory complications, ischemic stroke), health-care utilization (e.g. unplanned ICU admission, 30-day readmission) as well as long-term outcomes (e.g., mortality, discharge to a nursing home, insufficient recovery of functional independence). In order to provide access to our BIDMC database to all researchers in the department, we have created a research data repository under the oversight of the departmental Bioinformatics and Data Use Committee, which has been approved by the IRB.

Our team is conducting several prospective observational and interventional clinical studies in critically ill patients. In a multicenter randomized controlled trial, we investigated the effects of early mobilization in the intensive care unit (ICU), guided by a facilitator. In collaboration with ICU nurses, physical therapists, and physicians, our goal is to create individualized, optimal mobilization treatment plans for patients who receive treatment in the surgical intensive care unit, to help improve long-term outcomes, and to ensure functional independence after severe illness.

Based on our preclinical work, we also conduct translational pharmacophysiological interaction trials to create new sedation and analgesia treatments that do not affect breathing and cognitive function more than needed. We were, for example, able to show that supplemental carbon dioxide reverses propofol-induced upper airway collapsibility by increasing pharyngeal muscle activity. Ketamine apparently has similar beneficial effects, and we are investigating these effects in the surgical ICU on breathing and cortical function.

## Conclusion

Outcomes that reflect our patients’ well-being are neurological, cardiovascular, and respiratory function. We collaborate within our department and also with surgeons, neurologists, cardiologists, physical therapists, pharmacists, respiratory therapists, and nurses to develop individualized, patient-centered care plans based on innovative research in perioperative medicine.



**Dan Levy, PhD, MSc**

Associate Professor of Anaesthesia

**Team**

Andy Blaeser, PhD

Dara Bree, PhD

Jun Zhao, PhD

**Grants awarded: 2013–2023**

**2013–2023** R01NS078263 National Institute of Neurological Disorders and Stroke “Mechanisms of CSD-evoked persistent activation of meningeal nociceptors”

**2014–2019** R01NS086830 National Institute of Neurological Disorders and Stroke “Peripheral Mechanisms of posttraumatic headache”

**2017–2020** R21NS101405 National Institute of Neurological Disorders and Stroke “Chronic two-photon calcium imaging of intracranial meningeal afferents in awake behaving mice”

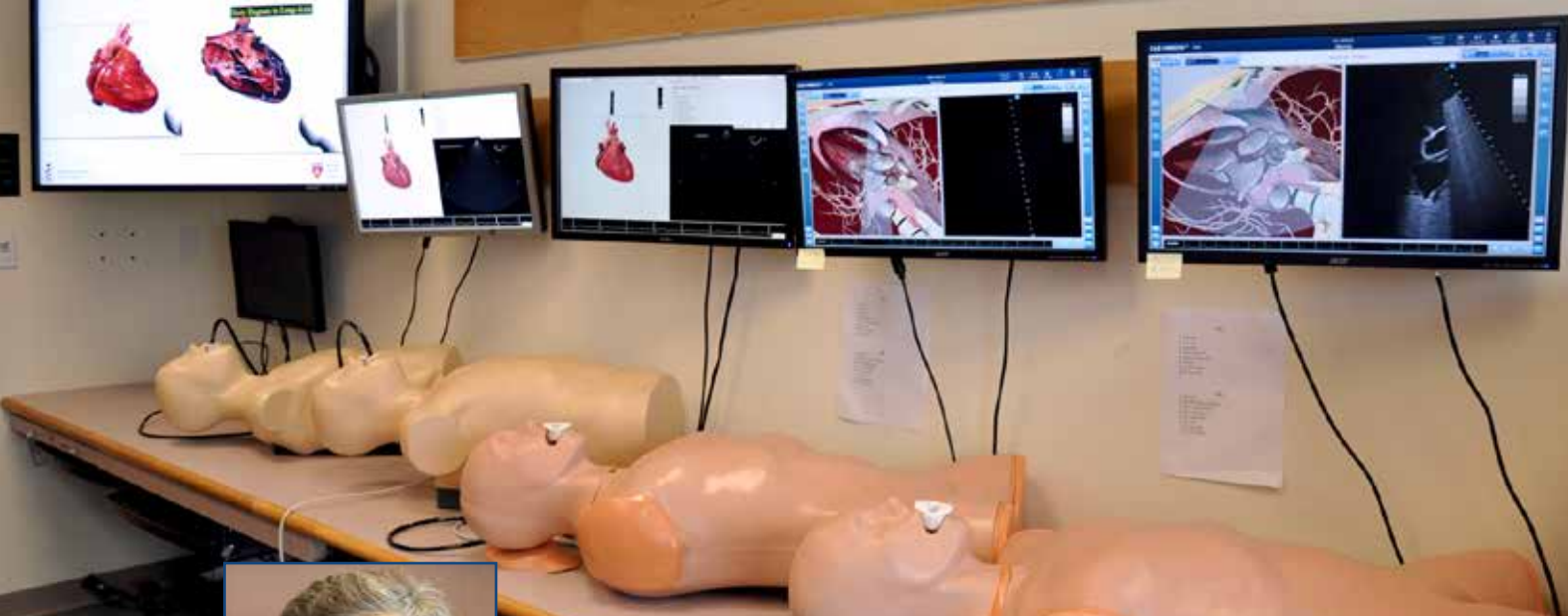
**2016–2020** “The role of CGRP in chronic posttraumatic headache” (TEVA)

## Levy Lab

Migraine is one of the leading causes of disability worldwide, and the incomplete understanding of its pathogenesis has limited the development of effective treatments. The Levy Laboratory conducts research using in vivo approaches in rats and mice on mechanisms underlying triggers of migraine headache. We also study mechanisms of migraine-like headache that arise following a concussion (post-traumatic headache). The lab has been sponsored during the last two years by three NIH grants and a grant by Teva. Research in the lab employs extracellular single-unit electrophysiology and two-photon calcium imaging to study changes in the activity and sensitivity of trigeminal meningeal afferents. The lab also utilizes various methods to assess headache-related metabolic changes in the cortex, including changes in cerebral blood flow, oxygen tension, and other metabolites. In addition, various behavioral models related to headache are employed, including testing of facial allodynia, em-

ploying the grimacing scale open field activity, and place preference paradigms. In the last two years, research in the Levy lab identified meningeal and cortical factors that contribute to the persistent activation and sensitization of meningeal nociceptors in response to cortical spreading depression, with focus on the role of astroglia, the most abundant non-neural cells in the cortex. We also continued to study mechanism of post-traumatic headache, using primarily a behavioral approach. These studies were conducted by Jun Zhao, PhD (senior research associate), Dara Bree, PhD (post-doctoral fellow), and Andrew Blaeser, PhD (post-doctoral fellow). In addition, the lab collaborates with Dr. Mark Andermann at the Department of Endocrinology to investigate the response of dural and leptomeningeal afferents in awake-behaving animals using two-photon calcium imaging. In the next two years, the Levy lab will continue to pursue the role of cortical astrocytes in headache.





**Feroze Mahmood, MD**

Director, Cardiac Anesthesia

Director, Perioperative  
Echocardiography

Professor of Anaesthesia



**Robina Matyal, MD**

Director, Vascular Anesthesia

Leonard Bushnell Chair of Anaesthesia  
at BIDMC

Associate Professor of Anaesthesia

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Omar Chaudhary, MD

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Yanick Baribeau

Vincent Baribeau

Rashid Rayan

## Mahmood-Matyal Lab

The Transesophageal Echocardiography (TEE) Laboratory at the BIDMC Department of Anesthesia, Critical Care and Pain Medicine, led by Drs. Feroze Mahmood and Robina Matyal, is one of the most well-known programs in the world. Our department was one of the pioneers in adopting this technology in the mid-1990s. Since then, TEE monitoring is routinely used during cardiac surgeries.

### Echo Lab Training

Since the late 1990s, perioperative TEE service has been recognized as a stand-alone division offering TEE monitoring services during the perioperative period. Besides cardiac surgery, we have introduced the use of TEE monitoring for high-risk non-cardiac surgeries and later expanded the program to the use of point-of-care (POC) ultrasound in the perioperative arena.

The Echo Lab, located on the fourth floor of the Rosenberg building, is the center of echocardiography/ultrasound operations. Besides echocardiography-related research, it is also the hub of our perioperative ultra-

sound education program, three-dimensional (3D) printing laboratory, and a simulation training.

As a result of the ingenuity and initiative of our educational division, our laboratory was one of the pioneers to introduce TEE and transthoracic echo (TTE) 3D printing, virtual reality simulators in echocardiography, POC ultrasound, and regional anesthesia education. In addition to Harvard Medical School's accredited continuing medical education programs, the Echo Lab offers multiple TEE, TTE, and POC ultrasound training programs to trainees from other departments within the medical center and regionally. Trainees from Tufts University Medical Center, Lahey Clinic, and St. Elizabeth's Medical Center have completed educational rotations at the Echo Lab. We are truly proud of our ultrasound educational curriculum, which has been identified as the program of record and shared by our educational division with multiple national and international medical centers for their trainees.

### In service to BIDMC with state-of-the-art equipment

Our TEE training is considered one of the most comprehensive and advanced training programs in the world. Thanks to continuing departmental and hospital support, we have a diverse portfolio of the latest 3D echocardiography equipment for our residents and fellows.

We are the sole providers of echocardiographic guidance for structural heart interventions for BIDMC. With the ever-expanding scope of structural heart programs at BIDMC, our involvement has increased exponentially, with dedicated faculty assignments for structural heart interventions. We have set up a unique pulsatile artificial heart in which we can implant patient-specific 3D-printed valves to practice percutaneous interventions and valve repair techniques prior to actually performing them.

Multiple highly sought-after hands-on 3D training courses are regularly conducted in the Echo Lab throughout the year. Additionally, our laboratory is identified as the hospital's

core 3D-printing facility providing 3D-printing services to the entire medical center.

### Collaborative Research

With the multidisciplinary scope of operation of the Echo Lab, we established the "Valve Research Group," a multispecialty group of clinical collaborators (anesthesia, cardiology, cardiac surgery), to design and conduct clinical research and develop innovative therapies for cardiovascular disease. We also have a dedicated website for the valve research group operations (<https://valveresearchgroup.hms.harvard.edu>), routinely updated with all Echo Lab happenings.

The Echo Lab also has a very robust basic science research program focused on diabetic cardiomyopathy and microvascular coronary artery disease. Small animal experiments are conducted in our laboratory at the Center for Lifesciences (CLS).

Currently there are multiple projects underway relating to nanoparticle-based remote delivery of angiogenic molecules for microvascular growth,

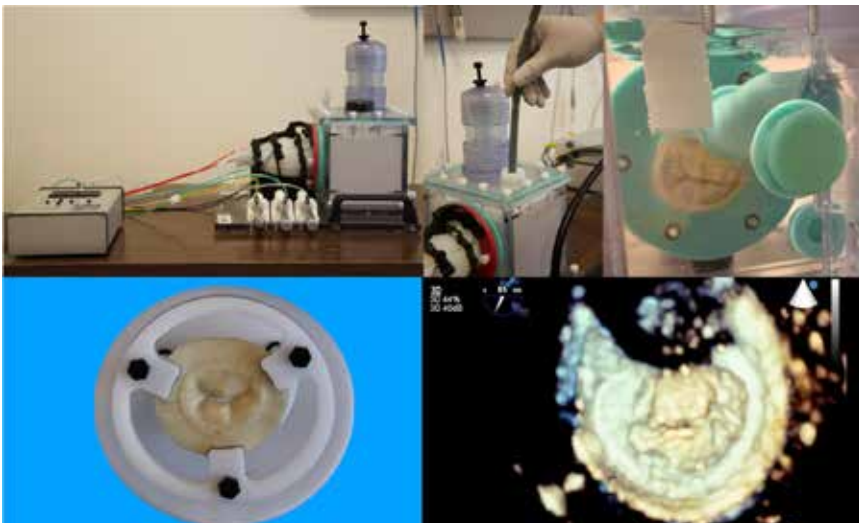
pathophysiology of post-cardiac surgical atrial fibrillation, and gender-based differences in diabetic cardiomyopathy. Multiple research fellows are involved in these projects and split their time between the Echo Lab and the CLS lab. With access to national databases, the research fellows are involved in outcome-related statistical projects.

We have multiple international collaborations with world-class medical centers from Canada, China, India, and Netherlands. The list of prestigious institutions from which our research fellows originate continues to grow with long-term clinical and research collaborations.

### Worldwide Reach

Over the last decade, in addition to training our cardiac anesthesia fellows, we have had more than 50 national and international post-doctoral research fellows contribute to our lab, more than 200 physicians attend our 3D mini-fellowship, and 20 research associates admitted to prestigious medical schools in the U.S. Interestingly, many of our research associates have re-joined our program as residents or post-doctoral research fellows.

With the collective hard work and dedication of each member of the Echo Lab, we have distinguished ourselves as one of the premier ultrasound/echocardiography/3D imaging centers of the world. We have a unique and productive multidisciplinary collaborative operation that continues to thrive in a culture of excellence.







**Balachundhar Subramaniam, MD, MPH**

Director, Center for Anesthesia Research Excellence

Ellison “Jeep” Pierce Chair of Anaesthesia at BIDMC

Associate Professor of Anaesthesia

**Team**

Pooja Mathur

Senthil PackiaSabapathy Kuthalingam, MBBS, MD

Valluvan Rangasamy, MBBS, MD, DNB

Puja Shankar, MD

Ammu Thampi Susheela, MBBS

## Subramaniam Lab

Our field of research involves perioperative outcomes, primarily focused on perioperative hemodynamics and postoperative neurocognitive function. Additionally, we have expanded our research to investigate the effect of meditation in the perioperative setting and wellness resilience.

### Perioperative Hemodynamics

**Dynamic Biomarkers of Intraoperative Instability.** This study aims to identify a correlation between intraoperative blood pressure variability and surgical outcomes of cardiac surgical patients. The goal is to develop a real-time dynamic cardiovascular risk index to help predict outcomes and guide anesthesia management of high-risk patients undergoing complex procedures.

**Complexity Signals with Non-invasive Continuous Arterial Blood Pressure Monitor with ClearSight**

**Monitor.** This study aims to identify a blood pressure complexity index that can predict surgical risk similar to existing risk indices, such as the Society of Thoracic Surgery Risk Index and/or European Score (EuroScore) in cardiac surgical patients. This non-invasive preoperative blood pressure complexity index can be obtained from currently available monitors, example ClearSight from Edwards LifeSciences.

### Light-Enhanced Transesophageal Echocardiography

for the development of a prototype with Wellman’s lab for photomedicine (Role: primary inventor and Investigator). The prototype has reached the stage of human testing in 2019.

### The OPERA (OPTimal blood prEs-suRe during Anesthesia) Study.

This study aims to identify the association between perioperative baseline blood pressure, intraoperative hypotension, and postoperative adverse outcomes in patients un-

dergoing vascular surgery and is currently ongoing in collaboration with the Vascular Surgery Department.

### Postoperative Neurocognitive Function

The DEXACET (**Dexmedetomidine and IV Acetaminophen for the Prevention of Postoperative Delirium following Cardiac Surgery** in Adult Patients 60 years of age and Older) Trial. This randomized factorial trial was conducted from September 2015 to April 2018 and published in *JAMA* (February 2019). The trial found that, among older patients undergoing cardiac surgery, postoperative scheduled IV acetaminophen, combined with IV propofol or dexmedetomidine, reduced in-hospital delirium vs. placebo. Biomarker discovery studies are currently ongoing to potentially identify a relationship between delirium and genetic factors. Future analysis will assess postoperative cognition following cardiac surgery through one year using a cognitive assessment scale. Given the positive findings of this RCT, a study was designed to determine whether a dose effect of IV acetaminophen and the incidence of delirium exists in elderly cardiac surgical patients. This study is currently ongoing in collaboration with Dr. Shahzad Shaefi. A larger, multicenter trial has been designed to further investigate the relationship between IV acetaminophen and delirium reduction.

### Association between Intraoperative Hypotension and Postoperative Delirium in Patients Undergoing Cardiac Surgery.

The association between intraoperative hypotension and postoperative delirium was explored in this observational cohort study nested in an RCT. It evaluated the effectiveness of IV acetaminophen and dexmedetomidine in decreasing the incidence of postoperative delirium (POD).

**Guided Meditation as an Adjunct to Enhance Postoperative Recovery: A Feasibility Study.** The aim of this study is to test the feasibility of implementing a meditation program in the perioperative period and explore whether this meditative regimen can result in improvements in postoperative pain management, sleep, cognitive dysfunction, and delirium. It is currently ongoing.

**Pecto-Intercostal Fascial Block for Postoperative Analgesia after Cardiac Surgery: A Pilot Study.** This study aims to determine whether administration of a pecto-intercostal fascial plane block (PIFB) with bupivacaine is a more effective therapy for postoperative analgesia after cardiac surgery as compared to patients who receive a sham block of normal saline. It is currently ongoing.

The PATHFINDER (**Perioperative multimodal general Anesthesia FocussING on specific carDiac surgERies**) Study: A Feasibility Trial. Study seeks to determine whether a rational strategy of EEG-guided multimodal general anesthesia (MMGA) using target-specific sedatives and analgesics could result in: a) enhanced recovery after anesthesia and surgery, b)



Effect of intravenous acetaminophen versus

placebo and dexmedetomidine versus propofol on

postoperative delirium in older patients following cardiac surgery: The DEXACET randomized clinical trial. Subramaniam B, Shankar P, Shaefi S, Mueller A, O'Gara B, Banner-Goodspeed V, Gasangwa D, Patxot M, Packiasabapathy S, Mathur P, Eikermann M, Talmor D, Marcantonio ER. *JAMA* 2019 Feb 19;321(7):686-696.



This study found that administering IV acetaminophen after cardiac surgery at six-hour intervals in the immediate postoperative period for 48 hours dramatically reduced the incidence of postoperative delirium. There was also lower use of opioids, decreased length of delirium, and shorter ICU length of stay in these patients. This single-center study has the potential to be the first therapeutic intervention for the prevention of postoperative delirium. Postoperative delirium following surgery is seen in up to 50% of patients 60 years of age and older. Delirium is a risk factor for prolonged ICU and hospital stay and long-term complications such as cognitive dysfunction and compromised daily functioning for up to six months. Untreated postoperative pain, opioid use, and neuro-inflammation are also risk factors. IV acetaminophen has the potential to counter both delirium and need for post-op opioids when administered for 48 hours, a time period where there is maximal secondary injury following surgery. If these results are confirmed in a larger future trial, this intervention will become part of the enhanced recovery protocols following cardiac surgery and will be a significant advance in caring for these patients.



decrease in (POD), and c) decrease in long-term postoperative cognitive dysfunction up to six months following cardiac surgery.

The PEaPOD (**Prevention of Early Postoperative Decline**) Study. A randomized feasibility study, completed in July 2018, was designed to outline subject interest, adherence to protocol, and generation of preliminary data regarding the ability of a neurocognitive training program to reduce the incidence of postoperative cognitive decline after cardiac surgery.

**The Relationship Between Administered Oxygen Levels and Arterial Partial Oxygen Pressure to Neurocognition in Postoperative Mechanically Ventilated Cardiac Surgical Patients.** A randomized trial, completed in July 2017, was done to determine the relationship between the level of administered oxygen and arterial partial oxygen pressure and postoperative neurocognition after cardiac surgery.

### Wellness Resilience

- **EEG changes with meditation:** A proposal to analyze EEG changes with a simple, online, guided meditative tool. This study aims to assess: a) the qualitative EEG measures associated with meditation; b) the observed difference in EEG changes between novice and experienced meditators; and c) the observed difference in EEG changes between the start and end of six weeks of daily meditation.
- The SAMURAI (**Neurophysiological changes before and after 8-day advanced meditation, Sa-**

**myama program in healthy volunteers**) Study. This study investigated the neurophysiological (EEG and MRI) changes with meditative breath watching before and after Samyama, an intensive eight-day meditative program.

- **Guided Meditation as a Wellness Tool in Anesthesia Providers.** The purpose of this study is to determine the effect of Isha Kriya meditation on stress and burnout among healthcare providers and to determine the feasibility of implementation and adherence to the Isha Kriya meditation technique among healthcare providers.
- **The Effect of a One-Time 15-Minute Guided Meditation (Isha Kriya) on Stress and Mood Disturbances Among Operating Room Professionals: A Prospective Interventional Pilot Study.** This study showed that this meditation technique improves mood changes and negative emotions among operating room professionals and could be used as a potential tool for improving wellness.
- **Impact of short- and long-term health effects on meditators. ISHA impact study.** This study

seeks to determine the health effects of a regular meditation practice on meditators.

### Major Accomplishments

Speaking Presentations:

- Organized and moderated a session at Sanders Theatre, Harvard Medical School, with Sadhguru Jaggi Vasudev, a Yogi Mystic and visionary and founder of the Isha Foundation, on “Memory, Consciousness, and Coma” on May 14, 2019, with Emery N. Brown, MD, PhD, and Nicholas D Schiff, MD, PhD.
- <https://youtu.be/w7irEcQHChw> 1.5 million views.

### Grants

Foundation for Anesthesia Education and Research (FAER) Grant for projects with Shahzad Shaefi, MD (role: principal mentor) and Brian O’Gara, MD (role: co-mentor)

Edwards LifeSciences for the project “Complexity Signals with Noninvasive Continuous Arterial Blood Pressure Monitor with Clear-sight Monitor” (Investigator-Initiated Study)

Mallinckrodt Pharmaceuticals for the project “IV acetaminophen and Dexmedetomidine for the prevention of postoperative delirium following cardiac surgery in adult patients more than 60 years of age.”





## Talmor Lab



**Daniel S. Talmor, MD, MPH**

Chair of Anesthesia, Critical Care and Pain Medicine

Edward Lowenstein Professor of Anaesthesia

### Team

Valerie M. Banner-Goodspeed, MPH  
Program Manager, Anesthesia Research  
Research Associate in Anaesthesia

Elias N. Baedorf-Kassis, MD  
Instructor in Medicine

Somnath Bose, MD, MBBS  
Instructor in Anaesthesia

Stephen H. Loring, MD  
Professor of Anaesthesia

Ariel L. Mueller, MA  
Biostatistician II

Brian P. O’Gara, MD, MPH  
Instructor in Anaesthesia

Todd W. Sarge, MD  
Assistant Professor of Anaesthesia

Shahzad Shaefi, MD, MPH  
Assistant Professor of Anaesthesia

Isabel Londono Marulanda, MD  
Research Fellow

Julia Larson, BS  
Clinical Research Coordinator

Benjamin Hoenig, BS  
Clinical Research Assistant II

We are a group of clinician scientists focused on improving outcomes for patients with critical illnesses. Our investigations range from the micro to macro, with mechanistic work at the bench extending into translational work, as well as interventional clinical trials supported and informed by epidemiologic surveys. We leverage a strong network of collaborators in other departments as well as critical care researchers across the United States and Canada. This cross-pollination leads to exciting and innovative ideas, with expanded resources to test novel hypotheses in multi-center studies. We are equally committed to the development and mentorship of trainees and early-stage investigators. A number of alumnae have gone on to secure independent funding and are advancing critical care for the sickest of our patients.

### Prevention and Early Treatment of Acute Lung Injury

Along with Dr. Nathan Shapiro in the Department of Emergency Medicine, our group leads the Boston Clinical Center within the

**NIH/NHLBI Prevention and Early Treatment of Acute Lung Injury [PETAL] Network.** Beth Israel stands apart as the only anesthesia-based center within the PETAL Network. Our group works with the PETAL Steering Committee at large to design and execute clinical trials to improve outcomes for very ill and at-risk patients across the U.S. As a clinical center, we oversee six enrolling sites, each with harmonized critical care and emergency medicine research teams. (Team: Talmor, Shapiro, Banner-Goodspeed, Sarge, Bose.)

- **ROSE: Do patients with severe Acute Respiratory Distress Syndrome (ARDS) benefit from early administration of neuromuscular blockade agents (NMBA), or do they fare better with avoidance of NMBA and a lighter sedation strategy?** This multicenter trial, completed in 2018, was published in the *New England Journal of Medicine* in 2019. Our team also contributed to several ancillary studies, including **PETE ROSE**, a qualitative project analyzing provider attitudes toward use or avoidance of NMBA, and



**RED ROSE**, a physiologic project measuring breath stacking dys-synchrony and true tidal volume delivered to patients enrolled in ROSE.

- **VIOLET: Does administering a single high dose of Vitamin D in high risk, vitamin-D deficient patients improve mortality at 90 days and reduce lung injury during the hospital stay?** This large, placebo-controlled, blinded, multicenter study was completed in 2018 and results will be published in the coming year. The trial design was supported with early pilot work, **VIOLET POCT**, evaluating appropriate point-of-care devices to measure vitamin-D levels rapidly in the emergency room setting. As part of the ancillary project, **VIOLET BUD**, patients are followed beyond their hospital stay to evaluate long-term cognitive impairment in patients who survived their illness.
- **CLOVERS: For patients in septic shock, is it better to maximize fluids or to administer vasopres-**

**sors in the first 24 hours?** This study is ongoing and has generated considerable interest in the scientific community. An ancillary project, **CLOVERS STEM**, aims to understand the cardiovascular mechanisms in early sepsis resuscitation obtaining global longitudinal strain data, a measure of cardiac contractility, via non-invasive echocardiograms. A network-wide project, **SHAM-ROC**, follows patients in the post-discharge period to measure the effect of the resuscitation strategy used on cognitive impairment and disability.

**DAMP-Mediated Innate Immune Failure and Pneumonia after Trauma – the Harvard-Longwood (HALO) campus area consortium:**

The innate immune response plays a pivotal role in the development and progression of lung inflammation. Our group is part of an exciting translational project in collaboration with the Department of Surgery at BIDMC, the Department of Surgery at Brigham and Women’s

Hospital, and the Departments of Biology and Biological Engineering at Massachusetts Institute of Technology. Funded by the Department of Defense, this consortium is conducting sequential and overlapping studies *in vitro* and *in vivo* to address the **role that danger signaling from danger-associated molecular patterns (DAMPs)** derived from somatic tissue injuries **plays in altering innate immune signaling in the lung** in ways that predispose patients to pneumonia. (Team: Talmor, Shaefi, Banner-Goodspeed, Mueller.)

**Use of inhaled anesthetics to prevent lung injury.** Volatile anesthetics have been shown to both prevent and minimize the extent of inflammatory lung injury in multiple preclinical models of ARDS, ventilator induced lung injury, endotoxin exposure, and pulmonary ischemia-reperfusion injury. Our recently completed single-center study looked at postoperative pulmonary complications in a cohort of patients undergoing cardio-pulmo-



Beitler JR, Sarge T, Banner-Goodspeed VM, Gong MN, Cook D, Novack V, Loring SH, Talmor D, for the EPVent-2 Study Group. Effect of Titrating Positive End-Expiratory Pressure (PEEP) with an Esophageal Pressure-Guided Strategy vs. an Empirical High PEEP-FiO2 Strategy on Death and Days Free from Mechanical Ventilation Among Patients with Acute Respiratory Distress Syndrome: A Randomized Clinical Trial. *JAMA* 2019; 321(9):846–857. PMID: 30776290



Acute Respiratory Distress Syndrome (ARDS) is a serious, often life-threatening condition affecting about 200,000 Americans a year. There is no commonly accepted treatment for ARDS, and most clinical management strategies focus on adjusting mechanical ventilator setting to minimize further injury to the lungs. An ideal positive end-expiratory pressure (PEEP) strategy for ARDS should be sufficiently high to keep open collapsible lung units while low enough to avoid over-distension. Adjusting PEEP to offset pleural pressure, estimated via using esophageal manometry, could help balance this benefit/risk and improve patient outcomes. This multicenter study was funded by NIH and enrolled 202 patients at 14 centers across the U.S. and Canada. We found that in patients with moderate-to-severe ARDS, PES-guided PEEP did not lower mortality or morbidity compared to empiric high PEEP-FiO2 titration but did reduce utilization of rescue therapies. Additional trials are needed to determine whether individualized PEEP-titration is beneficial for specific sub-groups of patients.

nary bypass during cardiac surgery assigned to receive either inhaled anesthetic or total intravenous anesthetic regimen for their surgery. We hope to further explore the lung-protective potential of volatile anesthetics in critically ill patients at increased risk for ventilator-induced lung injury. (Team: O’Gara, Talmor, Mueller.)

### Leveraging Respiratory Mechanics To Improve Outcomes

Our group looks closely at the respiratory physiology underlying lung injury and response to treatment. (Team: Talmor, Loring, Baedorf Kassis, Banner-Goodspeed, Sarge.)

- **EPVent2: esophageal-pressure guided PEEP titration compared to an empiric high-PEEP strategy for management of ARDS** was recently published in the *Journal of the American Medical Association* (see side bar). This multi-center randomized clinical trial found that both approaches lead to equivalent mortality rates and time off the ventilator for patients with ARDS. This project yielded a rich dataset of respiratory physiology recordings during the first seven days of mechanical ventilation in ARDS patients. We are using the data for a variety of secondary investigations to better understand how ventilator management can exacerbate or attenuate ventilator-induced lung injury. The biological specimens collected from trial participants are undergoing single- and multi-plex analyses to generate mechanistic data related to ARDS patient response to variations in ventilator strategies.

- **Comparison of two different techniques of establishing a “best PEEP” using physiologic data.** We are comparing the use of pressure-volume curves using PEEP to optimize compliance to the use of esophageal manometry, which can be utilized by adjusting PEEP to maintain positive end-expiratory transpulmonary pressures, limiting derecruitment and atelectrauma. This comparison will allow a more nuanced understanding of PEEP and how setting this pressure changes pulmonary mechanics and provides insight into the basic physiology of sick lungs.
- **Investigation of mechanical ventilator dyssynchrony during the early phase of ARDS and acute hypoxic respiratory failure.** The goals of the project include describing the incidence of several kinds of ventilator dyssynchronies and analyzing corresponding changes in respiratory physiology parameters. Ultimately, we hope to associate the incidence of ventilator dyssynchrony during the early phase of ARDS and acute hypoxic respiratory failure with outcomes and understand the relationship between sedation levels and regimens and the different types of dyssynchronies.
- **Evaluation of adaptive support ventilation compared to standard-of-care lung protective ventilation settings in patients with ARDS.** This single-center study compares respiratory physiology parameters (i.e., tidal volumes, driving pressure, respiratory rate, compliance, peak air-



### Grants

#### Federal

NIH/NHLBI “Clinical Centers (CC) for the NHLBI Prevention and Early Treatment of Acute Lung Injury Network” (Talmor, PI)

NIH /NHLBI “EPVent 2: a phase II study of mechanical ventilation directed by transpulmonary pressures” (Talmor, PI)

DoD/US ARMY “DAMP-Mediated Innate Immune Failure and Pneumonia after Trauma” (Talmor, project PI)

NIH / NHLBI “Understanding Response Shift in Acute Respiratory Distress Syndrome (ARDS) Survivors” (Bose, site PI)

NIH / NHLBI “Study of Treatments Echocardiographic Mechanisms (CLOVERS-STEM)” (Bose, site PI)

DoD/US ARMY “Addressing Post Intensive Care Syndrome (PICS) among Survivors of Acute Lung Injury” (Bose, site PI)

#### Foundation

FAER “Anesthetics to Prevent Lung Injury in Cardiac Surgery” (O’Gara)

FAER “The Relationship Between Administered Oxygen Levels And Arterial Partial Oxygen Pressure To Neurocognition In Cardiac Surgical Patients” (Shaefi)

BIDMC Chief Academic Officer Award. “The Relationship Between Administered Oxygen Levels And Arterial Partial Oxygen Pressure To Neurocognition In Cardiac Surgical Patients” (Shaefi)

#### Philanthropy

Hamilton Medical



way pressures, plateau pressures, PEEP) with each ventilator technique, and measures esophageal pressures to compare transpulmonary and respiratory system mechanics.

### Improving Long-Term Outcomes After Critical Illness

The field of critical illness research has been expanded in recent years to look beyond immediate in-hospital outcomes to longer-term recovery and patient-centered outcomes.

**Addressing Post-Intensive Care Syndrome** is a multicenter, prospective, observational study of survivors of acute respiratory failure (ARF) who are expected to be discharged home alive. Funded by the Department of Defense, this project examines the relationship between unmet needs after hospital discharge and patient-centered clinical outcomes. This study is augmented by two ancillary projects gathering data on patient experience and expectation: the **Observational Study of Expected ARF Recovery** looks at patients' expectations for recovery compared with their functional status and quality of life six months after discharge. In **Establishing a Hierarchy of Preferred Outcomes Following ARF Among Survivors and Caregivers**, we interview patients and caregivers to understand which domains of recovery are most important at set intervals after their critical illness. Team: Bose, Banner-Goodspeed.

### Epidemiology of Critical Care

Our group contributes to multiple nationwide and international investigations of ICU care delivery.

This work serves to better quantify existing processes, identify areas for improvement, and provide benchmark settings against which to measure the impact of research interventions. (Team: Talmor, Banner-Goodspeed, Baedorf Kassiss.)

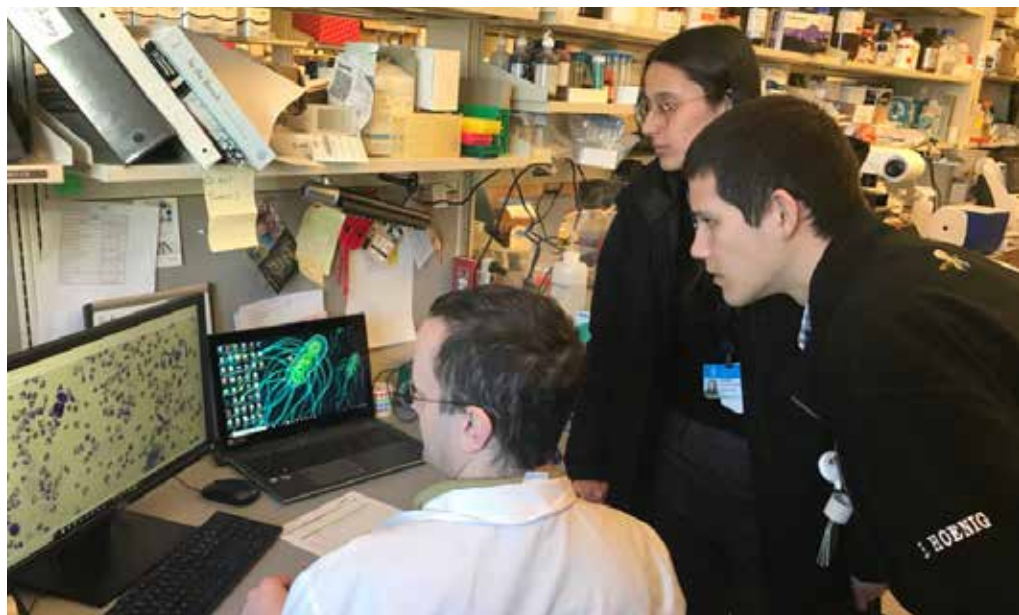
- **WEAN SAFE:** in a follow-up to the widely-cited LUNG SAFE study, this international epidemiologic survey prospectively captures mechanically ventilated patients to gather information on the **natural history and clinical decision making surrounding ventilator weaning**. This project completed in 2018; results are expected in the coming year.
- **SAGE:** This multi-center project assessed **early management of severe ARDS**, including ventilator management and use of rescue therapy, at 32 US hospitals. The goal of the study is to generate information about the patient-level factors associated with the variability in management of patients with severe ARDS, predictors of use of adjuvant

therapy, and variability in ventilator management of patients on extracorporeal membrane oxygenation. Findings from this multi-center U.S. observational study are being used to inform future interventional trial development.

- **LOTUS FRUIT:** Utilizing the PETAL network infrastructure, this observational study of mechanically ventilated patients in respiratory failure assessed institutional compliance with current lung-protective ventilator strategy recommendations. The findings were published in the *Annals of the American Thoracic Society*.

### Future Directions

Looking ahead, we continue to use the data from our hypothesis-generating work to inform interventional trials to improve outcomes for our critically ill patients. Our rapid small studies and large collaborative projects lead to innovative and impactful research of pressing clinical problems.





**Education**

**Faculty Affairs**

**Quality, Safety, Innovation  
and Information Technology**





**Stephanie B. Jones, MD**

Vice Chair, Education

Associate Professor of Anaesthesia

“As I enter my 16th year at BIDMC, I am truly awed by the transformation of the Education Division. Always an excellent clinical training program for our own residents and fellows, we are now improving anesthesia education on a national scale. It is truly a pleasure to work with such a talented group!”

## Education

Our educational mission is to develop leaders in our profession through excellent clinical experience, strong mentorship, innovative teaching curricula, and a flexible program of unique offerings that can be adapted to meet each learner’s needs. This is accomplished via a relentless pursuit of excellence through continuous quality improvement and creativity grounded in sound educational theory and evidence. In recognition of our success, our core residency program and Cardiac, Pain Management, Obstetric, and Critical Care Fellowships all hold the maximum 10-year cycle under the ACGME Next Accreditation System. Dr. Ruma Bose is now Program Director for our highly competitive Cardiac Fellowship program (100 applications for three positions), replacing Dr. Shazad Shaefi following his years of excellent service. Exemplifying the multidis-

ciplinary nature of the subspecialty, Critical Care has started accepting emergency medicine (EM) resident applications for fellowship through the ABA-approved pathway for EM-ACCM fellows. A new one-week blood bank rotation has been very well received by our OB anesthesia fellows. A two-week cardiology rotation to receive early training on transthoracic echocardiography has also been added. Our first Structural Heart Fellow will start in the Fall of 2019.

Our other non-ACGME fellowships continue to thrive as well. The Neuroanesthesia Fellowship is led by Dr. Richard Pollard; Dr. Ala Nozari leads Neurocritical Care (accredited by the United Council for Neurologic Specialties), and Dr. Galina Korsunsky has taken over the Regional Anesthesia Fellowship. The addition of the New England Baptist Hospital to our network will

## team

### Core Residency Leadership

**John D. Mitchell, MD**  
*Program Director, Anesthesia Residency*  
 Associate Professor of Anaesthesia

**Cindy M. Ku, MD**  
*Associate Program Director, Anesthesia Residency*  
 Instructor in Anaesthesia

**Sara E. Neves, MD**  
*Associate Program Director, Anesthesia Residency*  
 Instructor in Anaesthesia

### Categorical Internship

**Scott D. Zimmer, MD**  
*Director, Categorical Internship Director, Wellness and Mentoring*  
 Instructor in Anaesthesia

### Medical Student Clerkship

**Justin K. Stiles, MD**  
*Director, Medical Student Education*  
 Instructor in Anaesthesia

**M. Leo Tsay, MD**  
*Director, Non-Anesthesia Trainees*  
 Instructor in Anaesthesia

### Fellowship Leadership

**CARDIAC**  
**Ruma R. Bose, MD, MBBS**  
*Program Director, Adult Cardiothoracic Fellowship*  
 Assistant Professor of Anaesthesia

**NEURO**  
**Lauren K. Buhl, MD, PhD**  
 Instructor in Anaesthesia

**Ala Nozari, MD, PhD**  
*Program Director, Neurocritical Care Fellowship*  
 Associate Professor of Anaesthesia

**Richard J. Pollard, MD**  
*Director, Neuroanesthesia Fellowship*  
 Assistant Professor of Anaesthesia

**OB**  
**Philip E. Hess, MD**  
*Director, Obstetrical Anesthesia Program Director, Obstetrical Anesthesia Fellowship*  
 Associate Professor of Anaesthesia

**Yunping Li, MD**  
*Associate Program Director, Obstetrical Anesthesia Fellowship*  
 Assistant Professor of Anaesthesia

**REGIONAL**  
**Galina V. Korsunsky, MD**  
*Program Director, Regional Anesthesia Fellowship*  
 Instructor in Anaesthesia



### THORACIC

**John B. Pawlowski, MD, PhD**  
 Assistant Professor of Anaesthesia

**Sapna Govindan, MD**  
 Instructor in Anaesthesia

**VASCULAR**  
**Robina Matyal, MD**  
*Leonard Bushnell Chair of Anaesthesia at BIDMC*  
 Associate Professor of Anaesthesia

**GENERAL**  
**Haobo Ma, MD, MS**  
 Instructor in Anaesthesia

**Daniel P. Walsh, MD**  
 Instructor in Anaesthesia

**Simon X. Zhang, MD**  
 Instructor in Anaesthesia

### PAIN

**Paragi H. Rana, MD**  
*Program Director, Pain Medicine Fellowship*  
 Instructor in Anaesthesia

**ICU**  
**Ameeka Pannu, MD**  
*Associate Program Director, Anesthesia Critical Care Fellowship*  
 Instructor in Anaesthesia

**Shahzad Shaefi, MD, MPH**  
*Program Director, Anesthesia Critical Care Fellowship*  
 Assistant Professor of Anaesthesia

### RESEARCH

**Brian P. O'Gara, MD, MPH**  
*Resident Program Director, CARE*  
 Instructor in Anaesthesia

**Balachundhar Subramaniam, MD, MPH**  
*Director, Center for Anesthesia Research Excellence*  
 Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC  
 Associate Professor of Anaesthesia

**QUALITY**  
**Cullen D. Jackson, PhD**  
*Director, QSI*  
 Instructor in Anaesthesia

**Satya Krishna Ramachandran, MD**  
*Program Director, Perioperative Quality and Safety Fellowship*  
 Associate Professor of Anaesthesia

provide an excellent opportunity for expanding regional anesthesia training. A brand new fellowship offering is the two year Perioperative Quality and Safety Fellowship, led by Dr. S. Krish Ramachandran. In addition to clinical and project work at BIDMC, the fellow will obtain a Master's Degree of Healthcare Quality and Safety from Harvard Medical School. Our first pair of resident Loring Scholars will soon be completing their CA1 (PGY2) year. This integrated

program, which pairs each scholar with an individual mentor, includes 18 months of research over five years of training. Our goal is to develop the next generation of anesthesiologist investigators.

Elsewhere in the education continuum, Dr. Justin Stiles continues in the challenging role of Director of Medical Student Education. Pinpointing the learning needs of everyone from beginning second-year clerks to highly motivated vis-

iting senior students "auditioning" for residency requires an uncommon degree of flexibility and enthusiasm. Dr. Scott Zimmer directs our categorical internship program, which has increased in size to 12 positions and is highly sought after by applicants. The internship now includes a pain medicine month that offers early exposure to this anesthesia subspecialty and a chance for interns interested in pain to build mentorship opportunities. The ICU rotations are now



completely contained at BIDMC, allowing the interns to foster relationships with our critical care staff as well as senior anesthesia colleagues. The interns have begun rotating to Mount Auburn Hospital as well, and we plan to expand this experience to a senior anesthesia elective rotation. The anesthesia education month has been broadened dramatically. The curriculum now includes introductions to the basics of anesthesia, obstetric anesthesia, critical care, and regional anesthesia in addition to TEE and TTE, with an overall emphasis on procedural learning and common clinical scenarios.

The Division of Quality, Safety, Innovation and Information Technology facilitates a week-long program focusing on how anesthesiologists can take the lead on projects that improve the culture of safety within the hospital and remedy underlying systems issues that contribute to adverse outcomes. This program introduces the principles of root cause analy-

sis and action (RCA<sup>2</sup>) using clinical examples that have been previously discussed and presented by our safety committee. The RCA<sup>2</sup> curriculum continues longitudinally into the residency program, where small groups of residents complete RCA<sup>2</sup> projects with the guidance of trained faculty, led by our newest Associate Program Director, Dr. Sara Neves.

### Strategic Plan

Much of the past two years has been devoted to creation of a department-wide strategic plan. Education is one important pillar, with goals and objectives emphasizing the creation of an education research pipeline, optimizing the learning environment for all levels and types of learner, and utilization of a competency-based learning model. Central to this effort is our Education Lab. This innovative space on Rabb 2 houses a variety of task trainers, multiple computer stations, a projection screen, and a huddle room. A variety of work-

shops are held there, and learners are encouraged to utilize the lab for just-in-time procedural learning. Education leads from each division have been identified and will integrate the lab as well as online resources into their rotation curricula.

We are well on our way to fostering our next generation of education researchers with Dr. Lauren Buhl and Dr. Haobo Ma, both awarded Harvard Medical School Medical Education Research Fellowships. Dr. Ma's project is entitled "Incorporating Video-Based Feedback to Enhance Fiberoptic Intubation Teaching," while Dr. Buhl is working on a "choose-your-own-adventure" style curriculum on neuroanesthesia for medical students.

Near-term goals include expanding recognition of educators via departmental awards and acquisition of a new learning management system to better organize the myriad of learning materials and assessment tools.

### National and International

Our national reputation as preeminent educators continues to grow. Dr. Stephanie Jones is President-elect, and Dr. John Mitchell is Secretary, for the Society for Education in Anesthesia (SEA). Dr. Cindy Ku chairs the SEA Committee on Resident Education. Drs. Jones, Mitchell, Sugantha Sundar, Shazad Shaefi, and Robert Leckie continue in their role as ABA APPLIED Board Examiners. Drs. Mitchell, Jones, and Robina Matyal sit on the ABA OSCE committee, where Dr.



Mitchell oversees the “interpretation of echocardiograms” section. We continue our partnership with the Anesthesia Toolbox and its peer-reviewed curricular offerings. Dr. John Mitchell sits on the steering committee and directs the cardiovascular content. Several faculty and trainees have contributed modules to this peer-reviewed online resource. Dr. Mitchell is also a member of the SAAAPM Board and part of the Interhospital Study Group writing questions for the AKT exam. Dr. Jones is the Editor-in-Chief of UpToDate Anesthesiology and International Anesthesiology Clinics, and utilizes these positions as a means to sponsor junior faculty authors and promote diversity. She was recently named co-editor for the eighth edition of *Stoeltzing’s Anesthesia and Co-Existing Disease*.

The education division has a significant presence presenting on education and other topics at national meetings, including the ASA, SEA, SCA, and others. Dr. Sugantha Sundar directs the Harvard Anesthesiology Update each spring, an immense CME undertaking with a large number of our faculty contributing lectures. In addition, our department runs the wildly popular Regional Anesthesia Workshop during the Update. We continue to provide Maintenance of Certification in Anesthesiology (MOCA) courses in the BIDMC simulation center on a regular basis, as well as our long-running Evaluating and Treating Pain course and several echocardiography and peri-operative ultrasound offerings by



our nationally renowned experts.

### Awards

BIDMC residents and fellows continue to garner awards locally and nationally. Dr. Priya Ramaswamy placed first in the 2018 STA Engineering Challenge for “Use of Blockchain for Difficult Airway Assessment” Dr. Mark Jones won the Best of Meeting Resident Abstract Award at the 2018 SAMBA meeting as well as the 2017 ASRA Resident/Fellow Research Award. Cardiac anesthesia fellow Dr. Andaleeb Ahmed was the recipient of the SCA Early Career Investigator Award 2019 for his paper “Impact of Left Ventricular Outflow Tract Flow Acceleration on Aortic Valve Area Calculation in Patients with Aortic Stenosis.” 2018 Excellence in Education awards were granted to four graduating residents. As part of our resident-as-teacher track, residents receiving this award must commit time and energy to demonstrating expertise in teaching and education theory across a range of environments and situations. This year we were proud to recognize Drs. Kiran Belani, Eric Buell, Merry Colella,

and Bijan Teja. We look forward to watching their future careers as anesthesia educators develop.

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## Anesthesia Education

### Number of Trainees

**12** Interns  
**54** Residents  
**21** Fellows

### Percent of Residents Who Entered a Fellowship

**63%** 2018  
**69%** 2019

### Percent academic vs. private

#### Class of 2019

**31%** Non-Academic Practice  
**69%** Fellowship

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#### Class of 2018

Upon graduation in 2018

**13%** Academic Practice  
**25%** Non-Academic Practice  
**63%** Fellowship

Upon completion of Fellowship in 2019

**44%** Academic Practice  
**44%** Non-Academic Practice  
**13%** Fellowship

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On the global health front, Dr. William (Frankie) Powell was awarded a highly competitive ASA Global Health Scholarship, and Dr. Hebah Ismail received an SEA-HVO scholarship. Our rotations in Botswana and China continue to develop.

Drs. Neves and Shaefi were selected to participate in the BIDMC Physician Leadership Program. This is a 12-month program, first established in 2012, geared toward early to mid-career physicians who are in a leadership role at Beth Israel Deaconess Medical Center.

### Research

Drs. Robina Matyal and Feroze Mahmood continue to position us at the forefront of **perioperative ultrasound education**. Research in point-of-care ultrasound (POCUS) and echocardiography education is robust and moving in exciting new directions. In 2018, we published our experiences developing and implementing an OSCE exam to measure workflow proficiency,

a critical element of successful implementation of POCUS. We also reported on our initial experiences adding augmented reality headsets to simulator-based teaching of echocardiography. We trained surgical interns and residents in addition to anesthesia and cardiology trainees and reported our initial efforts with this new group of learners. We completed our initial efforts in faculty and CRNA ultrasound training with publications accepted for 2019 in both of these areas. Adapting our teaching and testing methodologies to encompass a variety of learner types demonstrates the versatility of our training approaches and has taught us some important lessons about training learners from different backgrounds that we will apply in future courses.

Dr. Jones continued her NIH-supported work with engineers from Rensselaer Polytechnic Institute on a **virtual airway skills trainer** (VAST). The major goal of

this project is to develop a virtual airway model to teach direct laryngoscopy and cricothyroidotomy, with particular attention to the difficult airway. Multiple members of the department, including residents, CRNAs, and faculty, have been instrumental in providing feedback on device prototypes and assisting with the development of the assessment metric that will eventually be incorporated into the simulator.

Drs. Cindy Ku and Cullen Jackson continue to lead efforts investigating **innovative training methods for improving anesthesia technical and non-technical skills**. Over the past four years, they have led a project with resident and staff partners to determine if wearable sensors can be used to assess technical expertise during direct laryngoscopy. Working with Northeastern University, they have differentiated novice from expert performance on airway simulators, and they are currently

collecting data in the ORs to see if these results are replicable at the bedside. The ultimate goal of this research is to develop a system to provide granular feedback on the procedure to the learner in the clinical setting. In 2015, Dr. Jackson developed a course curriculum for teaching teamwork to

our interns and residents using an off-the-shelf collaborative board game that expanded into a set of workshops conducted at the SEA and ASA annual conferences. In 2019, we used an expanded version of the workshop with high school students as part of our community outreach program. Dr. Ku



CME Course Listing July 2017–June 2019		
CME Course	Date	Directors
Anesthesia Grand Rounds	July 1 – December 31, 2017	Alan Lisbon, MD
Maintenance of Certification in Anesthesiology (MOCA)	July 1 – December 31, 2017	John Pawlowski, MD, PhD
Three-Dimensional (TEE) Workshop	August 26-27, 2017	Feroze Mahmood, MD
Anesthesia Grand Rounds	January 1 – December 31, 2018	Matthias Eikermann, MD, PhD
Maintenance of Certification in Anesthesiology (MOCA)	January 1 – December 31, 2018	John B. Pawlowski, MD, PhD
Three-Dimensional (TEE) Workshop	March 10-11, 2018	Feroze Mahmood, MD
Ultrasonography for Intensivists and Emergency Medicine Clinicians:	April 27-28, 2018	Todd W. Sarge, MD Akiva Leibowitz, MD Achikam Oren-Grinberg, MD, MS
Harvard Anesthesiology Update	May 9-13, 2016	Sugantha Sundar, MBBS
Evaluating and Treating Pain	June 25-29, 2018	Carol A. Warfield, MD R. Joshua Wootton, PhD Thomas T. Simopoulos, MD
Three-Dimensional (TEE) Workshop	August 25-26, 2018	Feroze Mahmood, MD
Three-Dimensional (TEE) Workshop	November 10-11, 2018	Feroze Mahmood, MD
Anesthesia Grand Rounds	January 1 – June 30, 2019	Matthias Eikermann, MD, PhD
Maintenance of Certification in Anesthesiology (MOCA)	January 1 – June 30, 2019	John B. Pawlowski, MD, PhD
Harvard Anesthesiology Update	May 13-17, 2019	Sugantha Sundar, MBBS
Evaluating and Treating Pain	June 24-28, 2019	Carol A. Warfield, MD R. Joshua Wootton, PhD Thomas T. Simopoulos, MD





extended this work into an ongoing project (initially funded by a SEAd grant) to determine if this type of game-based training is as effective at teaching teamwork and communication skills as traditional simulation-based team training. Dr. Jackson recently presented the results of this work as a poster at the 2019 IARS Annual Meeting in Montreal.

We also thank our talented administrative staff: Fondo Bokembya, Mary Jane Cahill, Kimberley Brown, Ron Mayes, Taneshia Piña, and Vanessa Wong. Without their unfailing support of the education mission, we would not be able to accomplish all that we have over the last two years.

### Anesthesia Resident Research

In partnership with the Center for Anesthesia Research Excellence, the BIDMC Anesthesia Resident Research Program provides a robust opportunity for residents to participate in research, either by taking dedicated research electives to complete their project or by joining an existing project as a co-investigator alongside their clinical responsibilities. Dr. Brian O’Gara continues to guide our resident research efforts with the able

assistance of Ariel Mueller and CARE, approving and coordinating research rotations and acting as a personal mentor for many. In the last year, the Resident Research Program granted elective research time to six residents. Projects this year were heavily focused on pain research, but also included studies of innovative technology and tools to predict surgical outcomes:

- **Thoracolumbar Injury Classification and Severity Score (TLICS) in the Management of Osteoporotic Compression Fractures** (Vwaire Orhurhu, MD MPH; Mentors Jatinder Gill, MD and Matthias Eikermann, MD PhD)
- Retrospective cohort study to analyze **long-term outcomes of an epidural blood patch** (Ivan Urits, MD; Vwaire Orhurhu, MD MPH; Emily Bouley, MD; Mentors Viet Cai, MD and Jatinder Gill, MD)
- **High-Frequency Spinal Cord**

**Stimulation (HF-SCS) at 10 kHz as Salvage Therapy for Unsuccessful Traditional Spinal Cord Stimulator Trials and Implants** (Priyanka Ghosh, MD; Mentor Thomas Simopoulos, MD)

- **Analysis of Opioid-Related Adverse Drug Events Following Spine Surgery** Using a National Administrative Database (Mark Jones, MD; Mentor Richard Urman, MD)
- **Machine Learning for ASA Classification** (Priya Ramaswamy, MD; Mentors John Pearson, MD and Matthias Eikermann, MD PhD)
- **Virtual Reality in the Operating Room: Using Immersive Relaxation as an Adjunct to Anesthesia** (Adeel Faruki, MD; Mentor Brian O’Gara, MD, MPH)

Program participants this year presented their work at local conferences, including the BIDMC Research Night and the New England Anesthesia Resident Conference (NEARC), as well as national specialty conferences such as the Society for Technology in Anesthesia (STA), American Society of Interventional Pain Physicians (ASIPP), North American Neuromodulation Society (NANS), and Society for Ambulatory Anesthesia (SAMBA).









## Global Health

Our global health program provides unique learning experiences both to our own trainees and to anesthesia and critical care clinicians in other countries. It is based on a commitment to use teaching and learning to help spread access to the type of excellent anesthesia care we provide to our patients at BIDMC to other parts of the world. We build collaborations and partnerships that not only provide superb training but also assist local clinicians in the countries we visit to develop and improve their own systems to care. At the same time, our faculty and trainees gain enormous benefit from these experiences. They learn different cultural perspectives on medical care, gain valuable clinical skills, and form new, sometimes lasting relationships with colleagues at our global teaching sites. Our residents have the opportunity to do anesthesia and critical care rotations and quality improvement work in Botswana. In our thriving China program at Peking Union Medical College Hospital, they can do



rotations in one of China's best hospitals or join an OB anesthesia program that helps Chinese anesthetists learn when and how to use epidural anes-

thesia to ease women's pain during labor and delivery. Recently, some of our gifted faculty members helped design and teach in an ultrasound course in the Middle East that brought Palestinian and Israeli physicians together for shared learning. Liberian nurse anesthetists visit our ORs to gain skills and knowledge critically needed in their country, and we have hosted visits by physicians from Singapore, China, India, England, and Sweden to observe the cutting-edge work we do in our ORs and ICUs.

### Botswana



#### Building capacity for anesthesia and critical care in Botswana

Our Botswana-BIDMC residency program is centered at Scottish Livingston Hospital (SLH), a 350-bed government hospital in Molepolole, Botswana. Dr. Edward Clune, who is based in Botswana 10 months per year, serves as both the BIDMC Program Director and Chief of Anesthesia at SLH. With the help of rotating trainees from BIDMC and other institutions, Dr. Clune has brought structure and resources to the hospital's operating rooms and ICU. They have collaborated with local Botswana clinicians to create protocols and diversify the

case mix to expand care and provide a better training experience. As a member of the SLH faculty, Dr. Clune is expanding educational efforts to train local residents and recruit medical staff, and plans to start the first nursing anesthesia program in the country. The program's quality improvement efforts are targeted and ongoing. They have brought equipment to the ERs, including ventilators, intubation, central lines, monitoring, and ultrasound, and are planning to bring acute peritoneal dialysis to the hospital so they can stabilize patients on site. Along with U.S. collaborators Drs. John Tarpley, MD, from Vanderbilt, Rebecca Lockett from BIDMC OB/GYN, and Tomer Barak from BIDMC Medicine, Dr. Clune has piloted tools and started data collection to get a national surgical and anesthesia program up and running.

*"I love working and learning from the practitioners here who have developed their knowledge and skills, often without many of the tools that we have at our disposal back home."*

-Ed Clune, MD

### Israel and Palestine



#### BIDMC anesthesiologists co-lead ultrasound course that unites Israeli and Palestinian physicians

BIDMC anesthesiologists Akiva Leibowitz, MD, Achi Oren-Grinberg, MD, and Marc Shnider, MD co-directed and taught in an ultrasound training course in Beer-Sheva, Israel, on November 28-29, 2017, that brought together Israeli and Palestinian physicians for shared learning. The Palestinian physicians, who came from areas in the Palestinian Authority, were able to attend the course free of charge thanks to several grants, one from the European Union and the Second from the Israeli Ministry of Foreign Affairs, in addition to support from BIDMC's Department of Anesthesia, Criti-

*(Continued on page 97)*

## Liberia



### BIDMC Helps Build Anesthesia Care in Liberia through nurse anesthetist training

The BIDMC Advanced Nurse Anesthesia Program has a partnership with Northeastern University's Bouve School of Nursing and Boston Children's Hospital. Each year BIDMC sponsors one to three Liberian CRNA faculty

from Phebe School of Nursing in Liberia for rotations and advanced training in anesthesia care. The program, run by Eileen Stuart Shor, PhD, ANP-BC, a nurse practitioner in BIDMC PAT, and Alan Lisbon, MD, provides training in clinical pathways, best anesthesia practices, and managing difficult airways for these nurses who have so little in the way of clinical resources to work with in their country, where there is a severe shortage of anesthesia clinical staff. The Phebe nurses, who also rotate at Boston Children's Hospital and Northeastern University, spend two weeks in BIDMC ORs observing our culture of safety, teamwork, and patient-centered care. They are trained to run simulations in realistic clinical experiences and mock emergencies to enable clinicians in Liberia to respond quickly to life-threatening situations. The nurses trained in this program have made remarkable progress, including creation

of a competency-based nurse anesthesia curriculum, increased recruitment, and creation of an Anesthesia Learning Center at the school. Most importantly, the program has helped sow the seeds to create a sustainable model for anesthetic nursing training in Liberia.

***“Response from everyone who spent time with our Liberian guests was overwhelmingly positive and compassionate. Our clinicians and staff were deeply moved by their story of hardship and perseverance and left with a sense of commitment to take action to help rebuild the anesthesia clinician base that has been decimated over the past 50 years in Liberia.”***

-Eileen Stuart Shor, PhD, ANP-BC

cal Care and Pain Medicine and Ben-Gurion University. The event offered two sections, one on Ultrasonography for the Management of Shock and another on Ultrasound-Guided Regional Anesthesia. In addition to lectures, discussion, and hands-on learning, there was time between sessions for interaction among the participants. After the course, Drs. Leibowitz, Oren-Grinberg, and Shnider, joined by BIDMC anesthesiologists Scott Zimmer, MD, Dustin Boone, MD, and Musa Aner, MD, spent an additional day teaching the ultrasound sessions at BASR Hospital in Bethlehem and Al-Ahli Hospital in Hebron. The neuraxial anesthesia simulator used in the course created by BIDMC Anesthesiologists Dr. Robina Maytal and her laboratory team was donated to the Palestinian Society of Anesthesiology for future training.

***“This was a great opportunity to bring people together and provide tools and training useful for many different anesthesia practices that these clinicians encounter.”***

-Akiva Leibowitz, MD

## China



### Creating “No Pain Labor and Delivery” through better anesthesia for women in China

“No Pain Labor and Delivery – a Global Health Initiative” (NPLD-GHI) is a non-profit organization whose mission is to use teamwork and education to lower unnecessary caesarean deliveries in China and increase use of epidural anesthesia during labor. Dr. Yunping Li, Section Chief for Gynecological Anesthesia at BIDMC, brings several residents entering obstetric fellowships to a Chinese Hospital each year to run a one-week training program focused on making the labor and delivery anesthesia experience safer for women and babies. They conduct lectures and simulations and provide

training in emergency anesthesia in areas such as resuscitation and converting a labor epidural to a caesarean section quickly and safely. Chinese hospital sites have expanded use of epidural anesthesia, lowered caesarean rates, implemented shared guidelines, and updated their stocks of equipment. Dr. Li and her team provide information about pre-labor nutrition, initiate processes to improve maternal satisfaction, run open clinics for expecting mothers and fathers, and introduced the patient status board used at BIDMC that continuously monitors progress during labor. The focus is promoting teamwork in the hospitals to improve patient safety, emergency management, and outcomes.

***“Everything we do is aimed at keeping mom and baby safe during labor and delivery. They are learning in China that it is a woman's right to have safe options for pain relief in the delivery room. As a doctor, we should always strive to alleviate pain safely.”***

-Yunping Li, MD





**Matthias Eikermann, MD, PhD**  
Vice Chair, Faculty Affairs  
Professor of Anaesthesia

“Our goal is to have an impact on our people’s lives. We elevate the wellness of our colleagues and patients simultaneously.”

## Faculty Affairs

The Faculty Affairs Division contributes to professional workplace culture and environment by hiring, developing, and retaining the best anesthesia providers. We help improve our anesthesia providers’ performance and aim to provide personalized career opportunities for all clinical staff. Our staff include Harvard Medical Faculty Physicians (HMFP) at Beth Israel Deaconess Medical Center in Boston, BID–Milton, BID–Needham and Associated Physicians of Harvard Medical Faculty Physicians (APHMFP) at BID–Plymouth and Anna Jaques Hospitals, as well as certified registered nurse anesthetists (CRNAs).

These tasks cannot be conducted by the faculty affairs team alone – we work within the existing objectives of the Department’s Strategic Plan, illustrated by our “Strategy House,” whose pillars

(clinical excellence, research, and education) support our overarching goal of building and maintaining a world-class department. Faculty Affairs is part of the foundation of the Strategy House and the Department (see figure, right).

At BIDMC, BID–Plymouth, and Anna Jaques Hospitals, the Faculty Affairs Division provides:

- Faculty recruitment
- Hiring
- Credentialing

At BIDMC in Boston, BID–Milton, and BID–Needham, the Faculty Affairs Division provides:

- Faculty recruitment
- Hiring
- Credentialing
- Annual reviews and promotions at HMS
- Mentoring for junior faculty
- Performance appraisal and management

## team

### Administrative Team

**Susan H. Kilbride, BSN**  
*Manager, Faculty Development and Recruitment*

**Nora T. McCarthy, BA**  
*Project Administrator, Faculty Development and Recruitment*

**Letisha Phillips, BS**  
*Project Administrator, Credentialing, Privileging and Enrollment*

**Taneshia Pina, BA**  
*Administrative Coordinator for Education and Faculty Affairs*

### Faculty Affairs Advisory Committee

**Matthias Eikermann, MD, PhD**  
*Professor of Anaesthesia*

**Ruma R. Bose, MD, MBBS**  
*Assistant Professor of Anaesthesia*

**Ameeka Pannu, MD**  
*Instructor in Anaesthesia*

**Maximilian S. Schaefer, MD**  
*Visiting Scientist in Anaesthesia*

**Shahzad Shaefi, MD, MPH**  
*Assistant Professor of Anaesthesia*

**Scott D. Zimmer, MD**  
*Instructor in Anaesthesia*

**Patricia M. O'Connor, CRNA**  
*Chief Nurse Anesthetist*

**Dawn M. Ferrazza, MA**  
*Chief Administrative Officer*

**Susan H. Kilbride, BSN**  
*Manager, Faculty Development and Recruitment*

**Nora T. McCarthy**  
*Project Administrator, Faculty Development and Recruitment*

**Taneshia Pina, BA**  
*Administrative Coordinator for Education and Faculty Affairs*

### Promotions Committee

**Matthias Eikermann, MD, PhD**  
*(Committee Chair)*  
*Professor of Anaesthesia*

**Daniel S. Talmor, MD, MPH**  
*Edward Lowenstein Professor of Anaesthesia*

**Sheila R. Barnett, MBBS, BSc**  
*Associate Professor of Anaesthesia*

**Rami Burstein, PhD**  
*John Hedley-Whyte Professor of Anaesthesia*

**Simon C. Robson, MBChB, PhD**  
*Professor of Anaesthesia*  
*Charlotte F. & Irving W. Rabb Distinguished Professor of Medicine*

**Philip E. Hess, MD**  
*Associate Professor of Anaesthesia*

**Robina Matyal, MD**  
*Leonard Bushnell Chair of Anaesthesia at BIDMC*

**Shahzad Shaefi, MD, MPH**  
*Assistant Professor of Anaesthesia*

### Data Use Committee

**Matthias Eikermann, MD, PhD**  
*(Committee Co-Chair)*  
*Professor of Anaesthesia*

**David M. Feinstein, MD, MS**  
*(Committee Co-Chair)*  
*Assistant Professor of Anaesthesia*

**Aaron H. Banner-Goodspeed**  
*Project Manager, Finance and Administration*

**Robert A. Carlin, BS**  
*Senior Project Manager*

**Cullen D. Jackson, PhD**  
*Director, QSII*  
*Instructor in Anaesthesia*

**Haobo Ma, MD, MS**  
*Instructor in Anaesthesia*

**John D. Mitchell, MD**  
*Associate Professor of Anaesthesia*

**Ariel L. Mueller, MA**  
*Biostatistician II*

**Sarah Y. Nabel, MS**  
*Director, Anesthesia Information Technology*

**John F. Pearson, MD**  
*Instructor in Anaesthesia*

**Richard J. Pollard, MD**  
*Assistant Professor of Anaesthesia*

**Satya Krishna Ramachandran, MD**  
*Associate Professor of Anaesthesia*

**Stephanie Grabitz, MD**

**Peter Santer, MD**

**Richard A. Steinbrook, MD**  
*Associate Professor of Anaesthesia*

**Balachundhar Subramaniam, MD, MPH**  
*Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC*

**Associate Professor of Anaesthesia**

**Eswar Sundar, MBBS**  
*Assistant Professor of Anaesthesia*

**Xinling (Claire) Xu, PhD**  
*Biostatistician*

- Faculty development orchestration across strategic pillars
- Support for hospital activities via BIDMC Council for Career Development

### Activities

The Department of Anesthesia, Critical Care and Pain Medicine has grown in both size and complexity over the past three years, adding roughly 27 MDs and 15 CRNAs at over five sites, with large community site additions on the horizon. With the growth of the department, the need for structured faculty support and development has become more critical for the professional advancement and personal job satisfaction of our providers. The Faculty Affairs Division was created to address this need.

As a fledgling group, our primary goals from the past year include:

- Assess and prioritize faculty development needs across the department
- Develop a strategic plan for the Faculty Affairs group
- Help address current faculty work assignments and career advancement
- Orchestrate individualized career development plans across the strategic pillars of our department
- Form collaborations between departments that have a positive impact on a greater number of faculty

### Recruiting and On-boarding

Recruiting and on-boarding is one of the major areas that we have focused on, improving the



**Strategy House:** This graphic symbolizes our departmental strategic plan comprised of three strategic pillars—Education, Clinical and Research—and the foundation and supports to build a world-class department. The Faculty Affairs Division supports the vision and mission of the Department of Anesthesia, Critical Care and Pain Medicine.





experience with more outreach for interested candidates and a more in-depth orientation and onboarding process. Most recently, we have hired a recruiting specialist to help recruit CRNAs as well as physicians via HMFP and APHMFP. We have created a comprehensive set of onboarding materials for all new hires. There is a systematic two-week orientation period guided by an experienced faculty mentor. We have also started to create a process that streamlines onboarding across physician and nurse anesthesia providers.

### **Credentialing**

Our credentialing team functions in the background, working to steer our clinical staff through the increasingly complex world of credentialing both at BIDMC and at several of our community sites. The team completes initial credentialing and re-credentialing for new and existing staff in addition to hospital, site, and insurance appointments and re-appointments for all faculty members, CRNAs, and NPs. They also renew state and federal certification for controlled substances and BLS and ACLS certification; assist with visa applications and processing; complete Occupational Health

clearances, link payors; and more. In the past two years, the team has completed roughly 185 appointments and reappointments for new and existing faculty.

### **Mentoring**

Relationship building with staff and the support of senior leadership are critical to the success of our efforts with the mentoring program. We have primarily worked with executive leadership and incoming faculty to develop our current mentoring program and metrics. We started by surveying recent incoming faculty who did not have official mentors and found that the majority of responding faculty wanted the support and assistance of a mentor to help navigate BIDMC policy and culture. Close to half of the incoming faculty wanted long-term mentor/mentee relationships, lasting years and providing guidance on research, career planning, and academic promotions.

### **Data Use Committee**

The purpose of the IRB-approved data repository is to centrally combine patient data related to clinical research in the field of anesthesia, critical care, and pain medicine. By establishing a central repository

for the respective data under the governance of the Bioinformatics and Data Use Committee, the Department of Anesthesia, Critical Care and Pain Medicine aims to support researchers to utilize pre-combined and highly granular patient data and thus to enhance research projects.

The Faculty Affairs team, in collaboration with the Eikermann Laboratory, have created an electronic data repository derived from BIDMC databases to support different domains, clinical operations, quality, and safety. Drs. Eikermann and Feinstein lead the Departmental Data Use Committee, which oversees the IRB-approved data repository.

### **Promotion Committee**

As a teaching hospital, we partner with Harvard Medical School as a primary affiliate to offer academic appointments to our faculty, physician scientists, and research/clinical fellows. HMS employs an “academic ladder” appointment and promotion process, with clear requirements for physicians to move to a higher level (or ladder rung). The process is often lengthy and rigorous, and faculty members need guidance.

To improve the department’s process and the likelihood of advancement at HMS, we have reconvened and restructured the Anesthesia Academic Promotion Committee as part of Faculty Affairs’ mission to both develop and support the members of our faculty. We have created several pathways for staff

to enter the academic promotion pipeline. Staff may now approach a Promotions Committee Member, Division Director, or mentor with a request for a CV review and discussion. The HMS Anesthesia Executive Committee then reviews the request and approves, or returns with suggestions for improvement and typically a timeline of when to resubmit.

### Faculty Affairs Advisory Group

We recently started to build a Faculty Affairs Advisory Group to provide input on the strategic plan of the Faculty Affairs Committee for the next five years. Thus far, the group consists of Drs. Ameeka Panu, Ruma Bose (Fellowship Director Cardiac Anesthesia), Scott Zimmer (Director of the Wellness Committee), and Dawn Ferrazza (Chief Administrative Officer), along with the rest of the Faculty Affairs team. The committee is open to faculty members who want to support our mission.

### Anesthesia Leadership and Executive Operations Fellowship (ALEOF) Program

Starting in the fall of 2019 we will kick off our first year of the ALEOF program orchestrated by the Faculty Affairs team. Two successful candidates have just been selected to participate in this fellowship program.

ALEOF is a one-year fellowship program that offers a pathway for interested and experienced clinicians to work alongside the department's executive leaders to develop/implement a high-impact project that

supports the department's strategic plan. The mentors from the executive team will advise the ALEOF fellows in the development and implementation of their project.

These projects provide experience in specified areas across the departmental strategic pillars, which are defined as:

- Clinical operations
- Education
- Research
- Faculty Affairs
- QSI
- Administration

We are also partnering with Beth Israel Deaconess Medical Center to offer our leadership fellows a spot in the Physician Leadership Program (PLP). This is a 12-month program for early to mid-career physicians who are in a leadership role at BIDMC, BID-Milton, BID-Needham, BID-Plymouth, or BID HealthCare. In the last seven years, 74 physicians, representing 17 different departments, have participated in PLP and feedback has been extremely positive.

The successful candidates for the first year 2019-2020 are Dr. Soumya Mahapatra (who will work with Drs. Eswar Sundar and Sheila Barnett on a GI Anesthesia project) and Dr. Leo Tsay (who will work with Drs. Adam Lerner, Ala Nozari, and Dawn Ferrazza, on an OR scheduling project).

### Wellness

We all spend many hours at work, and we are exposed to stressful and challenging situations on a weekly

basis that make us vulnerable. The Faculty Affairs team oversees the Wellness Committee, and Dr. Scott Zimmer has just been appointed its new Director. Dr. Zimmer's goal is to improve specific working conditions that can be realistically modified to make a tangible difference. The committee promotes social events that are felt and experienced throughout the department and raise the morale of our workplace. One of the first initiatives started by Dr. Zimmer was to make free healthy snacks available during the late hours of the on-call shifts on both East and West campus. Dr. Zimmer and his team have selected this project since it is simple and can be instituted quickly and have an immediate impact for our colleagues who are hungry and tired in the middle of the night. Feedback from all members of our department has been positive, and ongoing input is crucial to the success of our wellness program.







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**Satya Krishna Ramachandran, MD**

Vice-Chair, Quality, Safety,  
and Innovation

Program Director, Perioperative Quality  
and Safety Fellowship

Associate Professor of Anaesthesia

“Anesthesia is a highly technical field that blends the science and art of medicine into the delivery of care in the perioperative setting. There is much to be done as we continue exploring and defining best practice through data analytics.”

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## Quality, Safety, Innovation and Information Technology

The Division of Quality, Safety, Innovation and Information Technology (QSII) supports the delivery of safe and efficient patient care through processes directed at the site, division, and individual levels. The four foundational arms of this division aim to create more effective ways to modify both human and system drivers of quality and safety.

### Clinical Quality

The QSII leadership group comprises site directors, quality leaders, and support staff who are actively engaged in developing and tracking both process and outcome metrics relevant to their constituencies. This group combines data from multiple local and organizational databases in order to link processes of care with outcomes that matter to our patients, department, and organization.

Specific cross-departmental issues that are identified through thresh-

old indicators are explored in depth through the Faculty Hour mechanism using multidisciplinary project teams. It is estimated that the combined efforts of these project teams continue to reduce hospital costs by several million dollars a year, while enhancing patient safety. Our project management team supports the clinical leadership in executing key interventions.

### Clinical Safety

Departmental safety systems continued to improve in 2018–2019. We now have a clear delineation of organizational quality and safety processes from individual peer review. QA methods focus on system-based approaches to enhance both quality and safety. This philosophy is evident in our new Morbidity and Mortality (M&M) structure and provides a standardized set of support tools to enhance both individual and organizational learning from

## team

**Cullen D. Jackson, PhD**  
Director, QSI  
Instructor in Anaesthesia

**Sarah Y. Nabel, MS**  
Director, Anesthesia Information  
Technology

**Richard J. Pollard, MD**  
Director, Quality Improvement  
Assistant Professor of Anaesthesia

**David M. Feinstein, MD, MS**  
Director, Clinical Informatics  
Program Director, Anesthesia Clinical  
Informatics Fellowship  
Assistant Professor of Anaesthesia

**Sara E. Neves, MD**  
Program Lead, Resident RCA Program  
Instructor in Anaesthesia

**Robert A. Carlin, BS**  
Senior Project Manager

**Julius Agyemang, BS**  
Project Coordinator

### IT Management and Implementation

**Sarah Y. Nabel, MS**  
Director, Anesthesia Information  
Technology

**Kalpana Sachinthanandham, BS**  
Senior Developer

**Michael Broglio, MS**  
Senior Project Manager

**Laura I. Ritter-Cox, MSN, RN-BC**  
Informatics Nurse Specialist

**Tuyet Tran, BS**  
Data Analyst

**Thomas S. Xie, BS**  
Systems Analyst

**Rob Ruiz**  
Systems Analyst

### Safety Committee

**Satya Krishna Ramachandran, MD**  
Associate Professor of Anaesthesia

**Richard J. Pollard, MD**  
Assistant Professor of Anaesthesia

**Ruma R. Bose, MD, MBBS**  
Assistant Professor of Anaesthesia

**David M. Feinstein, MD, MS**  
Assistant Professor of Anaesthesia

**Sapna Govindan, MD**  
Instructor in Anaesthesia

**Cullen D. Jackson, PhD**  
Instructor in Anaesthesia

**Megan L. Krajewski, MD**  
Instructor in Anaesthesia

**Cindy M. Ku, MD**  
Instructor in Anaesthesia

**Lisa J. Kunze, MD, PhD**  
Assistant Professor of Anaesthesia

**Rikante O. Kveraga, MD**  
Assistant Professor of Anaesthesia

**Soumya Mahapatra, MD**  
Instructor in Anaesthesia

**Sarah Y. Nabel, MS**  
Director, Anesthesia Information  
Technology

**Sara E. Neves, MD**  
Instructor in Anaesthesia

**Edward K. Plant, CE**  
Technical Director

**Andrey Rakalin, MD**  
Instructor in Anaesthesia

**Paragi H. Rana, MD**  
Instructor in Anaesthesia

**Fred E. Shapiro, DO**  
Associate Professor of Anaesthesia

**Scott D. Zimmer, MD**  
Instructor in Anaesthesia

adverse events or close calls. Further changes in the M&M structure were unveiled in 2019. Peer review is designed to evaluate individual competence through the Ongoing Professional Practice Evaluation (OPPE) and investigate concerns with standards of care or professionalism through the Focused Professional Practice Evaluation (FPPE).

The Safety Committee comprises 14 standing members and four consultants who are all trained in industry-standard techniques for retrospective and prospective safety investigations. Their focus is centered on identifying systems factors that cause or contribute to increased risk or actual patient harm. Through standardization of these review processes, we have created a mechanism to perform robust

event reviews, root cause analyses, safety assurance, and failure mode effects analyses, to name a few. In addition to event-based processes, the committee also tracks national safety indicators and investigates threshold changes in concert with clinical leadership.

The department performs more than 35,000 anesthetic procedures yearly using an electronic anesthesia information system. Each case requires that intraoperative outcome data be entered into the QA field before the case can be closed. Approximately 99% of the cases are associated with no adverse intraoperative events. However, about 1% (or about 300 cases per year) do have one or more events. These cases are reviewed, and appropriate follow-up is determined. This can include no needed follow-up,

## Quality, Safety, Innovation and Information Technology 2018-2019

**42** Residents trained in formal quality and safety techniques

**10** RCA<sup>2</sup> performed

**2**-year fellowship in Perioperative Quality & Safety established

**2** major international collaborations established for talent acquisition

**2** large-scale perioperative safety team-training sessions conducted with over **750** attendees

**\$800,000** of departmental funds saved through malpractice insurance premium reduction program

**25** distinct research/quality projects supported

**5** new applications developed

case presentation at the weekly clinical meeting for both peer review and departmental education, and/or reporting to outside regulatory agencies. Major adverse events are presented at the twice-monthly multidisciplinary hospital Quality Improvement Directors meeting for further review and potential reporting to state agencies.

Through a Delphi approach, the Safety Committee developed a HIPAA-compliant safety review system that can support event review from multiple locations within the BI-Lahey network. We are in the process of testing this tool for implementation in 2019.

### Team Training/Projects

We had a second successful year delivering the new Controlled Risk Insurance Company (CRICO) program requirements for malpractice insurance premium reduction under Dr. Cullen Jackson's leadership. The

management of this program saves the department over \$400,000 each year for faculty alone. It saves the hospital an additional \$250,000 each year for resident and fellow training. This success is in no small part due to the contribution of several trainers and every staff member who participated. The Combined Safety Grand Rounds was a team-training opportunity for 400 perioperative staff, including surgical, anesthesia, and nursing services. We engaged and trained over 35 trainers covering every major service in the ORs. We received special recognition from our CMO, who wishes to replicate this course across additional sites as well.

### Quality and Safety Education

We were successful in integrating an expanded quality and safety training program for postgraduate residents, fellows, and faculty over the last two years. The intern QA week is

now a fully mature immersive program with lectures from nationally renowned experts in quality, safety, operations, and human factors. Our interns presented two projects built around our Omnicell systems, with one group following the Pharmacy Medication Workflow and the other following the Clinician Workflow. Starting in 2019, this program will host exceptional students from England through the Meghana Pandit Safety Scholarship, a collaboration with the University Hospitals of Coventry & Warwickshire, England.

Under the leadership of Dr. Sara Neves, we completed the second full year of Root Cause Analysis and Action (RCA<sup>2</sup>) training for the CA-2 class. Our residents have now completed over 10 RCA<sup>2</sup>s over the last two years. Through this program, residents and faculty trainers are employing industry-standard techniques endorsed by the Institute for Healthcare Improvement and





the National Patient Safety Foundation. We have also defined the Implementation Science Training Curriculum for the CA-3 residents, to be piloted in 2019. The goal is to train our residents in the approach and methodology for influencing and implementing change in health care environments. The program was developed through collaboration with Dr. James Bagian and Joseph Derosier, two internationally renowned leaders in patient safety for their work in the National Center for Patient Safety and authorship of the majority of the RCA<sup>2</sup> methodology.

### **Fellowship in Perioperative Quality and Safety**

A two-year PGY-5 fellowship in Perioperative Quality and Safety was approved as a non-ACGME program by the BIDMC GMCE and endorsed by the ABA in 2018. This program will host up to two post-residency fellows every year, and successful fellows will receive the Master of HealthCare Quality and Safety degree from Harvard Medical School. A collaboration was finalized with the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain & Ireland through the Safety Liaison Group to host up to two fellows a year at BIDMC through this mechanism. This provides a tremendous opportunity for us to develop up to four clinical fellows a year, who will work between 32 to 48 hours a week in addition to their active academic program at HMS. We welcome our inaugural fellows, Drs. Liana Zucco and Nadav Levy, who began the program in July 2019.

We also conduct ongoing faculty

and CRNA training. One of our faculty members, Dr. Andrey Rakalin, was sponsored for completion of the one-year Masters in Health Care Quality and Safety program at Harvard Medical School this year. We look forward to enhancing our organizational methods and processes from his insight during and after the program. Four new faculty members joined the safety committee in 2018 and have been trained as trainers for the RCA<sup>2</sup> methodology, bringing the total number of trained faculty in the department to 10. Twelve super trainers for the emergency manual were trained in two one-day workshops on the methods and materials for the emergency manual rollout scheduled to start in 2019. This program will focus on team training around events directly relevant to anesthesia care and enhance in situ performance of teams during actual crises. Drs. Richard Pollard, David Feinstein, and John Pawlowski combined efforts with a team of resident, fellow, faculty, and CRNA trainers to develop a practical manual and program.

### **Innovation**

The Innovation Division spearheads efforts to discover improvements that will positively impact health care delivery in the perioperative environment. This work involves both quality improvement initiatives and rigorous research projects. The results influence areas such as team and organization design, communication pathways and transitions of care, information management systems, and training and education. As part of the Anesthesia Department, we work across all phases

of the perioperative environment and strive to work across departments to ensure our improvement and research efforts encompass the interdisciplinary nature of our work.

### **Faculty Hour Chartered Teams**

In 2019, we celebrated the ninth anniversary of the launch of Faculty Hour. Started in April 2010 through the leadership of Dr. Brett Simon, Faculty Hour affords anesthesiologists, surgeons, nurses, and others the opportunity to meet once each week at the start of the day (currently Tuesday mornings) to advance quality and outcomes for patients, to accelerate learning and innovation, and to foster mutual joy in work. In order to facilitate this multidisciplinary opportunity, operating room start time is set 30 minutes later, which shows the endorsement and investment that BIDMC and participating departments are making with the Faculty Hour program.

Multidisciplinary teams lead projects initiated by clinical providers within the medical center and chartered by the Faculty Hour Steering Committee, which is comprised of leaders from Anesthesia, Surgery, Perioperative Services, Orthopedics, and Obstetrics/Gynecology. These “chartered” teams are guided by input from various sources: other health care providers, patient advocates from the Patient-Family Advisory Council, observations of external facilities and processes, and more. A triad leads each team to strengthen the multidisciplinary nature of the project and to ensure endorsement across the constituent departments, and they recruit additional members (generally

six to 10) to complete the team's membership. Each Chartered Team is supported with data, literature, and a facilitator trained in process improvement (as well as other resources as needed). To date, over 60 interdisciplinary teams have completed projects, and there are generally three to six projects in progress or in the planning stage at any given time.

### Research

In addition to our focus on improvement, the division also conducts cutting-edge applied research focused on enhancing our methods for evaluating and implementing solutions for both our quality and safety missions. Over the past three years, we have engaged in human factors and cognitive systems engineering research to understand and mitigate safety and quality vulnerabilities for our individual providers, teams, and systems. Currently, our research focuses on three areas: individual performance assessment and augmentation, simulation-based training and education and system-level collaboration and resilience.

Our research in system-level collaboration and resilience currently focuses on understanding the complexity of managing OR floor operations, which is the work of the floor manager (FM). The FM coordinates interdisciplinary resources between multiple operating rooms (ORs) and procedure areas and manages the day's OR schedule. He or she is required to trade off between competing organizational goals such as efficiency, frontline workload optimization, and quality

and patient safety. Previous studies on OR floor management have largely taken a retrospective, deterministic approach to characterizing work. This approach may not fully reflect the adaptive nature of work on the frontline, which is marked by uncertainty and variability. Given the need for the FM to maintain a flexible and adaptive OR floor, we are studying OR floor operations using a resilience engineering approach. Our future work in this area will expand on our current results by interviewing and surveying FMs as well as OR caregivers to gain a holistic perspective on performance of FMs. We will use the insights gleaned from this study to develop a measurement framework for FM performance.

### Information Technology

The Division of Information Technology, lead by Sarah Nabel, promotes the effective use of information technology and information sharing within and outside the department. The division has worked successfully on many clinical and administrative IT-related areas. Although the Division of Information Technology is not a clinical division, we provide technological support to every aspect of our clinical efforts at BIDMC and affiliated sites, supporting our vended systems and ensuring integration with hospital and network affiliate systems. We also provide technical support for department and hospital-wide research efforts.

Our application development work, led by Kalpana Sachithanandham and Praveena Muthuraj, has been focused on updating the Anesthe-

sia Intranet and its associated web modules to allow for our expanding department. Other projects in progress include development work for QGenda integration, CARE, and the large-scale Faculty Development System.

Our Data Analytics team has built data models for various reporting objectives so that we can better understand data related to clinical, operational, research, and quality and safety initiatives. Data Analyst Tuyet Tran, is actively working to complete the Resident Quality Scorecard, a dynamic learning tool that will allow residents to better understand their clinical performance in terms of specific outcomes.

The configuration of our new AIMS system, Talis, is led by IT Project Manager Mike Broglio. Parallel efforts are also underway for the ICU, as Talis and BIDMC are working collaboratively to develop a new ICU product. Laura Ritter-Cox, RN, our system admin for MVICU, is playing a critical role in evaluating key features that will be necessary for this new system.

### Datamart Team

Our Information Technology Services and Informatics group has been extremely productive in 2018-19. The Datamart team is fully functional with integration of multiple resources from within our departmental IT services, hospital Information Services, Clinical Informatics, Research, and Quality, Safety and Innovation.

This team directly supports departmental Research goals — we have



**Safety Committee**

provided data for several ongoing research programs and large studies over the last year. This year, we created a Data Use Committee under the joint leadership of Drs. Matthias Eikermann, David Feinstein, and Krish Ramachandran. This group has already reduced the barriers for data access for research and operations.

### **Fellowship in Clinical Informatics**

The Division of Clinical Informatics Fellowship Program at BIDMC is a multidisciplinary fellowship in collaboration with five BIDMC departments: Anesthesia, Emergency Medicine, Medicine, Radiology, and Pathology. The program offers six annual positions and trains participants to creatively utilize information and communication technology to transform healthcare. Fellows are exposed to our state-of-the-art clinical computing system and learn to assess needs, refine clinical process, and design and implement clinical systems. The program was ACGME accredited as of July 2015. Each fellow completes a research project, is encouraged to obtain a Masters in Biomedical Informatics, and completes the Program in Clinical Effectiveness at Harvard School of Public Health. Dr. David Feinstein is the

Program Director for the Anesthesia portion of the Fellowship.

### **Anesthesia Information Management Systems**

Our Anesthesia Information Management System (AIMS; Philips, CompuRecord) was deployed at BIDMC in 2005. It has been used extensively in almost all areas of anesthesia care. We are currently engaged in the preparation for launching a new AIM system, Talis, in 2019, which is being led by Michael Broglio and Dr. David Feinstein.

Digital Reasoning (formerly known as Shareable Ink) has been deployed as the AIM system at BID-Needham and BID-Milton. In 2015, this system was upgraded to an iPad tablet version and is currently being used. The iPad version has allowed providers to quickly and accurately create anesthesia records that are reliably stored and retrieved from the “cloud.”

### **Departmental Intranet Project**

The Department of Anesthesia, Critical Care and Pain Medicine has had a robust intranet site since its creation 12 years ago. Its creator, Kalpana Sachithanandham,

continues to add new functionality to ensure its use will enhance department communications. Our department intranet has continued to grow and provide important administrative and educational information to the department. These changes have been driven by our new affiliations and involvement with satellite hospitals. As our organization has evolved and our department has expanded to include our new BID enterprise facilities, our intranet has made the appropriate changes and allowed for the dissemination of vital information to the department.

In addition, we introduced a daily feedback system on the department intranet site. Using attending-resident pairings acquired from AIM system data, attending staff are emailed a feedback request for the residents they have worked with during the day. The anonymous data has been helpful to the educational process in the department. We deployed an analogous feedback system for residents’ evaluation of attendings. This feedback system, spearheaded by Drs. John Mitchell and Stephanie Jones, has achieved national recognition with the Society for Education in Anesthesia.



## 2019 Graduates

### Residents

Emily Bouley, MD  
Priyanka Ghosh, MD  
Erin Highfill, MD  
Mark Jennings, MD  
John Kaminski, III, MD  
Peter Kelsey, Jr., MD  
Samuel Kurtis, MD  
Vwaire Orhurhu, MD MPH  
Syed M. Khurram Owais, MD  
Priya Patel, MD  
William Powell, JR, MD, MPH  
Christopher Singh, MD  
Lindsay Sween, MD, MPH  
Ivan Urits, MD  
Cameran Vakassi, MD  
Katerina Wilson, MD



### Fellows

*Adult Cardiothoracic Anesthesia Fellows*  
Andaleeb (Andy) Ahmed, MD, MPH  
Graham (Barden) Berry, MD  
Scott Gilleland, MD

*Critical Care Fellows*  
Omar Hyder, MD, SM  
Tanya (Keverian) Birkett, MD  
Sara Maben, MD  
Gabrielle Paoletti, MD

*Neuroanesthesia Fellow*  
Andres Brenes, MD

*Obstetric Anesthesia Fellow*  
Meredith (Merry) Colella, MD

*Regional Fellow*  
Nadav Levy, MD

*Informatics Fellowship (2 yr)*  
John Pearson, MD

*Pain Medicine Fellows*  
Mina Ghaly, MD  
Amita Jain, MD, MBA  
Laura Lombardi-Karl, MD  
Anh Ngo, MD, MBA  
Mohamed Osman, MD  
Indu Reddy, MD  
Anastasios (Tasos) Sakellariou, MD, DMD



## 2018 Graduates

### Residents

Kiran Belani, MD  
Anna Budde, MD  
Eric Buell, MD  
Meredith (Merry) Colella, MD  
Victoria Derevianko, MD  
Joseph Foley, MD  
Scott Gilleland, MD  
Tanya (Keverian) Birkett, MD  
Sarah Maben, MD  
Damon Min, MD  
Francisco Narvaez, MD  
Josh Oliver, MD  
Chinedu Otu, MD  
Bijan Teja, MD  
Janelle Tryjankowski, MD  
Simon Zhang, MD

### Fellows

*Adult Cardiothoracic Anesthesia Fellows*  
Derek Lodico, DO  
Jamel Ortoleva, MD  
Alex Shapeton, MD

*Critical Care Fellows*  
Hemant Joshi, MD, PhD  
Abi Kumaresan, MD  
Kadhir Murugappan, MD  
Dan Walsh, MD

*Neuroanesthesia Fellow*  
Lauren Buhl, MD, PhD

*Neurocritical Care Anesthesia Fellow*  
Johann Patlak, MD

*Obstetric Anesthesia Fellows*  
Margaret O'Donghue, MD  
Erin Ciampa, MD, PhD

*Pain Medicine Fellows*  
Abbas Asgerally, MD  
Stanley Eosakul, MD  
Jeremy Epstein, MD  
Obaid Malik, MD  
Julie Petro, MD  
Lindsay Rubenstein, MD  
Alan Sheydwasser, MD  
Omar Viswanath, MD

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## OR Technical Team

**Edward K. Plant, CE**  
Technical Director

**Thomas J. Malboeuf, Cer.AT**  
Clinical Manager

**Bejan Abaspour**  
Clinical Engineer Specialist

**Michael J. Chen, BS**  
Anesthesia Technician

**Elvira P. Clarke, BS**  
Anesthesia Technician

**Agnes E. Clermont**  
Anesthesia Technician – Lead

**Desinor Dely**  
Anesthesia Technician

**Frantz Gilbert**  
Cardiac Monitoring Technician

**Anson J. Harrison**  
Anesthesia Monitoring Technician

**Clarisa B. Joseph**  
Anesthesia Technician

**Zachary Mitchell**  
Cardiac Monitoring Technician

**Geanpal Mora**  
Cardiac Monitoring Technician

**Markens Polynice**  
Cardiac Monitoring Technician

**Nick I. Rami**  
Anesthesia Technician

**Alyssa M. Rossi**  
Cardiac Monitoring Technician

**Joseph A. Salas**  
BMET II

**Edwardo Santiago**  
Anesthesia Technician

**Derick R. Sealy**  
Anesthesia Technician

**Desiree Shields**  
Cardiac Monitoring Technician

**Edlin W. Silcott Jr.**  
Anesthesia Technician

**Tammy L. Staffier**  
Anesthesia Technician

**Janette E. Stephenson**  
Anesthesia Technician

**Carolina Swarton**  
Anesthesia Technician

**Penee D. Wiggins**  
Anesthesia Technician

**Ron Wilburn**  
Anesthesia Technician – Lead

**Rob Ruiz**  
AIMS Technical Analyst

**Tom Xie**  
Systems Analyst

**Jila Jila**  
Anesthesia Technician





## Administrative Team

**Dawn M. Ferrazza, MA**  
Chief Administrative Officer

**Brian Duckman, MBA/MHA**  
Director, Department of Anesthesia, Critical Care and Pain Medicine

**Aaron H. Banner-Goodspeed**  
Project Manager, Finance and Administration

**Fondo Bokembya, BA**  
Residency/Fellowship Program Coordinator

**Kimberley Brown**  
Fellowship Coordinator

**Mary Jane Cahill, MBA, C-TAGME**  
Manager, Medical Education Programs

**Shannon Cameron, MBA, MHIIM, CPC**  
Executive Director of Revenue Cycle

**Heather Derocher, MA**  
Director of Communications and Special Projects

**Nina Khoda**  
Intern

**Joanne Grzybinski, MBA**  
Manager, Scheduling Operations

**Beth Hill**  
Executive Assistant to the Chief and CAO

**Gidget F. Hunter**  
Administrative Coordinator

**Christine Kuhn**  
Scheduling Administrator

**Elizabeth A. Kiernan**  
Administrative Manager-Operations

**Susan H. Kilbride, BSN**  
Manager, Faculty Development and Recruitment

**Ronald C. Mayes**  
Medical Education Coordinator

**Nora T. McCarthy**  
Project Administrator, Faculty Development and Recruitment

**Taneshia Pina, BA**  
Administrative Coordinator for Education and Faculty Affairs

**Letisha Phillips, BS**  
Project Administrator, Credentialing, Privileging and Enrollment

**Ann M. Plasso, BA**  
Communications Specialist

**Melissa Quinchia-Rios, MSM**  
Administrative Supervisor

**Alexander Shtifman, PhD**  
Administrative Director of Research

**Daniel L. Scotina, BS**  
Financial Administrator

**Sable Smith, BA**  
Administrative Coordinator, Research

**Patricia R. Stevens, MBA**  
Director of Finance

**Jacqueline Villafuerte**  
Administrative Coordinator, West Campus

**Vanessa T. Wong, BS**  
Project Coordinator, Education



## Nurse Practitioner Team

Elisabeth M. Baker, NP <i>Lead NP</i>	Devon O'Connell, NP
Yun Y. Bae, NP	Norma Osborn, NP PAT
Regina Champagne, NP Acute Pain Service	Peguy Philemon, RN
Joelle Chateaufneuf, NP PAT	Yolanda Perez-Shulman, NP PAT
Sara S. Durgerian, NP Regional	Virginia A. Sheppard, NP PAT
Norine M. Gentner, NP PAT	Eileen M. Stuart-Shor, NP PAT
Ina Harten, NP PAT	Bethany W. Thomas, NP PAT
Brian A. Hoell, NP PAT	Lauren E. Wilson, NP
Joyce Larson, NP PAT	Michele Gaudet, NP PAIN
Ashley A. Lowery, NP	Lindsay Gusioria, NP PAIN
Sheila M. McNaught, NP	Katrina Roberston, NP PAIN - BID-Needham
Mary-Ellin Moore, NP PAT	



## Anesthesia Financial Services Team

Shannon Cameron, MBA, MHIIM, CPC Executive Director of Revenue Cycle	Samantha Payne, CPC Senior Coder	Caroline Hannon Billing Associate Sr.
Tracy Blake, CCS-P HR and Operations Manager	Allyson Silva, CPC Coding Analyst	Holly Kirkpatrick Billing Associate Sr.
Michael Kurey AR Data & Payer Relations Manager	Paulette Simmons CCS, CPC, COC, CRC Senior Coder	Sabrina Linscott Billing Associate Sr.
Carmen Saralegui, RHIT, CPC, CGSC Coding Manager	Trinia Thompson, CPC Senior Coder	Susan McClain, CPC Billing Associate Sr.
Patricia Spicer, CPC, CANPC RCM Manager	Marissa Tierney, CCA Coding Analyst Judy Wells, CPC – Senior Coder	Candice Morgan Billing Associate
Cathy Manzelli Supervisor Chart Capture	Virginia Wells, BSHA, CPC Senior Coder	Lauri Muniz Billing Associate Sr.
Caitlin Parece Supervisor/Trainer AR	Wesley Jeune Data Analyst	Ingrid Olivo Billing Associate
Ruth Zung Supervisor/Trainer Payments	Edmund Kelly, CMBS Data Analyst	Eileen Starr Billing Associate
Jessica Duffy, CPC, CANPC Coding Analyst	Nicole Ellison Billing Associate	Kim Weinstein Billing Associate Sr.
Sonja Moon, CPC, CPMA Senior Coder	Lindsay Forecast Billing Associate	Ann Huff Bookkeeper/ HR Generalist



### Administrative Team, Pain Center

**Brian Duckman, MBA/MHA**  
Director, Department of  
Anesthesia, Critical Care and Pain  
Medicine

**Elizabeth Carvelli, RN, MSN**  
Nursing Director

**Katherine P. Boyle, RN**

**Joanne Cullen, RN**

**Susan B. Dwyer, RN**

**Anne S. Hooley, RN**

**Marian A. George, RN**

**Patricia A. Smith, RN**

**Faith Lawal, RN**

**Sean H. Abiera**  
Practice Coordinator

**Melanie Airoso**  
Diagnostic Technician II

**Meron Ayele**  
Diagnostic Technologist II

**Sandy S. Barbosa**  
Managed Care Coordinator

**Claudine O. Beauvais**  
Administrative Assistant I

**Nathaniel Beyer, MA, MAT**  
Practice Manager

**Alyssa Brancaccio**  
Diagnostic Technologist II

**Christopher Burgos**  
Diagnostic Technologist II

**Maureen Burke**  
Diagnostic Technologist III

**Ana Cabrera-Delgado**  
Medical Assistant

**Kemeisha T. Daley**  
Administrative Assistant II

**Clairma Jean-Francois**  
Medical Assistant

**Miclyna Etienne**  
Medical Assistant

**Jose Garcia**  
Administrative Assistant I

**Wanda Hunt**  
Practice Representative

**Rachelle Jean Pierre**  
Practice Representative

**Renetta L. Johnson, AS**  
Administrative Coordinator

**Victoria Kronillis**  
Diagnostic Technologist II

**Haregewoin M. Lemma**  
Practice Assistant

**Marisa E. Maldonado, AS**  
Administrative Assistant II

**Fredline Louis Marin**  
Administrative Assistant II

**Genesis-Ann Martell**  
Practice Assistant

**Gianna Mirabella**  
Diagnostic Technologist II

**Gabrielle Mobayed**  
Diagnostic Technologist II

**Rahma Mokdad**  
Diagnostic Technologist II

**Peter Negrotti**  
Practice Representative

**Julie Nicholson**  
Diagnostic Technician III

**Norma J. Nighelli, AS**  
Practice Manager, Revenue Cycle

**Marie Pauleus**  
Admin. Assistant II

**Alexander Raymond**  
Diagnostic Technologist II

**Katie Siegel**  
Diagnostic Technologist II

**Najibi Tejeda**  
Administrative Assistant III

**Aziza L. Wilkerson**  
Managed Care Coordinator

**Earlena Williams, BA**  
Outpatient Authorization Pain  
Specialist

**Brittany Williamson**  
Practice Representative

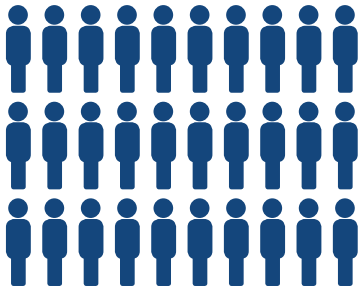
**Shaw'tae Sullivan**  
Administrative Assistant II, Pain  
BID-Milton

**Sandra Avendano**  
Patient Access Representative, Pain  
BID-Needham

**Christiana Nkrumah-Appiah**  
Administrative Assistant II, Pain  
BID-Milton

# By the Numbers

**433** Current Department Members



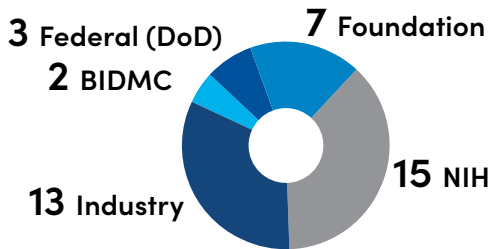
**87** ORs

**63** ICU beds

**34** Labor and Delivery suites

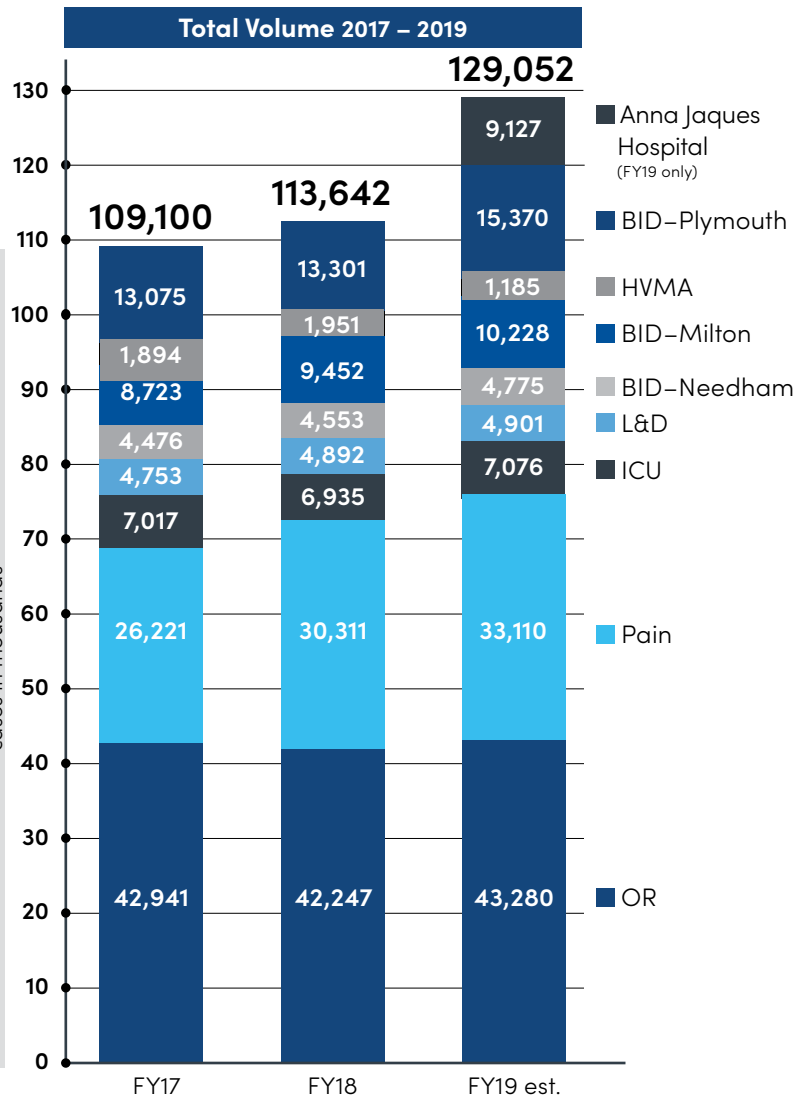
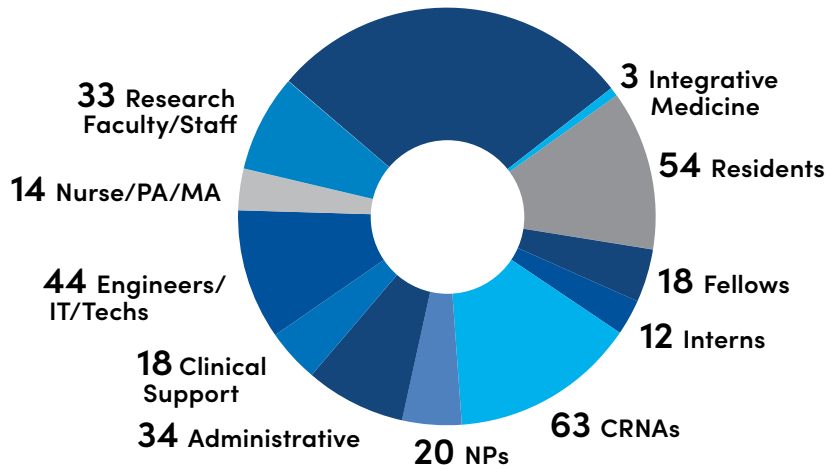
**8** Pain treatment rooms and Headache Clinic

**40** Research Grants



**\$4,081,163** FEDERAL  
**\$6,652,733** TOTAL

**123** Faculty





Beth Israel Deaconess Medical Center (BIDMC) is one of the nation's preeminent academic medical centers committed to providing excellence in clinical care, teaching, research and community outreach.

- Virtually all of our 1,250 full-time medical staff are on the faculty of Harvard Medical School (HMS).
- We have 651 licensed beds, including 473 medical/surgical beds, 77 critical care beds and 60 OB/GYN beds.
- 2016 stats: Inpatient discharges – 40,217; Outpatient visits – 638,449; Emergency Department visits – 56,959
- We're at the forefront of health information technology and scientific discoveries that help to transform medical care.
- We have a uniquely strong and deep medical education program that attracts top faculty and residents.
- We are the official hospital of the Boston Red Sox.

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**Beth Israel Deaconess  
Medical Center**



**HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL**

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Critical Care and Pain Medicine**

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