

A History of the
DEPARTMENT OF ANESTHESIOLOGY
University of Michigan Medical School



Introduction

In 2017 the University of Michigan will be celebrating its bicentennial anniversary. As part of this celebration the academic departments of the University of Michigan Medical School have been asked to present the past 50 years of their department's history as part of the overall University's efforts to document its contributions to the state and society in general. As a medical school department our contributions are to clinical care, medical and scientific education, and research. Since the Department of Anesthesiology is not much older than 50 years, we have chosen to chronicle our department's history from its inception as an independent academic unit within the University. This history will follow the chronology of the department chairs as they developed the department in all three academic missions. To our knowledge this is the first documented history of the Department of Anesthesiology at the University of Michigan and we hope it will be of interest to the readers.

Robert B. Sweet, MD, Founding Department Chair, 1952-1976

The University of Michigan Medical School advanced anesthesiology from a section of surgery to departmental status in 1949, making it one of the early academic Departments of Anesthesiology in the nation. Warren Wilmer, MD served as acting chair until Robert B. Sweet, MD was appointed as the first permanent chair in 1952. Bob Sweet had completed a surgical residency program at Michigan prior to training in anesthesiology at the Massachusetts General Hospital (MGH). (Of note, Bob Sweet's brother William would become the chair of neurosurgery at MGH.) Dr. Sweet's first goal was to develop an excellent clinical program to support the well-respected surgical department, which had trained the Mayo Brothers in surgery.



Soon after Dr. Sweet assumed chairmanship of the Department of Anesthesiology he recruited Lewis W. Lewis, who had trained under Duncan Alexander in McKinley, Texas, as an assistant professor. In addition to Lewis, by 1956 the department had two other instructors. In the 1950s there were few formally trained anesthesiologists to recruit as faculty. In the 1920's the Department of Surgery had a visiting exchange program with St. Barthomew's in London for young surgeons. On behalf of Dr. Sweet, Dr. Frederick Coller, the chair of surgery at Michigan, asked his colleagues at St.

Barthomew's if there were any young anesthesiologists who would be interested in spending a year in the U.S.

Consequently, in 1956 Dr. Thomas Boulton and his wife came to spend a year in Ann Arbor supported in part by a grant provided by Senator Fulbright. Boulton served as the third instructor and enjoyed the year so much he encouraged others to follow him, establishing a yearly tradition that has continued through to this day (Dr.



THOMAS B. BOULTON, M.D., F.R.C.A.

Boulton ultimately became the Chair of Anesthesiology at

Oxford).(1) In 1955 the first residents in anesthesiology started their program, graduating in 1957.

The first class consisted of Dr. George Alter, Dr. Edmund M. Krigbaum, and Dr. Leonard Waltz.

Figure 1 is a picture of the entire department as of 1960 showing the five faculty and six residents (three in each class). Among the faculty are Dr. Sweet as well as Drs. Georgine Steude, Rachi Izuka, Leonard Waltz, and Dixon Bieri. Dr. Sweet was in charge of both the physician anesthesiology residency program and the nurse anesthetist training program. At that time the majority of anesthetic care was provided by nurse anesthetists as the physician program



Figure 1.

progressively grew. In 1966, the department started a School of Respiratory Therapy at Washtenaw Community College and the following year they initiated a Respiratory Care Fellowship, which was the forerunner of Critical Care Medicine Fellowships at the University of Michigan. One of the early fellows was Barry A. Shapiro, MD who later became the Chair at Northwestern. In 1972, a

Division of Respiratory Therapy was started by Dr. Jay Finch, a graduate of the anesthesiology residency program in 1965 who would later become chair of the department.

In 1969, the Mott Children's Hospital opened and was staffed by a new pediatric anesthesia service which ultimately grew into the largest fellowship in the department (9 fellows per year as of 2012). Also, in 1972, the department initiated a service of local anesthetic blocks for non-operative pain, which established the foundation for a Pain Fellowship in 1981.

From a scientific perspective the department first studied electrophysiology measurements evaluating the depth of anesthesia in 1963 (2) and conducted the first phase-II studies of ketamine, led by Dr. Ed Domino at the University of Michigan in 1965. The first clinical studies on ketamine involved anesthesiologist Dr. Gunter Corssen and were published in 1966. (3,4)

Veteran's Administration Hospital

In 1953 the Veteran's Administration opened up a hospital in Ann Arbor. Medical and surgical services were staffed with faculty from the University of Michigan. Anesthesiology services were provided by nurse anesthetists until the new department at the University grew sufficiently to provide physician anesthesia. In 1962, David Learned, a recent graduate, was sent to the VA to start the physician anesthesia service. He left one year later for private practice and Dr. Tom Corbet took over as the Chief of Service in 1963. He stepped down as Chief of VA Service in 1973 and was replaced by Dr. Anne Hill until 1975. At that time, when Dr. Sweet stepped down as Chair of the Department, he went on to direct anesthesia services at the VA in 1975. He continued as Chief of Service until 1981, when Ron Harris directed the VA. In 1986 Dr. Harris died of pancreatitis and Dr.

Robert Myyra became the new Chief and continued for the next 20 years as the clinical and teaching services grew. In 1999 a new surgical wing opened at the VA with nine operating rooms and an adjacent ICU. In 2014, Bob Myyra retired and Michael Lee became the new Chief of Service at the VA. In 2013, the Department of Anesthesiology was requested to direct the surgical ICU and the full critical care service was initiated in the summer of 2014. The contracted service consists of eight OR faculty as well as ICU coverage and two FTE appointments, the Director of the Surgical ICU and Dr. Lucy Waskell in research. The educational mission at the VA consisted of a rotation for residents in their first clinical anesthesia year and a second rotation in cardiac anesthesia.

Peter Cohen, MD, Chair 1976 – 1985

Dr. Sweet stepped down as chair in 1975 and a national search was initiated with the goal of finding an individual who would develop a more extensive research program. Dr. Peter J. Cohen became the second chair of the department in 1976 and he recruited a large group of faculty. Many of these faculty were recruited from the University of



Colorado, including Dr. Paul Knight who ultimately became the director of research. Other recruits included Dr. Sujit Pandit who directed ambulatory anesthesia and, ultimately became the President of Society for Ambulatory Anesthesia, Dr. Alan Brown who started a Difficult Airway Clinic, Michael Nahrwold who directed cardiac anesthesia, Dr. Jeff Lane and then Dr. Jorde Waldron who directed pediatric anesthesia at the Mott Children's Hospital.

Dr. Cohen further developed subspecialty services and fellowships. A pediatric anesthesia service had been developed in 1969 but the first fellowship was not initiated until 1983. The department

initiated a pain clinic in 1979 and a pain fellowship in 1981. The obstetric anesthesia service was started in 1978 and a fellowship was initiated in 1990. With the development of a surgical liver transplant program, a transplant anesthesia team was initiated in 1985.

In 1984, Peter Cohen stepped down as chair and a national search was initiated which narrowed to a final candidate. Unfortunately that candidate, Dr. Ed Miller, chose to accept the Chair at Columbia instead of Michigan.



Thomas J. DeKornfeld, MD, Interim Chair, 1984-86

Due to the failed chair search in 1984, Thomas J. DeKornfeld, MD assumed the position of Interim Chair. During that time the department's residency program was growing and Dr. DeKornfeld felt it was in the best interest for the future of the physician training program in the Department of Anesthesiology that the department discontinue training nurses in anesthesia.

He therefore petitioned and the University formally closed the training program in nurse anesthesia in 1985. The residency program was increased to 18 per class and the faculty was expanded to meet the clinical needs. In 1986, Dr. DeKornfeld stepped down as interim chair and Dr. Jay S. Finch assumed the position of interim chair.



Jay S. Finch, MD, Interim Chair 1986-1987; Chair 1987-1989

After successfully managing the department as interim chair for one year, Dr. Finch was appointed permanent chair in 1987. Unfortunately, not long after this appointment, Dr. Finch developed renal failure and had to step down as chair in 1989.

Georgine M. Steude, MD, Interim Chair, 1989-1990

In 1989 Dr. Georgine Steude was appointed as interim chair, having been the Director of Pediatric Anesthesiology. Dr. Steude helped the department expand to meet the demands of the increasing clinical service needs of the institution and expanded the residency to 20 per class. The department had to request that faculty be allowed to be recruited in the clinical track to enable the department to recruit and retain high quality clinician faculty to manage the ever expanding service needs. During this time she recruited Dr. Niall Wilton as the Director of Pediatric Anesthesia.



The British Wave, 1980-1990

The decade of the 1980s was somewhat tumultuous with respect to departmental leadership: a chair stepped down, there was a failed search, there was a succession of two interim chairs, and finally the unanticipated retirement of the permanent chair who was ultimately appointed. During this period the department's clinical service and education needs continued to grow with the expansion of the surgical programs and the construction of the new University Hospital to replace the "Old Main." In 1986, the University of Michigan opened its greatly expanded adult University Hospital, which at the time was visionary given the economic condition of the State of Michigan. There were 18 adult operating rooms, 3 medical procedure rooms, 5 adult intensive care units, and 500 in-patient beds. Recruiting and retaining faculty was more challenging given the changing leadership. Fortunately, a constant supply of British visiting faculty not only came for their one-year appointments as "rotators" (as they were referred to) but many chose to immigrate to the United States permanently and join the regular University of Michigan faculty. Within this group there were notable figures

who ultimately assumed key administrative and leadership roles in the department. In 1983, Dr. Timothy Rutter came as a rotator with additional training in pain management. In 1985 he returned and became the director of the chronic pain program and later that year was appointed clinical director of the operating rooms in the Adult Hospital. In 1989, he was appointed as the Associate Chair for Clinical Affairs for the Adult Hospitals. Dr. Niall Wilton, who had come from South Hampton as a rotator, assumed the position of Chief of the Pediatric Anesthesia Service in 1989, which he held until he left the department in 1994. He is currently the Chief of Anesthesia at the Starship Children Hospital in Auckland, New Zealand. Also in 1985, Dr. Allan Brown was recruited from University of Colorado with Peter Cohen, but had originally been trained in England. He initiated what was possibly the nation's first Difficult Airway Clinic with Dr. Martin Norton. A Liver Transplant program was initiated and was headed by Dr. Douglas McLaren, another British transplant (no pun intended); and finally, Dr. Donald Mackie, who was also on the Liver Transplant Team, developed the department's first Quality Assurance Program. Don Mackie later became the Chief Physician of the National Health System of New Zealand in 2011.

It is therefore clear that the British Visiting Faculty Program, starting with Dr. Boulton in 1956, has not only added to the unique flavor of the department, but also the breadth of training perspectives as well as clinical and academic strength from the very beginning. As will be noted later in this history, a second British wave occurred in the early 2000s.

Kevin K. Tremper, PhD, MD, Chair, 1991- present

In 1875, a senior resident completing his training in surgery at the University of Michigan presented his required senior thesis entitled: “Anaesthetics and their Use.” This 46-page neatly handwritten manuscript described the state-of-the-art of anesthesiology in impressive detail. His name was Robert Tremper and he left Michigan to practice surgery in Los Angeles, California. What was surprising is that one-hundred and fifteen years later, Kevin K. Tremper, PhD, MD left Los Angeles to become the fourth department chair of anesthesiology at the University of Michigan.



In October of 1990, Kevin Tremper, then Chair of the Department of Anesthesiology at the University of California, Irvine, accepted the position of Professor and Chair of Anesthesiology at the University of Michigan with a starting date of January 1, 1991. His initial vision for the department had several aspects that would ultimately create significant growth over the next decade.

First, a financial model was designed to allow the department to have a positive margin to enable growth of an endowment for academic pursuits. Second, the department was given the directorship of a surgical intensive care unit (Cardiothoracic ICU) to meet the needs of its growing residency and to fulfill the requirements of any first-rate anesthesia department, i.e. clinical leadership of a surgical ICU. Third, funds were allocated so that the department could build, buy, or develop a perioperative information system for the purposes of clinical care, education, and research. It was envisioned that in the future anesthesia departments would use automated systems to collect perioperative data, which would be integrated with the educational program and ultimately produce a database for

clinical research. In 1990, the only system that was available was called Archive and that system had proprietary hardware along with software that was not integrated with the hospital. Therefore, it was not a system that would grow with the institution. Dr. Tremper discussed the need for a new system with the hospital director at that time, John Forsyth, who agreed to place \$1.25 million in an account for the department to initiate this effort. He also agreed that if more funds were required they would be provided. Fourth, the department would be able to have 50% of its faculty appointed in the clinical track to enable expansion of the clinical program to cover service and educational needs. Dean Giles Bole, John Forsyth and the Chair of Surgery (Lazar Greenfield, MD) also supported the directorship of the Cardiothoracic ICU being under the Anesthesiology Department. The financial model and a plan to increase the residency size from 20 to 24 residents per year was also approved.

In January of 1991, Dr. Tremper arrived and initiated in-house faculty call (this was not part of the call system at that time), and a faculty salary program that would provide a clinical incentive shared among all faculty who were participating in the call system. Those who were over 55 years old or had medical contraindications did not have to take call, but also did not receive the clinical bonus/quarterly profit sharing plan. That clinical incentive for taking call was determined every three months depending on the department's profitability, taking half the department's profits for the faculty incentive and the other half invested in an academic endowment in the University of Michigan endowment program: Funds Functioning as Endowment.

Shortly after his arrival Dr. Tremper recruited two faculty from southern California, Ted Sanford, MD, who was at the UC San Diego Department of Anesthesiology to become the Residency

Program Director. He was appointed as a full professor in the clinical track, the first such professor in the department and in the history of the University of Michigan. At that time the clinical track was not encouraged by the University and most faculty were required to be in the instructional tenure track. Recruiting and appointing Ted Sanford in the clinical track made a statement that the Department of Anesthesiology valued clinicians and that a faculty on that pathway could be recognized as a full Professor and a departmental leader. The second recruitment was Dr. Norah Naughton, as the Director of Obstetric Anesthesiology. The department had several clinical subspecialty strengths, a strong group in pediatric anesthesia and a developing group in cardiac and transplant. There was a significant lack in recently trained obstetrical anesthesiologists and intensivists. Dr. Naughton came in as the Director of Obstetric Anesthesiology and over the next two years modernized the OB anesthesia care and initiated a fellowship position, the first fellow being Dr. Linda Polley.

The goal for the next few years was to progressively develop subspecialty-trained faculty groups in cardiac anesthesia, transplant, critical care, neuroanesthesiology, and pain management. During the same period, the residency program was increased in size to 24 per class, with fellows in pediatric anesthesia, obstetrical anesthesia, and pain management.

With respect to research, the primary anesthesiologist research faculty was Paul Knight, who left shortly after Dr. Tremper's arrival to become Chair of Anesthesiology at the University of Buffalo. At that point, Dr. Bert La Du took over as Associate Chair for Anesthesiology Research. Dr. La Du had joined the department after retiring as Chair of the Department of Pharmacology. Dr. La Du was a noted pharmacogeneticist who had identified 25 distinct genetic variations in cholinesterase

that accounted for prolonged action of succinylcholine. In addition to these studies, Dr. La Du also conducted fundamental work on peroxidase enzymes. This family of enzymes inactivates peroxidase and other insecticides as well as nerve gases. They have also been noted to protect against the development of cardiovascular disease.

During the early 1990s a series of fellowships became ACGME approved. A cardiac anesthesia fellowship was initiated in 1992 and became ACGME approved in 2006. A pain fellowship, which had been initiated in 1981, became ACGME approved in 1994. In 1995, the critical care medicine fellowship became ACGME approved. In 1998 the pediatric anesthesia fellowship became ACGME approved, and in 2013 the obstetric anesthesia fellowship became accredited. Also two new fellowships were initiated, the neuroanesthesiology fellowship in 2007, and the regional anesthesia fellowship in 2013.

In the early 1990s the department progressively grew in faculty and clinical services with the expanded number of residents and further development of subspecialty training.

With the election of Bill Clinton in 1992, there was an initial push for a change in healthcare in the U.S. The proposed healthcare changes would put more emphasis on primary care and capitated health systems. At this time the federal government proposed that 55% of graduates from medical schools should enter the primary care fields, with only 45% going into specialties. Medical Schools across the country, including the University of Michigan, emphasized this primary care goal among its graduates and de-emphasized specialty care, noting that there would most likely be a reduction in elective surgical procedures as capitated healthcare moved across the country from west to east.

With this encouragement of primary care and discouragement of specialty care, the specialty of Anesthesiology appeared to be the “poster child” for the specialty that would not be in great demand in the future. This was not only the common theme among medical school deans, but also appeared in the lay press, including the Wall Street Journal. The American Society of Anesthesiologists enlisted the Abt Corporation to develop a needs assessment for anesthesiologists in the future.(5,6,7) That report implied several outcomes with respect to needs for anesthesiologists depending on the supervision ratio of CRNAs in future care. All of these forces ultimately resulted in medical students not choosing to match into Anesthesiology in the 1996. With more than 1800 senior anesthesiology residents in 1996, there were only 143 medical students matching into the field that April. The University of Michigan, which had 24 positions, only matched three, while such prestigious institutions as the University of Pennsylvania matched zero for 24 positions. This produced a significant problem for Michigan and other academic anesthesiology departments throughout the country. Ultimately, applicants from other specialties were recruited into the residency class, allowing the 1996 class at Michigan to be 12 residents, far short of the normal 24. As it turned out, the perceived shortage of anesthesiologists was not to be and the needs for anesthesiologists throughout the country did not diminish, but the damage had been done. The graduating class of 2000 was less than half the size of the graduating class of 1999, and the 2001 and 2002 classes were not much larger. This resulted in a nationwide shortage of anesthesiologists of roughly 4,000. All of these national issues related to anesthesiologist workforce caused difficulties in the further development of the clinical, educational, and research programs at Michigan. Drs. Tremper, Sanford, Rutter, and Paul Reynolds (the chief of pediatric anesthesiology) worked to cover the clinical and educational needs of the institution through this shortage of residents. In 1996, Dr. Tremper met with John Forsyth and received approval to recruit CRNA positions to fill the deficit in

the resident workforce and at the same time to continue to support the services requested for the expanding surgical cases and ORs. In spite of this changing in numbers of residents there was a continued increase in the caseload over these years with additional ORs at the University Hospital and request for services out of the OR. Because of the need for operating rooms, the institution leased a four-room surgery center in Livonia.

British Wave II

Because of the shortage of residents matching into Anesthesiology in the mid-1990s there was a dramatic shortage of faculty in the early 2000s. To help support the needs for faculty, Dr. Tremper contacted directors of the British training programs and planned to increase the number of British visiting faculty from roughly eight to ten per year to a peak of 22 visiting faculty in the year 2000, the second British wave. These visiting faculty from Great Britain allowed the department to cover its clinical and educational obligations when there was a lack of qualified academic faculty graduating from U.S. training programs. At the same time, this enabled Dr. Tremper to select outstanding academic faculty in the early 2000s and hire them as permanent clinical and instructional track faculty and reduce the number of rotators over the decade.

Quality and Safety Initiatives

In October of 2010, Dr. James Bagian was recruited to the department as Professor of Anesthesiology with a joint appointment in the College of Mechanical Engineering. He was also recruited to be the Chief Safety Officer for the University of Michigan Health System. Previously, he served as the first and founding director of the VA National Center for



Patient Safety and as the VA's first Chief Patient Safety Officer where he developed numerous patient safety related tools and programs that have been adopted nationally and internationally. He was a NASA astronaut for over 15 years and is a veteran of two Space Shuttle missions including as the lead mission specialist for the first dedicated Life Sciences Spacelab mission. He is a Fellow of the Aerospace Medical Association, a member of the National Academy of Engineering, the Institute of Medicine, and has received numerous awards for his work in the field of patient safety and aerospace medicine.

In early 2011 Jim was asked to develop and implement a medical team training (MTT) program for all the operating rooms at the University of Michigan. This was undertaken to try to improve patient safety and efficiency in the ORs by facilitating improved communication building on the techniques and tools as demonstrated nationwide at the Department of Veterans Affairs. This MTT effort uses a checklist guided briefing and debriefing to facilitate improved communication. The ORs were closed for half a day so that all personnel could participate in the training. The anesthesia department also spearheaded the development of a formalized debrief system for all the ORs so that items requiring attention could be recorded and implemented to rectify issues identified during cases.

The anesthesia department also introduced the use of systematic physical observations to verify that the MTT tools and techniques were being employed and achieving the results as envisioned. As a result of the information developed through these Jim Bagian secured the support of the institution to use physical observation to assure that the quality and safety processes that were required to be performed were actually being utilized. The observation results also resulted in the institutional

management creating the Perioperative Quality Improvement Committee that was formed and led by Dr. Satya Krishna Ramachandran in the Department of Anesthesiology.

Renewed Research Investment: Dr. Ralph Lydic

During this same period it was felt the department needed to reinvest in basic laboratory research. Three areas were targeted as primary focuses of research interest for the search: anesthetic mechanisms/consciousness, pain, and inflammation. Each of these processes is instrumental to the fundamental properties of anesthesia and the surgical insult. After a nationwide search in the year 2000, the department recruited Ralph Lydic, PhD and his wife Helen Baghdoyan, PhD; who are world recognized researchers in the field of sleep neurobiology (their research has identified brain regions and neurochemical mechanisms regulating states of anesthesia, sleep, and pain). They had been recruited to Penn State University from Harvard where they developed a nationally recognized preclinical research program. They brought their NIH funded research program and over the next few years recruited two other funded sleep researchers, Mark Opp and Gina Poe. Unfortunately, during this time Dr. Bert La Du died of a ruptured abdominal aortic aneurysm as the age 85.

During the 1990s the funds generated from the quarterly investment in academic endowments grew rapidly, as all these funds were invested in the University's Funds Functioning as Endowment pool. These endowment accounts grew at double-digit rates for the decade taking the department's endowment funds from approximately \$600,000 to over \$30 million dollars by the year 2000. Up until this point all interest from the endowment was reinvested into the endowment, thereby producing accelerated appreciation. In the early 2000s, to be able to recruit faculty in the era of faculty shortages, faculty salaries and call incentives had to be increased. Therefore, during that

period the quarterly distribution for taking call was adjusted to approximately equal to the department's margin on operations. In spite of that, because of the impressive returns of realized gains in the University endowment account, the department's academic endowment continued to grow.

Starting in 2005 the time was right to recruit tenure-track academic anesthesiologists in each of the subspecialties: obstetrical anesthesia, pediatric anesthesia, critical care medicine, transplant, neuroanesthesiology, pain, and outcomes research.

In obstetric anesthesia it was Dr. Jill Mhyre, a Robert Woods Johnson Scholar, and later Dr. Melissa Bauer who has fellowships in both critical care and obstetric anesthesiology. Both of these faculty joined Dr. Linda Polley's Obstetric Anesthesiology Research Program. In Pediatric Anesthesiology Dr. Olubukola (Bukky) Nafiu was recruited from Great Britain to conduct research in pediatric obesity and its perioperative consequences. In Critical Care, Dr. Andrew Rosenberg followed by Dr. James Blum and Dr. Michael Maile were recruited.

A British component was added in 2005-06, Dr. David Healy for Head and Neck Anesthesia, Dr. Paul Picton for Transplant Anesthesia, Dr. Satya Krishna Ramachandran for Perioperative Sleep Apnea, as well as several other faculty strengthening our clinical and educational program.

There were several strong US recruits of Dr. Chad Brummett, Dr. Sachin Kheterpal, and Dr. George Mashour; their individual research programs will be discussed in the next section.

The Development of a Perioperative Information System and an Outcomes Research Database:
MorCARE to MPOG

Although with his recruitment in 1990 Dr. Tremper was provided \$1.25 million dollars to develop a perioperative information system, it wasn't until 1995 that an effort was initiated. In 1994, Dr. Michael O'Reilly was recruited from the University of Vermont, who had an interest in basic research in sepsis and also perioperative information systems. In 1995, a project called MorCARE (Michigan operating room CARE) was initiated to develop an RFP (request for proposal) for companies to co-develop a perioperative information system, later to be called AIMS (Anesthesia Information Management Systems). Multiple companies were interviewed and three finalists were selected. In 1998, after two failed searches, the third company on the list, SEC, a start-up software company in Ann Arbor, was chosen. This company's president, Vik Kheterpal, MD, was a graduate of the University of Michigan Medical School and the chief technology officer was Sachin Kheterpal (his brother), also an MD graduate from the University of Michigan. Actually in 1998 and 1999, Sachin was a medical student during the day and a programmer on nights and weekends. The MorCARE system was developed rapidly over the next 18 months and was implemented in the year 2000 in the Main operating rooms and progressed to all sites over the next 12 months. In 2001, the SEC Company was purchased by General Electric (who three years earlier had purchased Marquette Electronics) and Michigan continued as the development site for General Electric perioperative software for the next decade. The MorCARE product's name was changed to Centricity and marketed throughout the country. Sachin Kheterpal became a GE employee for the next four years. In 2005, Dr. Kheterpal, after receiving his MD and an MBA from the University of Michigan

decided to leave GE and return to clinical medicine as an intern and anesthesiology resident in our department. In 2008 he joined the faculty.

Anesthesiology Clinical Research Committee (ACRC)

With the development of a large clinical database from the Centricity system and the recruitment of young assistant professors in the instructional track, multiple individuals were requesting data and conducting observational research studies. It became clear that with multiple faculty attempting to conduct research in the same institution with the same large database, there could be problems with competing or overlapping studies. Therefore, in 2008 the department initiated a committee called the Anesthesiology Clinical Research Committee (ACRC). This committee met monthly (now every other week) and all clinical studies to be conducted in the department must be presented and approved by that committee before they can be initiated. Prior to discussion and presentation to the ACRC the principle investigator must write a comprehensive proposal that is detailed to the degree that it appears very similar to the final submitted manuscript with respect to the introduction, methods, statistics, and references. The initiation of the ACRC has allowed for a high quality of work and ultimately a higher success rate of manuscripts being accepted in high quality journals. This committee is chaired by Dr. Sachin Kheterpal.

Multicenter Perioperative Outcomes Group (MPOG)

In the early 2000s anesthesia information management systems (AIMS) were being progressively accepted and implemented in academic programs throughout the country.



The department at Michigan already used the high resolution database developed from its MorCARE/Centricity database for producing outcomes studies. It was envisioned that if data were shared from multiple academic institutions into one large database, the utility of that large research database would be extremely valuable for perioperative outcomes research. One of the difficulties was that institutions used different AIMS. In addition, there were technical, legal, and “social” reasons inhibiting the sharing of data on a large scale. In February of 2008, Dr. Tremper met with a dozen other academic chairs of large anesthesia departments and discussed the possibility of forming a data-sharing cooperative. He requested that the chairs of interested departments, who had AIMS, support a faculty coming to Ann Arbor in the summer for a meeting to discuss the development of such a data sharing organization. Eight of the departments that had AIMS sent their faculty to this inaugural meeting held in the August of 2008. At that point, Dr. Sachin Kheterpal had just completed his residency and understood the technical aspects of merging data from various AIMS vendors and also had completed large observational research using Michigan’s data. He, therefore, was in a position to understand the technical and academic aspects as well as the utility of such a data-sharing organization. At that meeting the organization was named the Multicenter Perioperative Outcomes Group (MPOG) and all institutions agreed to the basic bylaws. Dr. Sachin Kheterpal would lead this effort. Over the next three years all of these goals were achieved. Under Dr. Kheterpal’s direction with the help of several specialist programmers (ones who had worked on the Centricity program at the University of Michigan), a database was developed that would allow the retrieval and storage of data from various AIMS vendors (Centricity, Picis, CompuRecord, IMDsoft, and EPIC). An umbrella IRB at the University of Michigan was established that would allow data from multiple institutions to be stored and investigated. Data use agreements were obtained from each of the institutions sending data.

As the database grew the MPOG organization had to adopt a mechanism for reviewing and approving proposals for access to the data. A committee was developed called the Perioperative Clinical Research Committee (PCRC), was set-up analogous to the ACRC



developed by the department two years earlier. To date, proposals have been submitted from institutions throughout the U.S.A and Europe.

Lucy Waskell's Research

In 1995, Dr. Lucy Waskell was the first pre-clinical researcher recruited to the VA's Division of Anesthesiology. Dr. Waskell continued her NIH and VA funded research on cytochrome P450 in laboratories provided by the VA Hospital. At the writing of this paper, Dr. Waskell's 30-year NIH- and VA- funded career of impactful research on that crucial enzyme system in the liver has made fundamental contributions to the field.

Expansion of Translational Neuroscience Research

In January of 2007, George Mashour, MD, PhD came to the University of Michigan as the first fellow in neuroanesthesia. He had just completed his anesthesiology residency, and chief residency position, at the Massachusetts General Hospital. Prior to his residency, George had completed his

MD and PhD in neuroscience at Georgetown University and two Fulbright scholarships. He came to the University of Michigan with this significant academic background and the career goal to be both a clinician and scientist with an academic focus to better understand how the brain generates consciousness. Shortly after his arrival, Dr. Mashour responded to an RFP from the American Society of Anesthesiologists (ASA) for individuals who would be interested in investigating the clinical value of a commonly-used brain monitoring device for the operating room. George Mashour was one of two faculty in the country to receive this grant to study the prevention of intraoperative awareness with recall in patients undergoing general anesthesia. The other faculty member was Michael Avidan at Washington University in St. Louis. In the summer of 2008, Drs. Mashour and Avidan initiated what is to date the largest prospective, randomized trial ever attempted in the field of Anesthesiology. More than 26,000 patients were prospectively recruited across 6 hospitals at 4 institutions in the U.S. and Canada. The results of these two massive trials were published as lead articles in the *New England Journal of Medicine* and *Anesthesiology*, as well as other journals. While Dr. Kheterpal's work established an infrastructure for major retrospective observational trials, Dr. Mashour's work established an infrastructure for major prospective interventional trials. This infrastructure would later form the basis for NIH- and institutionally-funded research in perioperative genetics.

While this monumental clinical neuroscience study was being conducted, Dr. Mashour developed NIH-funded basic and translational neuroscience efforts, investigating consciousness using animal models, human volunteers and surgical patients. With a multidisciplinary team of anesthesiologists, neuroscientists, physicists, and biomedical engineers, Mashour was the first to introduce novel network science techniques to the study of brain state transitions during anesthesia. This resulted in

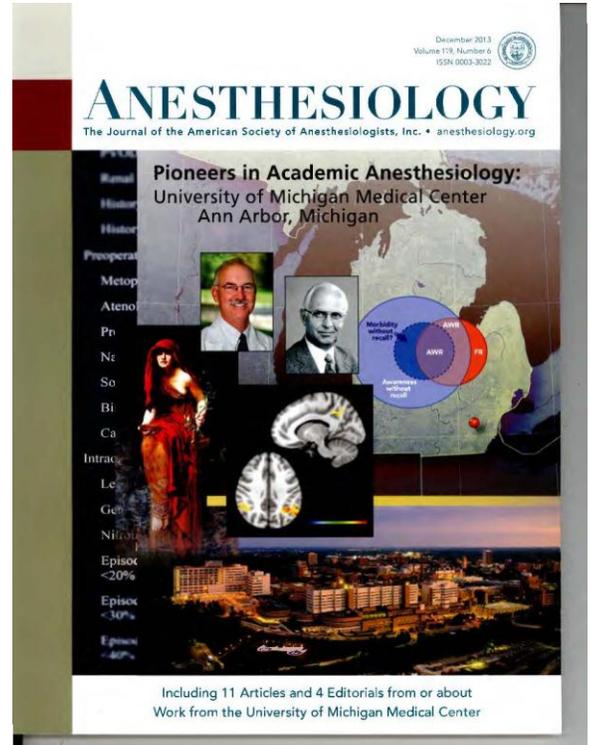
the first study ever to find a common neural mechanism across all major classes of anesthetics, which resulted in a cover article in our flagship journal. The work of Mashour's group also shed light on the neurobiology of the near-death state, attracting worldwide recognition for the department.

Pain Research: Clinical and Translational.

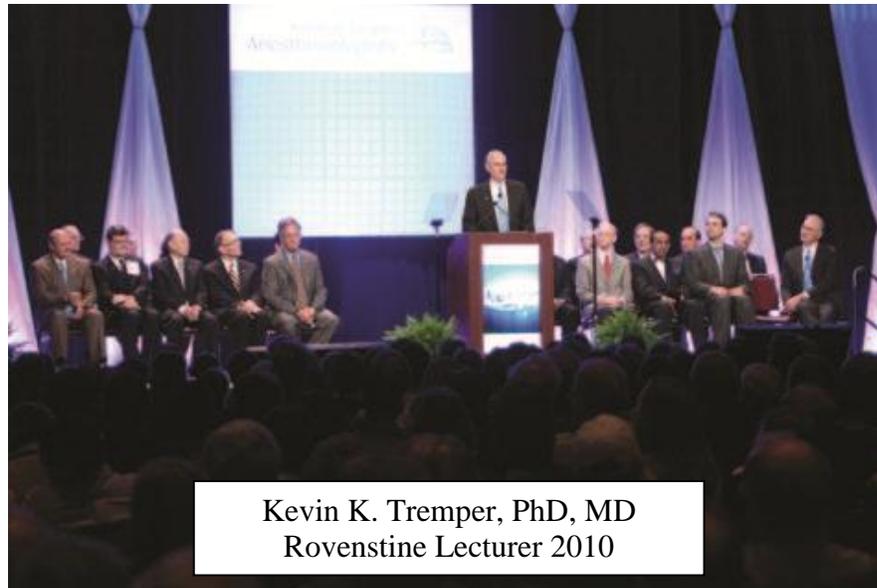
Also in 2008, Dan Clauw, MD joined the Department of Anesthesiology as a senior investigator and research mentor for junior faculty. Dr. Clauw had been recruited to the University of Michigan in 2002 to write the Clinical & Translational Science Award (CTSA) for the institution. After receiving a \$55 million dollar CTSA, Dr. Clauw found that being the administrator of the award was not as interesting to him as conducting his own research, and more importantly, working with young investigators in developing their research careers. Dr. Clauw was a Rheumatologist in the Department of Internal Medicine studying chronic pain and fibromyalgia. The Medicine Department at Michigan did not have a clinical pain group and therefore Dr. Clauw came to Dr. Tremper to request a transfer of his faculty appointment to the Department of Anesthesiology so he could work with the pain faculty in our department. In July of 2008, Dr. Clauw made the official transition to our department and began mentoring junior assistant professors. Over the next three years he was able to assist junior faculty in receiving National Institutes of Health (NIH) funding through the CTSA and directly through the NIH. The NIH funding for clinical research dramatically increased with his assistance and the efforts of these faculty, including Dr. Chad Brummett, Dr. James Blum and Dr. Sachin Kheterpal. With the efforts of these faculty and under his mentorship the department has developed a national and international reputation as a research leader. This is evidenced by Dr. Mashour receiving the ASA Presidential Scholar Award in 2011, and Dr.

Kheterpal receiving it in 2013. In 2012, senior investigator Dr. Ralph Lydic received the ASA Excellence in Research Award. In the December 2013 issue of *Anesthesiology*, the Michigan department was highlighted as a pioneer in research.

That issue has Michigan on the cover and has 14 articles by/or about the University of Michigan (7).



Recognition by the ASA		
2010	Emery A. Rovenstine Lecturer (Ref. 8)	Kevin Tremper, Ph.D., M.D.
2011	Presidential Scholar	George Mashour, M.D., Ph.D.
2012	Excellent in Research Award	Ralph Lydic, Ph.D.
2013	Presidential Scholar	Sachin Kheterpal, M.D.
2013	December Issue, <i>Anesthesiology</i> , Pioneers in Academic Anesthesiology	Department of Anesthesiology University of Michigan
2014	Lewis H. Wright Memorial Lecture	James P. Bagian, MD, PE



Kevin K. Tremper, PhD, MD
Rovenstine Lecturer 2010



Ralph Lydic, PhD



Sachin Kheterpal, MD, MBA



George Mashour, MD, PhD

Medical School's Fast Forward Research Program:

In 2012 the Medical School at the University of Michigan initiated a Fast Forward Research Program to accelerate clinical and laboratory research at Michigan. One-hundred million dollars in funds were allocated to this effort. This research funding came as a follow-up to the University Medical School's purchase of the 170 acre, 2.5 million square foot, Pfizer Research Complex on North Campus. The Department of Anesthesiology moved its Center for Perioperative Outcomes Research (CPOR) to the now renamed, North Campus Research Complex (NCRC). Dr. Sachin Kheterpal is the Director of CPOR which is composed of faculty, statisticians, and 14 computer

science/programmers. This outcomes research group is housed within a building which comprised > 700 outcomes and public health researchers from the University.

The Fast Forward Program requested proposals for innovative research programs which would move Michigan ahead of its academic competitors. In addition to internal Requests for Proposals (RFP) for these innovative research programs, the Medical School decided there was a requirement for two basic infrastructure components that would help the institution move forward in observational research and clinical genetics research. At this time, Dr. Sachin Kheterpal had the largest perioperative clinical research program in the world, housed in the NCRC space. He was approached by the Dean for Research and the Dean of the Medical School to extend his perioperative research data repository to all of clinical care at the University of Michigan Medical Center. This would develop a research data repository of cleaned and categorized data extracted from the electronic medical record. A five-million dollar grant was provided to Dr. Kheterpal to develop this research data repository (RDW).

At the same time the institution wanted to collect blood samples for genetic analysis on a large number of patients, who are consented to allow not only analysis of their genes but allow for follow-up with those patients in the future for research studies. A year prior to this decision, Dr. Chad Brummett had received NIH funding to conduct a focused trial examining the possible genetic components of chronic pain after elective knee surgery. He already had a system for collecting blood samples and consenting patients, and he was also asking by the Dean for Research and the Dean of the Medical School if he could expand his effort to collect 50,000 samples from consented patients to be in this large genetics data repository.

In 2012, both Dr. Kheterpal and Dr. Brummett initiated efforts to develop the institution's infrastructure for observational and genetic research as part of their Fast Forward Research Program.

Subspecialty Clinical Programs and Expansion of Fellowships

During the early 2000s there was an expansion of the residency to 26 and 30 per class, and also the expansion and addition of fellowships. Pediatric Anesthesiology went from seven to nine fellows per year, Pain went from six to seven fellows per year, Critical Care went from two to four to six fellows per year, Cardiac Anesthesiology went from two to four to six fellows per year, Neuroanesthesia was initiated with one to two fellows per year, and Obstetric Anesthesiology one fellow per year. In the year 2013, we initiated a fellowship in Regional Anesthesia. Starting the academic year 2013/14 there were 24 interns, 30 residents per class, and 30 fellows; totaling 144 trainees making the University of Michigan the largest training program in the nation.

From the initiation of the department to the present day the educational and research missions have been driven by and supported by a progressive increase in the clinical caseload in the operating rooms at the University of Michigan. Figure 2 demonstrates how the surgical procedures anesthetics caseload has progressively increased from

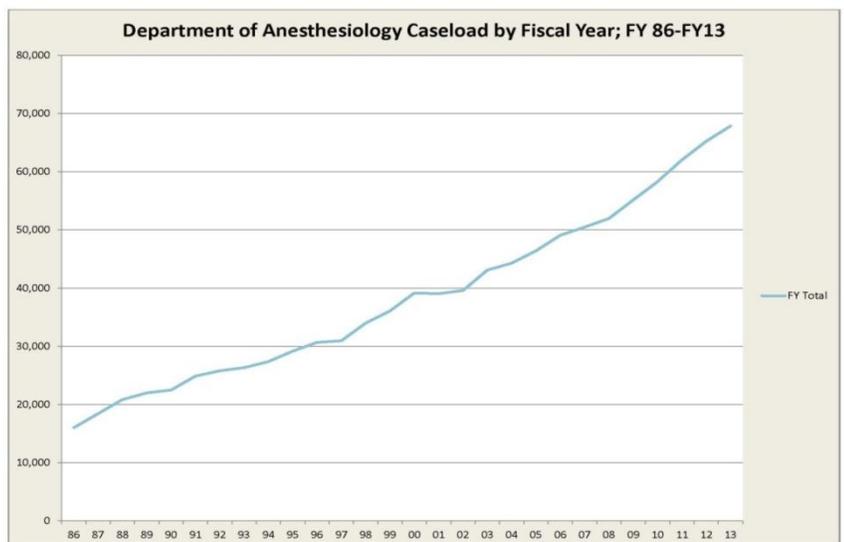


Figure 2.

approximately 16,000 per year 1986 to approaching 70,000 cases per year for 2014. This consistent growth number and diversity of surgical procedures and excellence of the surgical departments at the University of Michigan has been fundamental in enabling the development of an excellent Department of Anesthesiology.

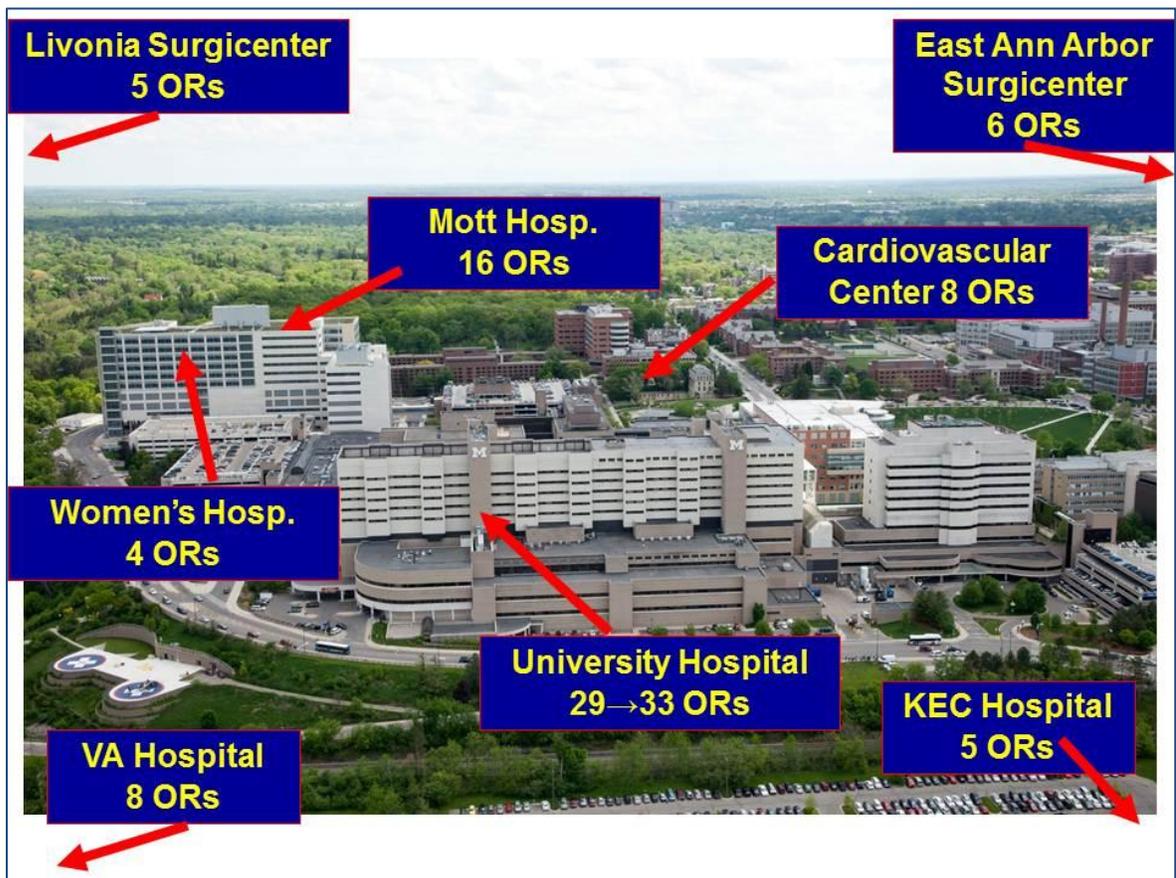


Figure 3. The above figure shows the operative sites as of 2013. Currently, construction is underway to increase the University Hospital ORs from 29 to 33 in 2016. Plans are also underway for a new Neuroscience Tower with 16 ORs which is anticipated to open in 2019.

Conclusion:

The University of Michigan's Department of Anesthesiology has witnessed tremendous growth in the past 50 years. With outstanding clinical care, one of the largest and most advanced education

programs in the country, and an internationally-renowned research program. We have established a unique foundation that we hope will result in remarkable advances over the next 50 years.

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ADDENDUM TO ANESTHESIOLOGY HISTORY: Service and Social Activities

Outreach Mission: Guatemala

Each year since 1999 the department has been involved with the UM Project Shunt medical mission to Guatemala. A group of surgeons, anesthesiologists, nurses, translators and helpers spend one week in Guatemala City taking over an empty operating suite, completely stocking it and operating on children with neurosurgical problems including hydrocephalus, myelomeningocele, tethered cords, diastems and encephaloceles.



Spinal cord abnormalities are very common in Guatemala due to combination of lack of prenatal vitamins, genetics, and a fumartoxin in the maize which blocks folate metabolism. Neurosurgical care for the poor is severely lacking although it is slowly improving.

The mission was started in 1999 by one of our anesthesiology critical care fellows, Judy Negele (now an attending at St Joseph's, Ann Arbor). Brian Woodcock has been involved since 2000. Gingie Gauger has also attended since 2012. We have been taking anesthesiology residents starting with one in



2000, and for the last several years 3 of the CA3s have been able to experience the challenges of anesthesia administration in less than optimal conditions. Deb Wagner, Pharm D, from our department runs a mini OR pharmacy for the team. We have always insisted on adhering to ASA Standards for monitoring but the anesthesia techniques used have been kept as simple as possible. In the early years we used halothane for induction and maintenance. Recently we have changed to sevoflurane for induction and isoflurane for maintenance. The children are intubated using succinylcholine, but need to breathe spontaneously during the case because of the absence of functioning ventilators on the anesthesia machines.

Kenya Summer Clinical Research Program

Dr. Dan Clauw (Professor of Anesthesiology) and Dr. Jeff Punch (Professor of Surgery) developed a student-learning program in Meru, Kenya. This program was integrated into the existing NIH-funded Multidisciplinary Clinical Researchers in Training (MCRIT) Program directed by Dr. Clauw. One element of the MCRIT program is a summer immersion program offered to medical, dental, pharmacy and nursing students to expose them to clinical research early in their training. UMMS students use the same NIH-approved structured curricula and evaluation tools that are required for



the MCRIT Summer Immersion students.

The project is co-led by two faculty who are passionate about the partnership they have been building with this community and the Kenya Ministry of Health for nine years. Students travel to the rural village of Meru, in Kenya, for three weeks



to perform a research practicum. Students may choose to work on an aspect of research designed by former participants, or they may work with faculty mentors to identify their own research questions within the larger annual community health survey that is conducted annually by UM and Kenyan faculty and

students. Some of these projects include: performing a menstrual hygiene assessment and implementing a health education curriculum for secondary schools, which was developed by Dr. Amy Tremper; examining the relationship between in-home cooking facilities and pulmonary diseases, and compiling a digital histology curriculum to share with two local Kenyan universities. The long-term goal is that this – and other planned partnership efforts in this region of Kenya – will create a platform for a much broader exchange between UM faculty and students from many different schools and colleges and two local universities in this region.

Each year, hundreds of UMMS faculty and their global collaborators design, implement, and analyze the results of their joint research. As the Medical School unit charged with facilitating the global health activities of others, Global REACH involvement takes many shapes.

Sometimes this means playing a major role, such as administering a Fogarty International Center Post-doctoral Training Grant. Sometimes it means serving as a facilitator by providing background expertise for a grant application or helping faculty make connections with global partners. Many times, we simply help others celebrate their global work by communicating and sharing information through a variety of media vehicles.

In this section, we highlight some of the newsworthy global health research items that have taken place over the past year at the Medical School. You'll find other research activities throughout the rest of the report.

Photo: Faculty and students from U-M playing with the children at Kithoka Primary School in Meru, Kenya.

A photograph showing a group of children and adults playing in a field. The children are wearing pink shirts and dark pants. The adults are wearing light-colored shirts and pants. They are all smiling and appear to be having fun. The background shows a line of trees and a clear sky.

RESEARCH

Annual Christmas Wish List for the Orphans and Foster Care Children with Wellspring Lutheran Services of Michigan

In 2008, Liz Studley, CRNA at C.S. Mott Children's Hospital and Henry Ford Hospital, began the Christmas Wishlist Program for orphans and foster care children through the Wellspring Lutheran Services organization. The orphanage, New Directions, is a residential facility on eighty acres at 9 Mile and Middlebelt in Farmington. A child must be ten years to eighteen to live in the residential center and prior to that age, any child without a parent or close relative remains in foster care. The state provides the children with food, education, under garments and toiletries. All clothes and toys are used or donated. For almost all of the children, these gifts that we purchase are the only ones that they receive. The department has sponsored over 250 children each year.

Annual Department Holiday Party/Child & Adolescent Psychiatry Holiday Giving

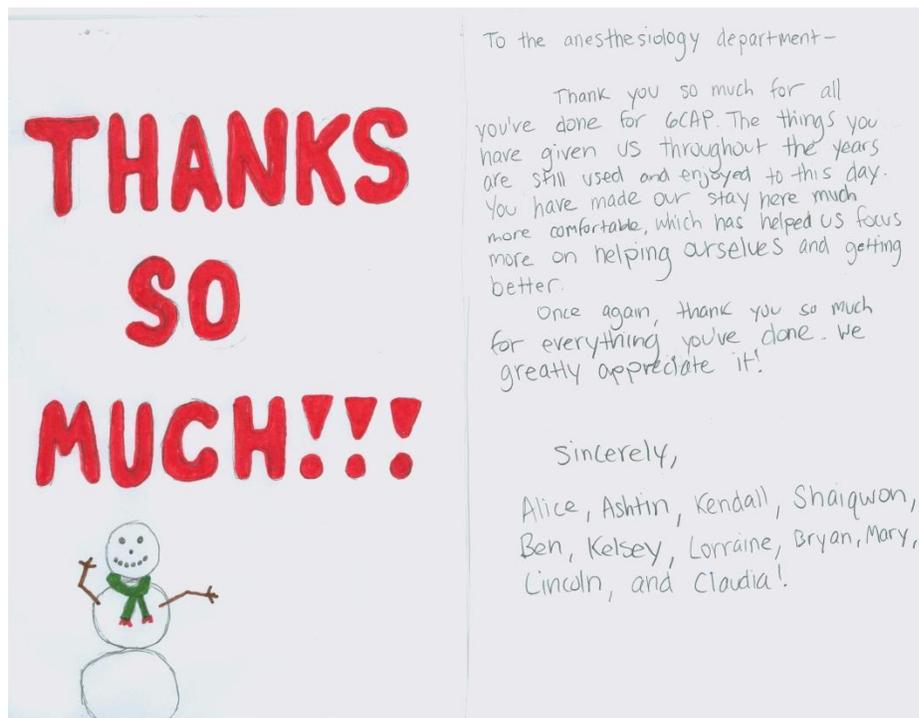
The Department of Anesthesiology hosts one of the largest holiday parties each year, inviting all surgical departments and OR nursing units. With over 500 attendees we have made this a fund raising event too. All beverages are one dollar which is donated to the Child & Adolescent Psychiatry Holiday Program. For over 20 years the department has provided gifts and entertainment to this in-



patient unit. This tradition was started by one of our anesthesia techs who was once a patient in this unit. In 1992, Jenny Mace from the administrative staff took over when this tech left the department. These kids are in a lockdown unit and get very little attention, unlike the Mott children's hospital where there are many groups who visit the children. Each year the department collects money from

several fund raising events which is used to purchase gifts for those children who will be in the hospital over the Christmas holiday. The unit collects wish lists from each child and the department tries to buy two or three items from each list. One of our staff plays the role of Santa, complete with the red suit and beard. We wrap all the gifts and then Santa and his “elves” transport the gifts through the halls of the hospital up to the Child Psych Unit. The trip upstairs is accompanied by our traveling musicians who play holiday carols on fiddles and guitars.

Once we reach the unit the kids gather in the day room and sing carols of their choice. Then Santa arrives with the gifts and everyone enjoys watching each other open their presents. In addition to the gifts for the kids, the department has always been able to purchase at least one large item for the unit. In years past we have provided items such as a DVD player, a Wii player, a Karaoke machine, educational toys and games, yoga mats, movies & books, art supplies, etc.



Summer Picnic

The department has held a summer picnic for all employees for over 20 years at the home/farm of Kevin and Amy Tremper. The picnic is held rain or shine and includes activities such as swimming, fenced in play yard, feeding the sheep, fireworks at dusk, and the annual Faculty vs Resident volleyball championship. To date the score is Faculty 18, Residents 2. (Or at least that is how Dr. Tremper remembers it).



Gasmasters Golf Tournament

Dr. Timothy Rutter has organized the department's annual Gasmasters Golf Tournament for 20 years. This is a popular event among the faculty, residents and alumni, with over 30 teams hitting the greens. The tournament is held on a Saturday in June at Reddeman Farms Golf Club and is followed by a lunch buffet and the awarding of trophies and prizes.



Practical Updates in Anesthesiology: Our Department's Annual CME Course

February 2014 marked the department's 17th Annual Practical Updates in Anesthesiology course held at the Fiesta Americana Hotel in Puerto Vallarta, Mexico. This course was designed to provide the anesthesia provider with a review of the most recent clinical information/literature review from all the subspecialties of Anesthesiology.



Each year on the first week of February, ten faculty (and their families) come to Puerto Vallarta to present two anesthesia update lectures. The lectures are Monday thru Friday mornings from 7:00 am to 11:00 am. Five residents are also selected to present an interesting complex case for discussion. The residents are selected during the year from cases presented to the department at the weekly Thursday morning conference. The residents who present the best five cases are invited to Puerto

Vallarta for a week with their family to represent the case.

The afternoon and evenings are free to enjoy the beautiful Puerto Vallarta attractions, such as, zip-lining, whale watching, dune buggies, golfing, horseback riding, and jungle tours.



There is also great shopping, restaurants, and relaxing by the poolside. It is a great education venue and a wonderful place to spend time with family.



Having fun in Puerto Vallarta!

