virginia society of anesthesiologists

UPDATE

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SUMMER 2022: **INNOVATION IN ANESTHESIA**

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The Modern Era of Pain Management

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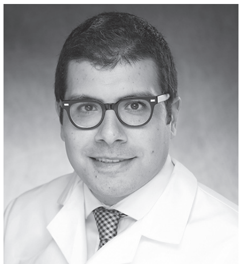

Dr. Maged D. Fam

Innovations in Chronic Pain

The specialty of chronic pain management has gradually evolved over time. Over the last two decades, it has become clear that the field could be on the cusp of an evolution. For years, chronic pain management was primarily limited to long term narcotics management, sharing some minor spinal and joint interventions with interventional radiology and orthopedic surgery. It was not until the introduction of implantable spinal cord stimulators and intrathecal drug delivery systems that signaled a turning point in the field. Successive recent advances in the field were swiftly and widely integrated. Modern pain management practice nowadays is a vibrant specialty, moving away from a prescription-based to pure narcotic-free interventional practice.

Two main factors fueled the evolution in chronic pain management. First, the monstrous magnitude of chronic pain as a healthcare burden. For example, take chronic low back pain (LBP) alone as a surrogate, representing one of the leading cases of all physician visits and believed to impact two thirds of all adults within a lifetime.[1] LBP has a direct financial burden estimated

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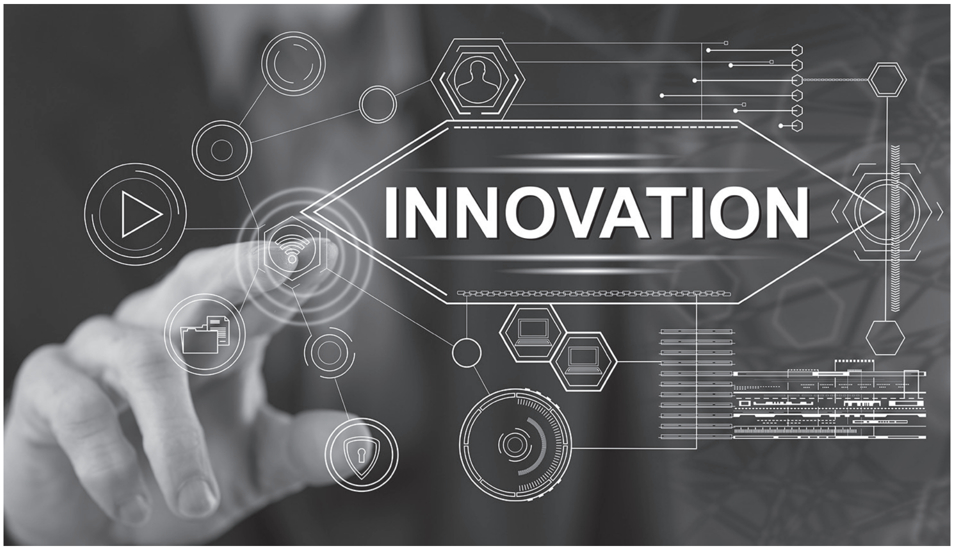
Feature Article



Innovation in Anesthesia: A Doubled-Edged Sword

By Robert H. Thiele, MD
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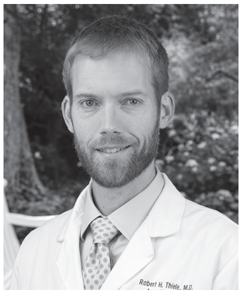

Dr. Robert H. Thiele

Is it possible to accidentally innovate yourself out of a job? Or, more likely, innovate the next generation of "you" (in this case, anesthesiologists) out of a job? Much has been written about the history of innovation, and the narrative typically goes something like this – humans were spending many backbreaking hours every week doing X, so somebody invented Y, and thanks to Y people didn't have to spend as much time doing X, which freed them up to do Z. X could be any number of things - moving objects, hunting animals, picking cotton, sending letters. Y could be the wheel, the longbow, the cotton gin, or email.

But what about Z? One of the interesting features about the last several millennia of innovation is that for most of human history, it hasn't exactly freed up any time for leisure. That "free time" that was saved by inventing "time-saving" technology has traditionally been filled with more work (this might sound familiar to anyone who lived through the transition from paper to electronic medical records). Anthropologists estimate that the average hunter-gatherer spent four hours per day "working" (Sapiens, Chapter 3). Then somebody invented agriculture – suddenly it became possible to grow food, rather

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INNOVATION IN ANESTHESIA

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The ***VSA Update*** newsletter is the publication of the Virginia Society of Anesthesiologists, Inc. It is published quarterly. The VSA encourages physicians to submit announcements of changes in professional status including name changes, mergers, retirements, and additions to their groups, as well as notices of illness or death. Anecdotes of experiences with carriers, hospital administration, patient complaints, or risk management issues may be useful to share with your colleagues. Editorial comment in italics may, on occasion, accompany articles. Letters to the editor, news and comments are welcome and should be directed to: Brooke Trainer, MD • brooke@vsahq.org.

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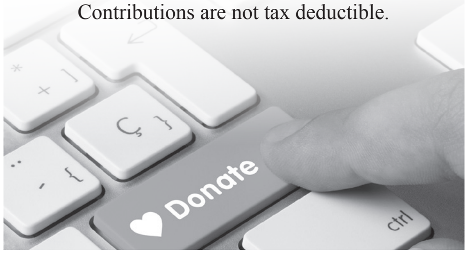

Dr. Takuo Aoyagi: The Man Behind the Pulse Oximeter

By Marie Sankaran-Raval, MD
VSA President


Dr. Marie Sankaran-Raval

As anesthesiologists, we are so fortunate to be at the cutting edge of medicine. We are a specialty dedicated to safety, and when innovation is combined with the pursuit of safety, amazing things can happen.

In 1974, Dr. Takuo Aoyagi PhD (1936 – 2020), a Japanese Bioengineer, completed ground-breaking research that effectively led to the invention of the first pulse oximeter. Dr. Aoyagi, an employee of the Nihon Kohden Corporation, credits Dr. Yoshio Ogino, Nihon Kohden's founder, with a profound influence on his discovery. Ogino said "a skilled physician can treat only a limited number of patients. But an excellent medical instrument can treat countless patients in the world." And thus, the pulse oximeter was born.

Dr. Aoyagi studied dye dilution techniques for measuring cardiac output but noted that arterial pulsation prevented accurate measurement of dye clearance. He focused his work on finding a mathematical calculation to account for the pulsations and calculate oxygen saturation.

While Nihon Kohden failed to create a commercially successful pulse oximeter, many other companies sought to improve upon his discovery. Nellcor (a company in Massachusetts founded by Dr. William New, an Anesthesiologist at Stanford) sought to create a monitor for the operating room. Their device, the Nellcor N-100, was invented in 1983 and was popular in the United States.

Popularity of the device can also be attributed to the 1986 version of the American Society of Anesthesiologists (ASA) Standards for Basic Anesthetic Monitoring, in which the use of pulse oximetry was "encouraged." The revision of the ASA Standard Monitors in 1989 made continuous pulse oximetry under anesthesia an official standard of care across the board.

Interestingly, with the Coronavirus epidemic, we witnessed Dr. Aoyagi's device transcend the hospital setting and reach widespread use. Individuals were able to purchase personal pulse oximeters and monitor themselves at home for signs of respiratory distress and failure. The pulse oximeter has now become somewhat of a household item! Dr. Aoyagi was nominated for the Nobel Prize in Medicine in 2013 and the American Society of Anesthesiologists recognized and honored Dr. Aoyagi with an honorary ASA membership in 2021.

We are excited to share this issue, which explores new technologies and ideas in Anesthesia, including Point of Care Ultrasound (POCUS) and the concept of Innovation and Artificial Intelligence. As a specialty, we should continue to strive to create and innovate.

In the words of Dr. Aoyagi, "1. Conceive the ultimate goal. 2. Notice actual barriers to achieving the ultimate goal. 3. Do what others have not done, and see what others have not seen."

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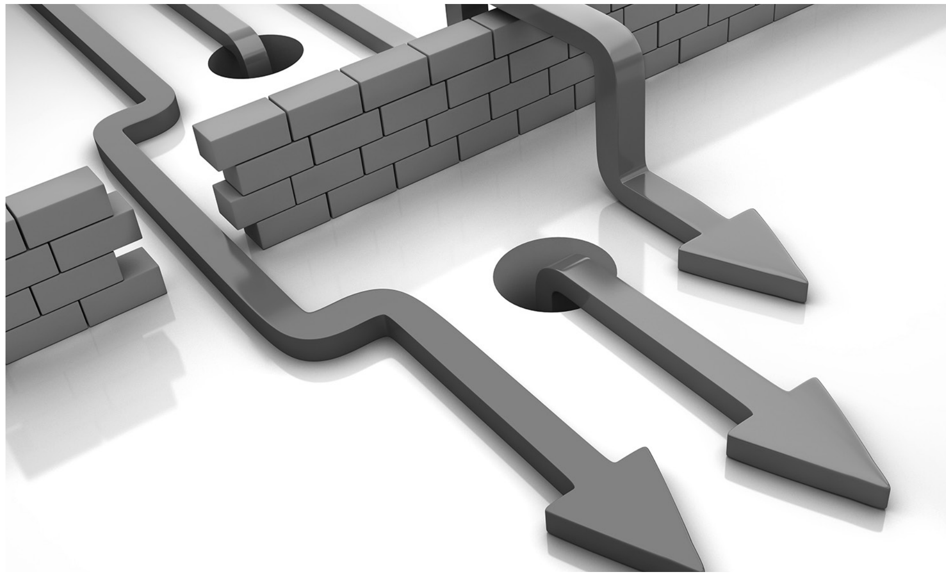
Overcome Obstacles to Incorporate Innovative Therapies into Modern Day Medicine

By Brooke Albright-Trainer, MD, FASA
Editor, VSA Update

Dr. Brooke Albright-Trainer

Three years ago, I encountered a unique and interesting case of a patient with Guillain Barre Syndrome (GBS) that I had the pleasure to participate in, using peripheral nerve stimulation (PNS) to treat his severe neuropathic pain.[1,2] The therapy was an established method of treating neuropathic pain, but had never before been tried in this patient population. The decision to utilize neuromodulation to treat our GBS patient's neuropathic pain was a novel and innovative one at the time, and to date, remains the only reported case. The therapy worked seemingly well, and the patient recovered with minimal disability or residual neuropathic pain at six months. Despite this success, PNS remains a rare, if at all, treatment choice for treating neuropathic pain in GBS. I speculate there are many reasons for this - but a large one being the resistance to adopt and incorporate novel and innovative therapies into modern day practice.



Throughout our careers, physicians will face many obstacles to incorporating novel treatments for patients, especially those with complex diseases, multiple comorbidities, or those with social issues, such as lack of insurance coverage, which further complicates their management. Other major hurdles to overcome in incorporating innovative therapies include 1) lack of evidence on their efficacy 2) lack of time to examine the literature 3) patient reluctance to accept them 4) or lack of availability at certain institutions, to name a few.

Despite these hurdles, physicians must find ways to overcome these obstacles, be thoughtful and creative in their practice, continually searching for ways to improve the quality of care provided to patients. Historically, much of the innovation in medicine has come out of academic institutions, and the reasons for this may not be so obvious. For one, academic physicians see some of the most complex cases, and certainly in higher volumes, than private practice or ambulatory settings, thereby creating a need to search for non-standard innovative therapies. Second, academia have largely been the leaders in quality improvement initiatives, regularly hosting morbidity and mortality conferences, leading root cause analysis discussions, and organizing multidisciplinary team conferences whose purpose is to work together to find creative solutions to systematic problems. And third, many academic institutions are able to offer dedicated research and scholarly time to interested clinicians with novel ideas. However, now with the adoption by CMS to tie payments to quality measures, smaller institutions and practices are finding ways to adopt similar strategies evaluating patient safety, care coordination, use of resources, and clinical processes to improve many aspects of patient care.[3]

Whether it be in the methodology of how patients are treated, the drugs we choose, or the interventions we perform, all of the choices we make as a physician should lead to a better overall outcome for the patient. This issue of the *VSA Update* Newsletter aims to review the many advancements we've made in medicine over the years and introduce provocative and innovative developments in the field of anesthesiology, critical care, and pain management. We hope you are able to find the time to read and enjoy this *Innovative* issue, bringing back some of the concepts learned, and incorporating them into your practice!

Enjoy!

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Anesthesiology Workshop for Medical Students

By Melissa Leaf, DVM
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Melissa Leaf, DVM

On a beautiful spring day in Roanoke, anesthesiologists from Anesthesia Consultants of Virginia shared their professional enthusiasm with medical students from three different schools through a hands-on workshop at Carilion's Simulation Center.

The workshop brought together 55 osteopathic and allopathic students from Liberty University College of Osteopathic Medicine (LUCOM), Edward Via College of Osteopathic Medicine (VCOM-VA), and Virginia Tech Carilion School of Medicine (VTCSOM) in a rare opportunity to learn practical skills while meeting peers from other medical schools.

Students were organized into small groups and rotated through seven physician-led stations: direct laryngoscopy, supraglottic airways, ultrasound-guided regional anesthesia, central lines, neuraxial anesthesia, cricothyroidotomy, and fiberoptic bronchoscopy; and participated in a case discussion and tips for anesthesia clerkships led by Leon Yang, an MS3 at VTCSOM.

"Attending this workshop was truly an amazing experience! I really enjoyed rotating through the various stations and learning more about the day-to-day skills needed to practice as an anesthesiologist," said Caleb Ramey, PharmD, the Anesthesia Special Interest Group Chair at VCOM-VA.

"The small focus groups allowed for students to ask questions throughout each rotation and work closely with the anesthesiologist coordinator for that station. Aside from learning about the various procedures, this workshop provided an environment for the instructors to share pearls of wisdom related to anesthesia practice that will only better prepare us for rotations and residency. My favorite station was the regional anesthesia rotation relating to the identification of various nerves commonly targeted for nerve blocks. As someone who received a nerve block for an Achilles tendon repair surgery, it was very interesting to learn about this technique within the role of a learner instead of a patient."

"I am grateful for VT Carilion School of Medicine, Carilion Clinic, and the instructing anesthesiologists for this special opportunity to learn more about this amazing field."

For many students, this was their first opportunity to practice clinical skills on teaching models, and their participation in the workshop increased their confidence and enthusiasm for upcoming clerkships.

"The anesthesia skills workshop was a great opportunity to learn hands on practical skills alongside our colleagues from both VCOM and VT. I'm grateful for the faculty who took time out of their weekend to make it happen," said Jonas Black, the Anesthesia Student Interest Group President at LUCOM.

Small group discussions touched on current and future challenges of the profession; students were interested in learning about research opportunities and strategies to maintain physician led anesthesia teams. Attendees were encouraged to join the Virginia Society of Anesthesiologists as well as the American Society of Anesthesiologists to engage more with the specialty.

The anesthesiologists who volunteered their Saturday to teach this much-appreciated workshop were Jim Crawford, MD; Matt Fulton, DO; Justin Hickman, MD; Maxine Lee, MD, MBA; Mike Saccocci, DO; Mike Sullivan, MD; and Kevin Vogeley, MD. The event was organized by Christy Sherman, MD.

Caleb summed up the sentiment of many of the attendees by saying "I am grateful for VT Carilion School of Medicine, Carilion Clinic, and the instructing anesthesiologists for this special opportunity to learn more about this amazing field."

Students learn supgraglottic airway techniques with Justin Hickman, MD

Mike Saccocci, DO, instructs a student on how to perform fiberoptic bronchoscopy in difficult to intubate patients.

Students learn airway anatomy before practicing direct laryngoscopy with Jim Crawford, MD

Innovation, *from page 1*

than kill it. But that came at a cost – more work. The upside was more food security and thus the ability to feed more children, but early farmers did NOT work less than their hunter-gatherer forbearers. A similar process occurred during the industrial revolution – steam powered machinery massively increased human productivity but this did not translate into a life of leisure. By 1870, Western Europeans were working an average of 66 hours/week (Enlightenment Now, page 249) and 25% of English children aged 10-14 were members of the labor force (Enlightenment Now, page 231). It is only until more recently that working hours have crept down towards 40/week in developed countries.

Another curious feature of innovation, if one looks at it through a historical lens, is how difficult it can be to spot disruptive technological trends. This phenomenon was nicely described by the late Clayton Christensen's book, *The Innovator's Dilemma*. Essentially, Christensen describes a technological lifecycle in which innovative products are first developed, then dismissed as inferior, then iteratively improved until they eventually replace the dominant product that ignored them. But it doesn't end there – these disruptive technologies will eventually be themselves displaced, and this process repeats itself over and over (records, tapes, CDs, MP3, streaming audio… what is next?). The key to the entire process is the fact that these "inferior" products (e.g. flash memory) initially find niche markets, where they are adopted and exist outside the spotlight. But while they are flying under the proverbial radar, they improve slowly and steadily, until they reach the point where they are ready to replace the dominant technology, and often wreak havoc on the established businesses that ignored them.

This has happened repeatedly in a variety of important industries - cable-based heavy machinery was replaced by "weak" hydraulic machines that were initially relegated to residential yard work but became progressively more capable, eventually wiping out all but one cable pulley machine manufacturer (Link Belt) and leading to a completely new set of established firms (John Deere, Caterpillar, Terex) which will one day also be replaced if they miss the next trend (electric power?). A similar process happened with solid state memory, photographic film (Eastman Kodak famously rejected the digital future of cameras despite the fact that

> *"The advent of artificial intelligence has opened up the possibility that computers could not only do the calculations involved in scientific or technical fields, but perhaps do some of the thinking."*

one of its engineers, Steve Sasson, actually invented the first digital camera), and a myriad of other technologies.

Interestingly, it is not just "things" that are being replaced, and that's what should get the attention of anesthesiologists. If we think of anesthesiologists from a broad, economic perspective, we are "service providers" – yes, we have technical skills, but by and large what we offer are knowledge, experience, and decision-making. And if we look back at history, generally it has been the low-paying, unskilled jobs that get replaced by technology and innovation. That is about to change.

The invention of the first mainframe computer (the Harvard Mark 1, first used in 1943) initiated the era in which computational power began to grow exponentially, as described by Moore's law. But calculating is not the same thing as thinking, and for many years computers were used as "force amplifiers," allowing mathematicians and scientists to work faster. The advent of artificial intelligence has opened up the possibility that computers could not only do the calculations involved in scientific or technical fields, but perhaps do some of the thinking.

Broadly, AI is the science of developing computers that can mimic human tasks, such as visual perception, speech recognition, decision-making. This is all accomplished using several different subcategories of AI – including, but not limited to machine learning, in which large datasets ("training data") are fed into algorithms which use multiple techniques to improve through experience; neural networks, a subset of machine learning that models the human brain (a computational system with a large number of interconnected processing units); deep learning, which uses especially large neural networks that utilize multi-layered processing units; and computer vision, which uses neural networks and deep learning to accurately identify images or videos.

Unsurprisingly, AI has started to encroach on the realm of human intelligence, at least if we define AI as mimicking human tasks. In 1997, IBM's Deep Blue first defeated Gary Kasparov in a six game series of chess. In 2011, IBM's Watson defeated Ken Jennings in Jeopardy and Google's X lab built a neural network that could reliably find cats in Youtube videos (even machines love internet cats!). In 2016 AlphaGo defeated the greatest Go player in the world, Lee Sedol, four games to one in a series of five games.

It's easy to dismiss these feats as exercises in mere computational power and brute force, because chess and Go both follow strict rules. Indeed, after his loss to Deep Blue, a bitter Gary Kasparov remarked "Deep Blue was intelligent the way your programmable alarm clock is intelligent. Not that losing to a $10 million alarm clock made me feel any better." More recent accomplishments in AI are far more impressive, and from the perspective of a professional in a primarily cognitive discipline, worrisome. In 2017, Deepstack became the first AI to consistently beat humans in heads-up no-limit poker, which was especially meaningful as it's an "imperfect information game" and must take into account uncertainty. In 2018, Alibaba introduced AI that can outscore humans taking the Stanford University reading and comprehension test. Jukebox, a product of OpenAI, has trained its music-generation neural network on 1.2 million songs, and can generate de novo music – search "Jazz, in the style of Ella Fitzgerald" on Soundcloud for an example - in addition to creating "deepfake" covers (e.g. Jay-Z singing Shakespeare's Hamlet soliloquy). A growing number of companies including The Associated Press, Reuters, The New York Times, The Washington Post, and Commerzbank are investing in natural language generation (NLG) capable of writing without a writer [Forbes 2021]. In fact, the AP artificially generates 30,000 draft articles of local news per day based purely on publicly available data, which can then be picked up and "finished" by human writers. The majority of analyst reports published by Commerzbank are now

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written by AI. And all of this occurred in the pre-quantum computing era. In 2019, a quantum computer made by Google (and named Sycamore) completed a calculation that would have taken the world's best "classical" supercomputer 10,000 years to complete (or 2.5 years according to IBM). It took Sycamore 3 minutes and 20 seconds.

What does all this have to do with anesthesiology? Our specialty is famous for leveraging technology to improve outcomes, as detailed by the Institute of Medicine in its book *To Err Is Human: Building a Safer Health System*: "Anesthesiology is an example of a local, but complex, high-risk, dynamic patient care system in which there has been notably reduced error. Responding to rising malpractice premiums in the mid-1980s, anesthesiologists confronted the safety issues presented by the need for continuing vigilance during long operations but punctuated by the need for rapid problem evaluation and action. They were faced with a heterogeneity of design in anesthesia devices; fatigue and sleep deprivation; and competing institutional, professional, and patient care priorities. By a combination of technological advances (most notably the pulse oximeter), standardization of equipment, and changes in training, they were able to bring about major, sustained, widespread reduction in morbidity and mortality attributable to the administration of anesthesia."

But there is only so much juice to be squeezed out of the physical technology lemon, in particular in the operating room, which is the anesthesiologist's domain. Yes, there is always going to be some room for improved monitoring devices, in particular in the areas of continuous and/or more accurate non-invasive blood pressure monitoring, more advanced brain monitoring including depth of anesthesia monitors, cerebral oximetry devices which give absolute saturation values, and ultimately real-time cerebral autoregulatory curves. But, as in most of the rest of the world, the next wave of technological advancement will not be physical, it will be cognitive.

Already, Europeans are well on their way to using closed loop feedback to maintain stable depth of anesthesia guided by processed EEG (not yet approved by the FDA) as well as to achieve hemodynamic control and manage ventilator settings [PMID: 31939839]. Substantial work is also underway in the United States to develop closed loop hemodynamic management (see Maxime Cannesson's research at UC Irvine and now UCLA). At the same time, vast amounts of data are pouring into the Multicenter Perioperative Outcomes Group (MPOG) as well as large, single institution databases (Cleveland Clinic), and these data are perfectly primed to "feed" machine learning algorithms. Predictive monitoring, while not mainstream, is coming, with the Edwards Hypotensive Prediction Index achieving FDA 501K clearance in 2021.

Our next opportunity as a specialty will be to leverage the growing power of artificial intelligence to augment our intraoperative decision-making. An obvious place to start might be decisions regarding neuromuscular blockade – an area in which anesthesiologists are shockingly deficient (a recent survey of over 2,000 anesthesiologists yielded a 57% composite score, with a mean confidence of 84% [PMID: 31094776], and our reluctance to adhere to expert guidelines is perplexing in its own right [Renew JR. APSF Oct 2021]). Or in ventilator management, with an inexplicable number of patients still receiving tidal volumes > 10 mL/kg [PMID: 26332856]. From these basic elements, more complex tasks can be added over time.

Suddenly innovation is starting to look a lot like a double-edged sword. Will we be the healthcare equivalent of Uber drivers, racking up miles and miles of data (or anesthesia minutes) so that one day Uber (or Drager) can get rid of the driver altogether? One might reasonably ask, what is the future role of the anesthesiologist? And while I don't have a clear answer to that important question (and neither does anyone else), there's a reason that Christensen described "medical doctors" as an established technology ripe for "disruption," his euphemism for elimination."

When we think about how to innovate, a few principles should be kept in mind. First and foremost, resisting innovation is futile. AI is coming to healthcare and it is coming to anesthesia. Midlevel providers will grow their footprint in every single medical specialty, including ours. Far better to think about how we might function in this new ecosystem than fight it tooth and nail.

Second, pay close attention to the economics. The US debt is $30 trillion and growing, healthcare consumes 18% of our GDP, and our future liabilities are staggering – the pressure to lower the cost of care, including physician salaries (most likely by freezing wages or eating away at them through inflation) will be immense. And while there is currently a huge shortage of healthcare providers, it will be far cheaper to fill these vacant positions with professionals who aren't six or seven figures in debt and expecting to earn top 1% income.

Third, data matters. Given how expensive it is to train (and employ) anesthesiologists, the onus is on us to quantitatively demonstrate our value, not the other way around. Fourth, start by identifying important problems that need to be solved, rather than inventing solutions in search of a problem (e.g. the Perioperative Surgical Home). Fifth, think outside the box and leverage the experience of people who work in a discipline completely different from your own – a shocking number of Noble Prize laureates, for instances, are amateur actors [Range: Why Generalists Triumph in a Specialized World]

My sense is that in the coming decades, anesthesiology as a specialty will bifurcate. A small number of academic or industry-funded physician scientists will push the envelope on the new wave of technology to be unleashed on our specialty, analogous to the automation engineers hired by firms to discover all of the ways humans can be replaced with machines or algorithms. The rest of us will find ourselves caring for an increasing number of patients, aided by a combination of both artificial intelligence and a multi-layered matrix of midlevel providers, much like the modern intensive care unit which might have one attending physician (who may be on another continent), six midlevel providers, twelve bedside nurses, two respiratory therapists, a handful of prediction algorithms and best practice alerts guiding the care of eighteen critically ill patients.

To be clear, AI has a long way to go (both from a scientific and regulatory perspective) before it can reliably be used in healthcare. But for our trainees and junior colleagues, who will inherit this specialty, acknowledging the possibility of this new reality is the first step in living up to Billy Beane's infamous maxim from Moneyball – "adapt or die."

at $560-635 billion annually or $2000 per capita, and add to that the cost of productivity loss (missed workdays) of $297-336 billion annually. [2] Second, the void created by the increased awareness of the narcotics pandemic. These two factors alone justified the strategic funneling of resources into the pursuit of novel therapeutics and innovations in managing chronic pain, and culminated in a boost in research output over the last decade. In this article, I will touch on the latest advances in basic, translational, and clinical pain research that is paving the way for the renaissance era of contemporary pain management.

Novel Drug Therapies

Through molecular cloning of voltage-gated sodium channels (VGSCs), scientists confirmed a significant role of these channels in regulating neuronal excitability in normal and pathological pain states. It is now known that the NaV1 VGSC family consists of nine members, NaV1.1–1.9 encoded by identified genes (SCN- group) according to the alpha subunit. [3] These are key determinants of excitability integrating the generator potential within nerve terminals and initiating the all-or-none action potential, the propagation of action potentials to the central nervous system (CNS), and finally neurotransmitter release. Once a stimulus has been applied to a sensory terminal, a transduction element is activated, resulting in an ion flux. VGSCs are then required to amplify this signal (termed a generator potential), which, once threshold is reached, triggers a regenerative action potential, transmitting this information to the spinal cord. VGSC subunits have differing kinetics and distinct patterns of expression, reflecting the functional groupings of sensory neurons. The expression of these sodium channel isoforms is expressed in several organs, with roles in cardiovascular, respiratory and neuronal function. Receptors are spatially and temporally regulated, and they possess distinct electrophysiological properties. Although non- selective NaV blockers can provide useful pain relief — local anesthetics such as the generic drug lidocaine, for example — the generalized nerve block and unwanted side effects, such as dizziness, underscore the need for enhanced selectivity to tap wider pain targets. Among these channel subtypes, Nav1.7, Nav1.8 (selectively expressed in DRG neurons) have been the center of research aiming to uncover the roles of these channels in the development and maintenance of chronic pain.

The discovery that Nav1.7 could have a central role in pain signaling began when a group of researchers in China in 2004, showed that patients with an inherited persistent pain syndrome called erythromelalgia had point mutations in SCN9A, the gene that encodes Nav1.7. [4] The following year, Waxman and colleagues at Yale University discovered that such mutations caused a gain-of-function alterations in Nav1.7, leading to pain hypersensitivity. [5] Around the same time, researchers in the John Wood neurobiology laboratory at University College London, showed that loss-of-function mutations abolished pain perception. Indeed, mice with conditional knockout of Nav1.7 were insensitive to inflammatory pain. In 2006, medical geneticist Geoff Woods, from Cambridge, reported in *Nature* journal that children from three families in Pakistan seemed incapable of experiencing pain. The children earned money as street performers, walking on hot coals and cutting their arms with blades. Genome sequencing revealed that these individuals had loss-of-function Nav1.7 mutations. [6] A condition later called Congenital Insensitivity to Pain (CIP). Together, these studies marked Nav1.7 out as a crucial mediator of pain.

Extensive bench research took place to validate the therapeutic potential of a selective NaV blocker. The challenge came when pharmaceutical companies tried to translate this into a drug for clinical use, only to be faced by the inherent inability of animal models to express the complexities of pain states in humans. More specifically, the very close biochemical similarity between the receptors that translate into difficulty in achieving a high degree of channel subtype selectivity. Indeed, many early phase clinical trials were challenged with failure. The presence of robust genetic and pre-clinical data supporting the role of selective NaV blockers, along with the dire need for novel pain drugs after the opioid crisis, only meant that more work is needed to hone in on the right biochemical structure that could achieve receptor subtype selectivity and subsequently deliver the therapeutic benefit. Indeed, only a few months ago, Vertex pharmaceuticals announced positive results from two Phase 2 proof-of-concept studies that investigated treatment with the selective NaV1.8 inhibitor VX-548 for acute pain following abdominoplasty surgery or bunionectomy surgery. [7] Treatment with an initial dose of 100 mg followed by 50 mg every 12 hours of VX-548 (high-dose) compared to placebo resulted in a rapid, statistically significant and clinically meaningful improvement in the primary endpoint of the time-weighted Sum of Pain Intensity Difference over 48 hours (SPID48), which was consistent in both trials. Investigators reported that the drug was generally well tolerated in both studies. Some other early phase clinical trials on selective NaV blockers reported drug safety, but a therapeutic effect that failed to achieve statistical significance. It remains to be seen in the coming years if a selective NaV blocker will make its way to the clinical world.

Degenerative Disc Disease

Another major territory where research is making big strides is degenerative disc disease (DDD) therapy. Translational research

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utilizes animal models to better understand the pathophysiology of intervertebral disc (IVD) degeneration at the cellular level, in order to depict therapeutic targets that can slow down or even reverse the degenerative process, a concept referred to as regenerative medicine. The IVD is comprised mostly of hypocellular avascular tissue with only 1% cells per volume. IVD cells, primarily nucleus pulposus and Annulus fibrosus (AF) cells, are responsible for synthesis and maintenance of the disc matrix. They are accustomed to survive in low oxygen environment. AF cells were also found to have pleuripotent stem cell potential and are able to differentiate into cartilage and/or fibrocartilage cells, osteoblasts, neurons, and endothelial cells to adapt to different stressors.

When IVD cells were studied, both from patients undergoing discectomy and animal models, we have come to learn more about their biological behavior. First, there is a steady slow decline in cell viability with aging that starts from childhood. At least partially explained by thinning of the vertebral end plates and subsequent decline in nutritional supply, which is further influenced by mechanical stressors. In addition, even for living cells, they found a gradual reduced ability to synthesize extra-cellular matrix, increased catabolic metabolism, pro-inflammatory state and reduced growth factor secretion. Cultured IVD cells have shown to respond to increased proliferation by growth factors like TGF-beta, BMP-2, and Osteogenic protein-1. [8]

While terminal stages of DDD with complete loss of cellularity and disc integrity are unsalvageable and require surgical disc grafting, earlier stages could be amenable for treatment. In early DDD, disc cellularity is maintained but have reduced function due to senility or inflammation, leading to loss of extracellular matrix, dehydration, loss of disc height, and other pathognomonic features of DDD. In theory, stimulation by gene therapy or biological agents like Bone Morphogenic Protein, TGF-beta, GDF-5 could be used at these early stages to suppress inflammation and stimulate synthesis of proteoglycans. One of the earliest works on the use of biological agents came from UCSF by Walsh et al in 2004. In their experiment, IVD of mice models was injected with transforming growth factor-β, insulin-like growth factor-1, basic fibroblast growth factor, or saline as control. [9] Comparisons of disc morphology, annular cell density, proliferating cells, disc height, aggrecans, and type II collagen gene expression, were made at 1 week and 4 weeks post-injection. The study results showed that TGF-beta resulted in increased disc cellularity and disc height. In 2010, Liang et al from University of Virginia, reported similar results using an adenovirus vector to induce GDF-5 (Growth and Development factor 5), a member of the Bone Morphogenic proteins, known to induce proteogylcans and collagen synthesis by chondrocytes.[10]

"Over the last decade, western healthcare has moved towards more minimally invasive procedures, adopting the advancements and widespread use of medical imaging."

As the disease progresses, the disc structure might be grossly preserved but cells start to decline in number, hence, induction therapy would not be effective. At this stage, stem cells implantation is necessary for regeneration. Many studies followed on the use of pleuripotent stem cells for slowing or reversing DDD in animal models. Different cell lines were used and compared to native IVD stem cells including bone marrow and adipose tissue derived stem cells. Studies also looked at whether pre-treatment of cultures stem cells with growth factors or genetic pre-programming prior to intradiscal injection, can maximize the cells viability and capacity for differentiation. [11-13]

The big body of literature and abundance of pre-clinical data naturally led to clinical trials on human subjects. In 2010, Yoshikawa et al, from Japan, reported two cases who underwent laminectomy for lumbar canal stenosis who underwent pre-operative bone marrow aspiration and isolation of stem cells. [14] Cells were then impregnated into small pieces of acellular collagen sponges that were seeded into the disc space during surgery. Authors report sustained clinical improvement at two years with MRI findings of increased disc height and signal intensity. Another case series by Orosco et al from Spain, involved intra-discal injection of autologous bone marrow derived stem cells in patients with chronic low back pain. Authors reported no change in disc height but significant symptomatic improvement that is most notable within the first three months and increase MRI signal intensity. [15] Pettine et al, published their results on 26 patients in an open label pilot study where patients received autologous bone marrow concentrate intradiscal injections in one or two levels. Investigators reported a substantial reduction in pain and disability indices that was more pronounced in subjects younger than 40 years and with higher cell concentration. [16] In 2017, a single arm phase I trial by Kumar et al involving 10 patients with chronic low back pain who underwent single intra-discal injection of adipose-tissue derived stem cells and followed for a year. Their study reported no procedural or stem-cell related adverse events. In addition, seven had significant improvement in pain scores and three had increase signal intensity on MRI. [17] There is currently few actively recruiting clinical trials aiming to investigate the therapeutic potential of intra-discal stem cell injections and compare it to conventional interventions like epidural steroid injections. Whilst it is still premature to form any expectations of cell-based regenerative therapy, successive positive results could usher a breakthrough in the management of DDD for millions of patients.

Minimally Invasive Spine Surgery for Pain Management

Over the last decade, western healthcare has moved towards more minimally invasive procedures, adopting the advancements and widespread use of medical imaging. These procedures tend to have minimal morbidity and mortality, but also cut the length of hospital stay and overall costs. The trend encouraged biotechnology companies and clinicians to develop and test novel therapeutic interventions targeting causes of low back pain. Interspinous spacer (ISS) devices were first used by neurosurgeons in high-risk surgical patients as a quick and technically

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simple open procedure with minimal destabilization of the spine mechanics. The procedure was done through a small midline incision and involved short time under general anesthesia compared to conventional laminectomy. Conceptually, distraction of the spinous processes within a spinal level can decompress the spinal canal by unbuckling the ligamentum flavum and stretching facet joint complexes. To a lesser extent, this distraction can also increase the distance between pedicles within that segment and could relieve neuroforaminal stenosis and radicular pain. Newer iterations of the ISS utilized the same concept but with much smaller incision and using fluoroscopic guidance. The newer systems have interlocking arms that, once in the interspinous space, can be hinged opened and locked using the introducer. This technology avoided problems with older generations which were less secure but also served to further decrease the tissue disruption, duration of procedure and recovery. Placement of ISS devices are now done with minimal sedation in a pain clinic or ambulatory center and the patient walks out within an hour or two. Latest versions of ISS now utilize a lateral intermuscular approach aiming to minimize disruption of the posterior ligamentous complex, spacer arms have anchors to grab onto the spinous processes for firm immobilization. Moreover, new spacers have a cavity that is filled with bone graft material offering more durable stabilization and potentially "fusion" of the posterior elements.

Percutaneous image-guided lumbar decompression (PILD) is another novel treatment that has reached clinical practice. The procedure primarily aims at relieving lumbar canal stenosis caused by degenerative ligamentum flavum hypertrophy. It serves to fill a gap in the treatment algorithm as an intervention that is more definitive than lumbar epidural steroid injection (LESI) but less invasive than open surgery. PILD is defined by the Centers for Medicare and Medicaid Services (CMS) as a minimally invasive technique to debulk the posterior elements of the spine (lamina and ligamentum flavum) using instrumentation in an image-guided (CT or fluoroscopy) fashion, with the assistance of contrast media to evaluate the effects of treatment on the compressed area via an epidurogram. The current system on the market, MILDÆ, for minimally invasive lumbar decompression, uses a very small (5mm) midline incision, a trocar-portal system is then introduced over a guide wire and positioned under fluoroscopic guidance. Once the positional is confirmed, the trocar is withdrawn and bone rongeur is introduced through the port, and the chips of the inferior lamina, and then the medial surface of the superior lamina are removed, and it is worked gradually toward the lateral lamina. Once the bony lamina is trimmed, the tissue sculptor is used to resect ligamentum flavum. The procedure typically takes less than an hour and patients go home the same day. Several studies came out between 2010 and 2014 on smaller groups demonstrating the safety and efficacy of PILD. It was not until 2012, that the first RCT came out from Florida. In this trial, 38 subjects were randomized to either PILD or LESI and followed for 12 weeks. Outcomes in the form of pain scores and disability indices demonstrated higher patient satisfaction with PILD vs. LESI, and sustained improvement of PILD, through the 12-week duration of the study. [18] In 2016, the 6-month and 12-month results of the MiDAS ENCORE study, a collaborative work between Johns Hopkins and University of Illinois were published. In the trial, 302 subjects were randomized to PILD or LESI and followed for 1 year. The PILD group had a 58% responder rate, compared to 27% for the LESI, with a primary safety endpoint demonstrating no difference between PILD and LESI. [19] Their two-year outcomes where later published confirming sustained improvement and long term durability. [20]

> *It is clear, however, that the pace with which pain management is evolving, emerging after the opioid pandemic, is reshaping itself into a modern clinical specialty utilizing cutting edge technologies to offer best outcomes for patients.*

Minimally invasive sacroiliac joint fusion is another novel technique that recently made its way to the pain management practice. Sacro-ilitis is commonly encountered in pain medicine as one of the common causes of axial low back pain. It is believed to account for 15–25% of patients with axial low back pain, and up to 40% of patients with ongoing pain following lumbar fusion. Short of open surgical fusion, treatment options were limited to long term pain medications and SI steroid injections. Recent advances in the treatment of SI joint pain have led to the development of a wide variety of SI joint fusion devices. These fusion devices seek to stabilize the joints themselves to become immobile and, in theory, can no longer be a source for pain. earlier systems utilized a lateral approach fusion and were performed by orthopedic surgeons since 2009. In lateral fusion, three titanium implants are surgically placed traversing the SI joint. Safety, effectiveness, and durability has been validated in many clinical studies since then. In 2017, a novel system, ControLoc Æ was introduced as a minimally invasive posterior approach SI fusion device. The system consists of two cortical allografts that are placed orthogonally to prevent migration and SIJ disruption. Placement involves a few steps of guidewire localization of the joint space under fluoroscopic guidance, dilation, and limited decortication, followed by placement of each of the stabilization implants through two small 1-2 cm paramedian incisions. CornerLoc does not contain any metal and does not require general anesthesia. The procedure is performed under intravenous sedation and local anesthesia and takes 45 minutes to perform. Whilst clinical trials are currently enrolling to investigate the effectiveness and durability of the system, ControLoc is being slowly adopted by interventional pain physicians across the country.

Conclusion

All these new innovations, and many others, remain a work in progress and we are yet to see which of these will establish itself in clinical practice and what will fall out of favor. It is clear, however, that the pace with which pain management is evolving, emerging after the opioid pandemic, is reshaping itself into a modern clinical specialty utilizing cutting edge technologies to offer best outcomes for patients.

Modern Era, *from page 10*

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Genetic Innovations in Pain Medicine

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Dr. Brian Brenner

"It still hurts, I just don't understand what is going on."

This is an almost daily conversation I have with my mom, a veterinarian, personal trainer, and health enthusiast who has been suffering from chronic pain for much of her adult life. Until her diagnosis of lupus when I was an adolescent, she suffered in silence, making sure life for my sister and I was not interrupted by her pain. The appearance of weakness was not an option; being a mother at the "prime of her life", pain was an internal cross to bear.

The diagnosis of lupus, harsh treatments, and immunosuppression were slowly creating problems that were almost as bad as the disease itself. Life became a game of trying to modify any factor possible to beat the autoimmune disease and the sequelae that came with it. For many chronic pain patients, suffering is one of the most complex and frustrating parts of their disease, but it is entirely unique to each individual. It can take extremely motivated people like my mother and leave them frustrated, angry, and confused. In spite of doing everything right, they still carry pain and remain less functional than they strive for, often bound by their symptoms.

Chronic pain has many causes, and the cumulative disability can be life-altering. We use many sophisticated methods and medications to try and combat things like autoimmune disease. We can turn off cell signaling pathways, target specific cellular receptors, and diminish immune cell responses. These treatments have created moderate success in the treatment of things like lupus by altering the inflammatory response and aberrancy in white blood cell activation that has tricked the body into breaking itself down. In spite of medicine's best effort at taming the beasts that are complex chronic diseases, autoimmune diseases, along with numerous other conditions, often leave a wake of "scorched earth" in those afflicted by them in the form of chronic pain. Our best treatments frequently leave patients with broken neuronal and nociceptive wiring that has proven to be exceptionally challenging to manage, oftentimes more debilitating than the original insult.

In recent years, treatment modalities in pain medicine have been stagnant with the exception of new innovations in neuromodulation and interventional procedures. While promising, our armamentarium of medications and targeted therapy for chronic pain is limited at best. Cohen et al recently published a review article on the best practices and new advances in chronic pain in the Lancet, identifying precision medicine and gene therapy as a few of the most promising areas of future research in the field.[1] Of which, I had a recently stimulating conversation with my significant other, a budding virologist, on the topic of epigenetic regulation and pain. A hot topic in science and medicine in general, the idea of selected gene therapy seems close on the horizon in the arena of pain management. A paper was published earlier this year on the utilization of the CRISPR-Cas9DNA endonuclease motif in the epigenetic repression of the ever-elusive NaV1.7 gene.[2] The NaV1.7 gene encodes a sodium channel identified in individuals with hereditary insensitivity to pain; people with mutations in this gene's expression have no or minimal sensation to noxious stimuli. The opposite of chronic pain, the absence of pain, is a phenotype that leads to morbidity and mortality in its patients as well. Pain is an inherent mechanism designed by the body for homeostasis, aberrant pain causes undue duress; while no pain can be pathologic leading to diseases of "unawareness" such as sacral, extremity ulcers, and wounds. Many people have attempted to create inhibitors of the NaV1.7 gene via various avenues since its identification in 2006 but have been unsuccessful. The introduction of the CRISPR-Cas9 system as a potential human gene-editing tool in 2015 has opened a new door into possible clinical therapeutic technologies.

A recently published paper in March of 2021 by Moreno et al has used the power of the gene specific CRISPR system with a novel "dead"/nonfunctional Cas9 endonuclease to take another stab at the NaV1.7 gene. Essentially, their "dead" Cas9 (CRISPRi) is a binding motif that sits on the gene of interest but does not cleave or break its inherent DNA structure.[2] Equally as popular in the world of basic science now is the concept of reversible "epigenetic" modifications in gene expression. That is, using signaling molecules that cause 3D conformational changes in gene structure that render it ac-

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Point of Care Ultrasound: The Future is Now

By Keith A. May, MD, FASA
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Dr. Keith A. May

Technology has come a long way in a decade. When I finished training in 2007, the first iPhone had just been released, peripheral nerve blocks were still being performed with nerve stimulators, and central lines were placed using landmark technique. I still remember drawing out the relevant surface anatomy on my patients prior to procedures, and the frustration of dialing the nerve stimulator up and down to get a twitch at just the right amperage. Then entered ultrasound. I can now place a probe on my patient, obtain the appropriate view, and watch the needle advance to the desired location in real time. Truly amazing.

Even more amazing is the comparison of ultrasound devices from a decade ago to those of today. Ultrasound devices have become cheaper, more portable, and have a much higher image quality. Most operating suites are now equipped with multiple machines that are capable of performing both M Mode and color doppler. In the past these modalities were only available in certain hospital locations, requiring the patient to be moved to the machines. Now the machines are moved to them. These improvements have also allowed ultrasound to become a more accessible tool in resource limited settings. Handheld devices which can plug into most iPhones and iPads are available in the $2500 range.

Ultrasound has also opened up a new world of regional techniques by allowing the direct visualization of nerves and the various fascial planes in which they are located. Some of these nerves would be difficult, if not impossible, to accurately target otherwise. For example, all sensory nerves to the knee can now be blocked without depriving the patient of motor function. Transversus abdominous plane (TAP) blocks for abdominal surgery have become commonplace along with pericapsular nerve group (PENG) blocks for hip surgery. These procedures help improve outcomes and the surgical experience for patients.

Anesthesia residency training has embraced ultrasound as well. Trainees are now being taught to use ultrasound for peripheral venous access, arterial lines, central venous access, TEE/TTE, and regional anesthesia. The ABA now includes ultrasound specific questions on the board examination. The ASA has also started a Point of Care Ultrasound (POCUS) certification pathway for practitioners to demonstrate proficiency of this skill set.

Most practitioners have already incorporated ultrasound into their practice to some degree, so why invest the time and money expanding this skill? The simple answer is bedside ultrasound can provide real time answers to real time questions. Exams can quickly provide important data like ejection fraction, valve function, volume status, and NPO status. No more guessing about stethoscope auscultation or depending on vague patient history. Just grab the ultrasound and look. Within seconds you will have important information to help guide your anesthetic plan or further patient workup.

Future developments in ultrasound technology will expand its ease of use and the information it can yield. Three-dimensional TEE has become commonplace in cardiac anesthesia and may become the future standard for all ultrasound imaging. Artificial intelligence is being incorporated to identify pertinent anatomical structures and needle trajectories on images. X plane imaging, now available in handheld probes, can create two full resolution images simultaneously and provide twice the information from a single scan.

It is clear that ultrasound can be a valuable tool both in and out of the operating room. As with most useful technology, it will continue to evolve in ways that will make it smaller, less expensive, and easier to use. While technology is improving, the most important component of ultrasound is having skilled practitioners who utilize it as part of their daily practice. Ultrasound is a powerful tool that can aid patient care in ways not thought possible just a decade or so ago.

Genetic Innovations, *from page 12*

cessible or inaccessible to gene expression without causing an intrinsic change in the DNA of the gene itself. By combining an epigenetic repressor motif (KRAB) that leads to the formation of inaccessible heterochromatin and linking it to the "dead" Cas9 endonuclease with its sequence-guided RNA (sgRNA) that leads to gene specificity, the authors were able to create a highly specific reversible molecule that selectively blocks expression of the NaV1.7 gene.[2]

They accomplished this by intrathecally injecting adenovirus vectors containing the genetic machinery in a mouse model. Their results are promising, demonstrating a reduction and even reversal of the pain phenotype created by many disease processes.[2]

While the understanding of gene editing and associated technologies are still in their infancy, this is a promising step forward for the fields of pain and medicine as a whole. The concept of gene-specific editing and silencing will continue to evolve and using machinery like a "stripped down virus" for anatomic tropism and delivery is an ingenious method to achieve this goal. As pain management evolves, the utilization of biologic "medication", such as the CRISPRi system packaged in an inactive virion injected intrathecally may be on the horizon.

The field of pain management is one of the most unique to medicine in that many of the mechanistic and pathologic questions are still unanswered. Thus, leaving the door wide open for innovation and discovery on the basic science and clinical level with the goal of alleviating pain and suffering, restoring function for our patients who deserve and demand a better future.

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Legislative Update

By Lauren Schmitt
Commonwealth Strategy Group

We finally have a budget! The legislature was called back to vote on a budget Wednesday, June 1st.

Despite that this session is just now wrapping up, we are already planning for next year. The Medical Society of Virginia is hosting its annual advocacy summit in June, where they will review legislative proposals from members and specialty societies. VSA will be submitting a proposal for MSV to advocate for an increase in Medicaid reimbursement rates for all physicians up to 80% of Medicare. As you know, we successfully lobbied a few years ago to bring our rates up to 70% of Medicare. We are hoping we can continue this momentum!

We also continue to explore the potential of pursuing licensure for Certified Anesthesiologist Assistants in Virginia. As you know, they cannot practice in Virginia because they are not licensed. We have heard from many VSA members that the licensure of CAAs would increase access to care.

VaSA PAC

Thank you to everyone who has contributed to our PAC this year. If you haven't contributed yet this year, please consider doing so! Now is the time to replenish our VaSA PAC. A strong and robust PAC demonstrates VSA's leadership and investment in the political and policy process.

Your support is crucial to our advocacy success! Contributions to the PAC will help raise the visibility and profile of anesthesiologists, connect us to new and returning legislators, and continue to build productive relationships with key General Assembly members.

As always, we continue to support members of the legislature who care about issues affecting our profession and our patients. We support both parties and their leadership through individual legislator and caucus events.

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January 1 – June 13, 2022

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Meet Your Legislator

Without You, the Learning Curve is Steep

By Delegate Keith Hodges
Virginia House of Delegates, 98th District


Del Keith Hodges

Reaching out to your local legislator is often not seen as a priority for many healthcare providers. In today's healthcare world, the complex and multi-faceted nature of the industry makes it virtually impossible for legislators to quickly react to changes and trends in healthcare. This, coupled with a highly regulated system, means that healthcare providers must be involved in the legislative process.

We are fortunate in Virginia to have a part-time legislative body that represents a wide variety of professions, including healthcare providers, but there is still a need for advocacy from the providers in the trenches. Experts in healthcare are often needed to explain nuances and unintended consequences of new laws and regulations. It is important to have professionals from a variety of healthcare models contribute to the discussions. Even healthcare workers in the same field may have different perspectives depending on their unique niche.

There is no one better equipped than you to weigh in on these issues. Legislators are thankful for constituents that take an active role in the betterment of the healthcare industry. It is only through this sort of collaboration that real gains are made in the positive healthcare outcomes for all Virginians.

The legislative process can seem daunting, and effective advocacy from providers is key for legislative success. Some examples of ways to advocate for your profession are obvious, many of which you are already doing. For example, being active in your professional association and vocal in your workplace are great ways to start. The next step is to visit and get to know your legislator. This is often most effective between legislative sessions, as it allows your views to be heard early on in the discussion phase of the issue at hand. Visits during session are also effective as you and your organization can meet with a large number of legislators in a relatively short amount of time. Phone calls and emails are also at times very effective.

Why is it necessary to advocate? Healthcare is now big business and is not only a major segment of our economy, but also constitutes a large part of federal and state budgets. The complex nature of health insurance makes understanding true costs almost impossible. This coupled with patient needs, healthcare worker compensation, and ensuring access for all, adds to the overall challenges in healthcare. Additionally, issues that are profession specific require even more clarity as healthcare trends and models change. Only workers in the fields can provide legislators with real time examples, feedback, and consequences both negative and positive. You as professionals are the piece that affect real change in healthcare. Without you, the learning curve is steep and yields less proactive strategies.

Pioneers in Anesthesia: History & Developments

By Jaikumar Rangappa, MD, LTC, DABA, FACA
Retired US Army
June 2022

On March 30, 1842 did Dr. Crawford Long
Administer the first Ether for just a song
To a patient for the benign tumor of his neck
Operated him as patient went to deep slumber
Patient swore he felt nothing & paid his check
Not published, medical society can't remember!

Gardner Colton gave the Nitrous Oxide inhalation
To Horace Wells for his wisdom teeth extraction
Relieved of dental pain without a painful operation
In 1845 Wells at MGH booed at failed demonstration

W O G Morton gave Ether anesthesia demonstration
On 16 October 1846 at MGH theater in city of Boston
Patient with neck tumor went to sleep by inhalation
Operated successfully with no pain by a fast surgeon

Ether used as inhalation anesthetic the world over
Along with chloroform, Cyclopropane during the war
Sodium Pentothal for IV induction became popular
Replaced in 1989 by synthetic Propofol by far

Then came Halothane and Penthrane and other ethers
Used with great success by anesthesiologists for years
With fire hazard and explosions, toxicities & other fears
Most of those useful agents were discarded with tears

In nineteen 80s the ASA took a stand against smoking
As a pioneer for health and safety in convention meeting
Before AMA and US government banned tobacco smoking
In all airports & bus stands and inside the public building

Safety and prevention in anesthesia has become the norm
Prevention of problems and checklists has taken that form
Basic principle is that no patient should come to any harm
Continuous monitoring of vital signs of patient is a charm
Space age gadgets with back-ups have their specific alarm
When available, patient neglect causes medical/legal storm

In nineteen nineties came the Laryngeal Mask Airway
From the United Kingdom across the Atlantic to USA
Anesthetist Dr. Archie Brain invented in ingenious way
Used 300 million times around the wide world till today
Inserted blindly and very quickly in the difficult airway
Was personally taught in 1994 on his visit to city of LA

Surgical anesthesia may have come a long way
But still anywhere ether anesthesia is safe today
Now in computer & space age and digital revolution
Every gadget & appliance has an electronic solution

When the computers oftentimes do crash
And many world-wide hackers come to bash
The Internet system will surely go down
And basic knowledge is the only solution

Local & Regional blocks for surgery have come to stay
With Des Florane and Sevoflorane, is safe to use today
In future perhaps Robot anesthesia will become the trend
With shortage of anesthesiologists, they will be the friend
Of surgical patient in the OR, as pioneers become legend
And human anesthesiologists will be seen as a God send!

Encourage Your Practice Administrators to Join VSA

The VSA encourages your practice administrators to join! We have two options:

1 If 90% or more of a group's physician anesthesiologists are VSA Active members in good standing and all members will be on a single group bill, the annual dues are FREE for your practice administrator.

2 If less than 90% of a group's physician anesthesiologists are ASA Active members in good standing, or the group does not participate in group dues billing, the annual dues are $75.00.

To have your practice administrator join, go to: https://www.asahq.org/member-center/join-asa/educational

- On this page, click on the category you're interested in – in this case, its: Anesthesia Practice Administrators and Executives – Educational Member
- Click on the + sign next to the title
- The box that opens, will contain full details and the membership rate(s)

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