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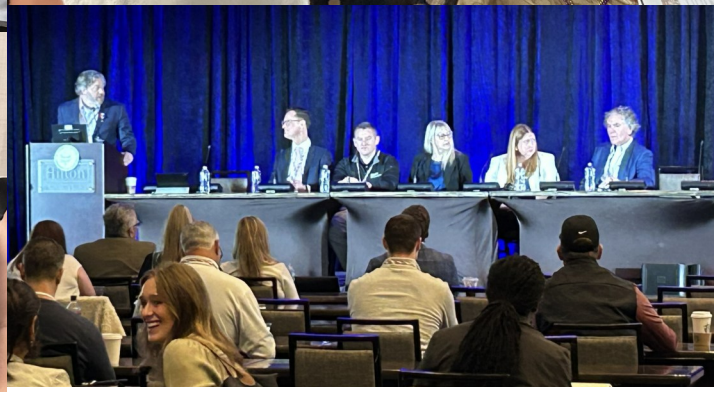


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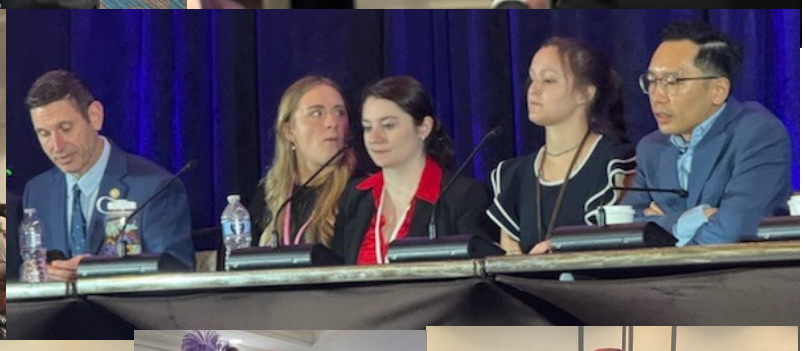


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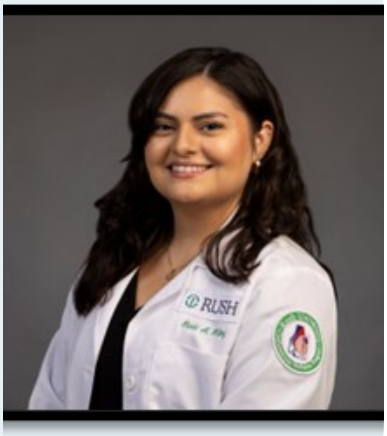

Optimizing ECMO Care: Real-Time Lung Function Monitoring During Verticalization Therapy

Ashley Smith, BSN, RN, CEN, **Tatania Gagnon**, BSN, RN, **Riley Stampfer**, BS, **Gloria Munoz**, BS

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Chicago, Illinois

Extracorporeal Membrane Oxygenation (ECMO) is a life-saving intervention for patients with severe respiratory and/or cardiac failure. Through many years of trial and error, it has been observed that prolonged supine positioning of these patients can contribute to complications such as reduced lung aeration, ventilation-perfusion mismatch and atelectasis.[1] Based on these findings, verticalization of patients with respiratory failure has been utilized to improve ventilation distribution.[1] Bouchant et al. (2024) demonstrated a positive improvement in oxygenation while verticalizing to 30 degrees. The author hypothesizes that alveolar recruitment and pulmonary perfusion redistribution were the key components of improvement.[3] Shayan et al. (2023) conducted a case study involving a patient on veno-venous (VV) ECMO. This research displayed that verticalizing the patient to 45-60 degrees twice daily for 30 minutes improved the patient's oxygenation saturation and lung function.[4]

Prone positioning is the practice of placing a patient face-down on their abdomen. Combes et al. (2018) demonstrated that this method has been widely implemented into treatment plans for patients with severe acute respiratory distress syndrome (ARDS). The position allows for the improvement of alveolar recruitment and increases gas exchange.[5] Franchineau et al. (2020) studied 21 patients on VV-ECMO and compared prone to supine positioning using electrical impedance tomography (EIT). The results showed a 62% increase in static compliance (≥3 mL/cmH_2O) with a 240% increase in end-expiratory lung impedance (EELI) of the dorsal region compared to an 81% decrease in the ventral lung region.[6] According to a trial study by Guérin et al. (2013), early prone positioning in patients with ARDS significantly reduced mortality rates when compared to supine positioning.

Ferreira et al. (2019) reported that mobilization during ECMO support is feasible and safe. For patients unable to participate in

mobilization, prone positioning is an effective strategy for improving lung aeration. However, in patients that may tolerate an upright or standing position in bed and not mobilization, then Verticalization Therapy (VT) can be a more effective treatment. Rottmann et al. (2023) found that patients with an ICU Mobility Scale (IMS) score >2, which indicates active mobilization, had higher 30-day survival rates. These patients also demonstrated greater success in ventilator weaning compared to patients with IMS <2. [9]

Electrical Impedance Tomography (EIT) is a noninvasive, radiation -free bedside imaging modality. This technology provides real-time assessment of lung ventilation during changes in patient position using the Timpel Enlight 2100 system as shown in Figure 1 (Frerichs et al., 2017). Sixteen electrodes are placed on the patient's chest and provide cross-sectional images of the thorax to depict changes in lung aeration and perfusion. The authors highlighted that consistent electrode placement is critical for reliable comparison over time. [1]

Figure 1: According to the *ENLIGHT 2100* brochure published by Medidyne (2023), the bedside Electrical Impedance Tomograph (EIT) created by Timpel provides clear, real-time images of the regional distribution of ventilation, allowing the assessment of regional lung volume changes. The belt is applied between the 4th and 5th intercostal space, providing visualization of a 15 cm slice, representing approximately 60% of the lung. [11]

Patients receiving ECMO are often underrepresented in studies examining verticalization therapy (VT) and lung function. By integrating EIT and VT in ECMO-supported patients, it allows for evaluation of its potential benefits on regional lung aeration. Our prospective case series of five adults aims to provide further insight to identify areas of improvement for management of ECMO-supported patients who are utilizing this therapy. We have used the Timpel Enlight 2100 EIT monitoring system for two ECMO patients. To assess the changes of lung recruitment in these patients,

About the Authors

Ashley is a current Rush University student graduating in May 2027. She is a former registered nurse with training in the emergency department and Neuro ICU. She is incredibly grateful for the perfusion community—the mentors, educators, and clinicians who continually offer guidance, encouragement, and support.

Tatania Gagnon is a current second year Rush University Perfusion student. She is former registered nurse and ECMO Specialist. Her experience working bedside sparked a deep interest on the complexities of extracorporeal support and its impact on patient outcomes. Tatania would like to thank Rush University's staff, as well as the faculty at Lurie Children's, Northwestern Memorial Hospital, and Loyola University Medical Center for all the time they've spent and knowledge they've shared with her as a perfusion student.

Riley is a current second year perfusion student at Rush University projected to graduate in May 2026. Prior to perfusion, she worked as a perfusion and medical assistant where she developed a strong

dedication for patient care. Riley extends her sincere gratitude to the faculty at Rush University, as well as to the cardiac teams at Northwestern Memorial Hospital, Corewell Health, and Advocate Children's Hospital for their mentorship, guidance, and continued support throughout her perfusion training.

Gloria is a current perfusion student at Rush University and is expected to graduate in May 2026. Prior to pursuing a career in perfusion, she worked as a medical technologist. She extends her gratitude to the faculty at Rush University, as well as the clinical teams at Barnes-Jewish Hospital, Allina Health, and MultiCare Tacoma General Hospital for their guidance and support throughout her perfusion training.

we compared the End-Expiratory Lung Impedance (EELZ) values recorded by the belt before and after verticalization. An increase in EELZ is interpreted as improved alveolar recruitment, while a decrease in EELZ suggests alveolar de-recruitment as shown in Figure 2. We have not yet completed the statistical analysis of all the patient data. However, preliminary observations indicate an upward trend in EELZ values during and after VT. We look forward to finalizing our research.

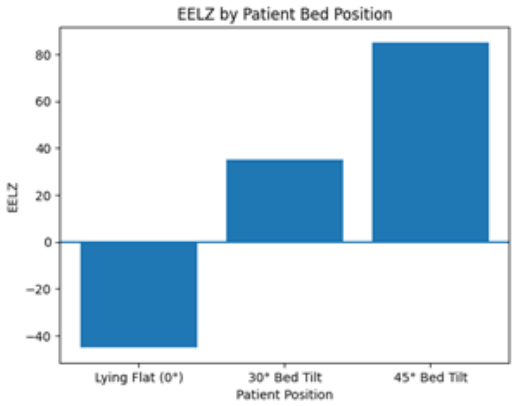

Figure 2: Preliminary results show that increasing bed elevation is associated with an aggressive rise in end-expiratory lung impedance (EELZ). The greatest improvement was observed at a 45-degree bed tilt for one patient.

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Mark Kurusz, CCP (Emeritus)
Austin, Texas

Tribute and Memories of Ken Taylor

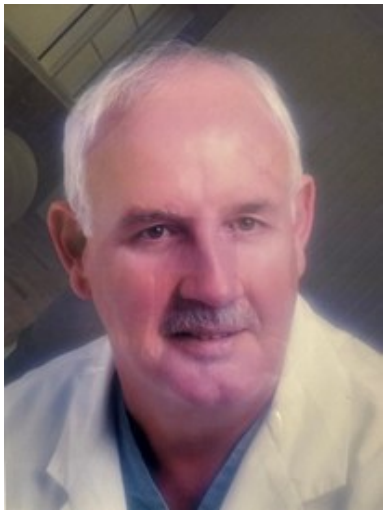
Professor Kenneth M. Taylor, MB, ChB, MD, FRCS, FESC, FETCS, FSA and British Heart Foundation Professor of Cardiac Surgery, Imperial College London was an esteemed friend to the perfusion community. He died 1 February 2026. Despite the many titles and honorifics he earned during his career, he preferred simply to be called, "Ken." For 25 years, he was a familiar presence to cardiac surgery teams internationally and at our Academy meetings. He first attended in 1983 in San Diego and reported on early studies on cerebral damage after cardiopulmonary bypass. The other panelists at the meeting were likewise experts on the subject, and a spirited discussion followed and is preserved in volume 4 of the *Proceedings of the AACP*. Ten years later, Ken offered his insights into perfusion research—methodology and its future. In 1996, he was back with us again to update attendees with the latest information on brain injury after cardiac surgery and how to lower patient risks. Another widely studied topic in the early 2000s was the systemic inflammatory response syndrome, and he once again shared with us the latest results of his group's research. In 2000, Ken became an Honorary Member of the American Academy.

In 1985, he had organized a meeting in London entitled, "On the Aspects of Neurological Dysfunction following Cardiopulmonary Bypass", which I attended. Four days later, we met at a pub in London, and Ken spoke of his intention to start a new journal. We agreed the most appropriate name would be "Perfusion", and he was recruiting an editorial board. He had the backing of a large publishing firm after the success of his textbook, "Cardiopulmonary Bypass." He said to me at the time, "This could be a good thing", and I agreed to become an Associate Editor. For the last four decades, authors presenting at the American Academy meeting have been afforded access to *Perfusion* and publication of their work after successful peer review.

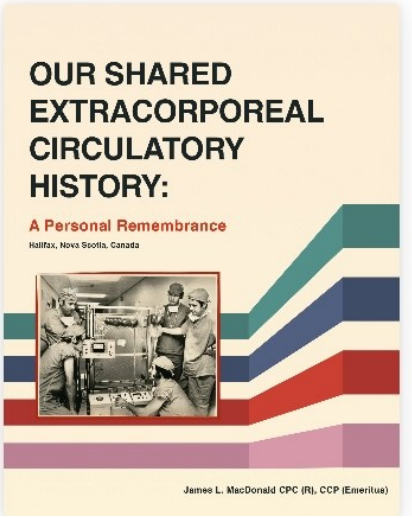
To stimulate interest in the journal and to encourage manuscript submissions, in 1986 Ken organized the Hammersmith Perfusion Workshop that was held annually on the first Friday in December—a magical time in London with Christmas decorations everywhere in the streets. It was well attended by perfusionists from the UK, Europe, and the US and had noted speakers from his extensive contacts with cardiac surgeons and academics. After the day's presentations, he invited the faculty to dinner followed by an evening at his home. It was a wonderfully convivial time to visit in a relaxed setting, enhanced by sipping some fine scotch whisky. I'll admit, Richard Chan and I sometimes stayed past midnight, and Ken's wife, Christine, once in a not too subtle way, even had us do dishes in the kitchen to convey that the party was over. Wonderful memories!

Ken retired from clinical practice in 2007, and our visits on both sides of the Atlantic became infrequent. I shall always remember his exuberance, warm smile, and his inclusiveness to perfusionists during his lifelong work to advance the science and practice of cardiopulmonary bypass. His successor as Editor-in-Chief of *Perfusion*, Prakash Punjabi, has written Ken Taylor will be remembered by his colleagues as "a man of integrity, humility, and quiet authority…known for his thoughtful judgment, generosity with his knowledge, and steadfast commitment to improving patient care…" This is Ken's legacy, and we who knew him and those who heard him speak at meetings were fortunate his academic career intersected with those of us as members of the American Academy.

A Nostalgic Look Back



Jim MacDonald, a retired Cardiovascular Perfusionist, welcomes the reader to his personal but nostalgic look back into his, and others, earlier era of shared extracorporeal open heart surgical experience. As such, within, Jim highlights the initial clinical interface/marriage of both open heart surgery and the long awaited, extracorporeal supportive modality known, in the day, as, "The Pump Oxygenator"! Mentioned throughout, this circulatory journey, are several clinical Pioneers who are thoughtfully remembered within the following quote



by one of Jim's cardiac surgical mentors, "the early years of one's career are shaped by the many"! A similar view, is sited by a fellow Cardiovascular Perfusion colleague, having offered the following thought provoking statement, "I have been told that WE are a little bit of ALL of those, with whom, we have been professionally associated with"! These same pioneering Pump Techs, while not always being remembered, especially given their ever evolving and unique historical tenure, are referred to, within this Apple e-book remembrance! This authentic and historical era is shared, with the inquisitive reader, by way of the authors on the job training (OJT), having occurred during their shared extracorporeal circulation (ECC) interface experience - albeit within an era of clinical similarity and uncertainty having being witnessed by the various initial surgical and extracorporeal clinical interface challenges, presented, these pioneering open heart clinicians, throughout North America and, indeed, the Western World. Jim MacDonald offers his authentic but, experienced personal perspective, given his initial OJT days and his related clinical experience - albeit within this ever challenging clinical introductory era having being lived given the emerging discipline and scope of two, initially distinct realities, that being, the already developing surgical domain of corrective closed heart surgery and the essential introduction of this initial, "Pump Oxygenator" extracorporeal support modality provided by the Pump Techs, while working in concert with the Cardiac Surgeon of the day! The essential merger of these two disciplines, into the ONE reality, would open the door into the new world of elective and corrective, "direct vision open heart surgical repair", for both congenital and acquired valvular heart defects! Given the uniqueness of the time and place and, given the essential historical merging and subsequent introductory period, of pump oxygenator support, direct vision open heart surgical intervention, was now, made possible! Shortly, thereafter, the need for a non beating but, preserved human heart, during such direct vision open heart surgery, would soon, be on its accompanying historical journey!

Those interested in their reading Jim MacDonalds educational but historical book, would, please go, to the Books app on your iPhone, tap Book Store or Audiobooks (which is free), to browse this title, or tap Search to look for a specific title, author, series, or publisher - tap the book cover to see more details, read a provided sample and the publisher's description. Apple Books is an e-book reading and store application by Apple, Inc.

Welcome to New Members

The American Academy of Cardiovascular Perfusion would like to welcome the following individuals into membership in The Academy.

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About the Authors

Haley is a current Rush University Perfusion student graduating in May 2026. She is a former medical assistant and has her MS in physiology and biophysics. She would like to thank the faculty at Rush University, and the staff at Baptist Health in Miami, New York Presbyterian Hospital (Columbia University), and Lurie Children's Hospital of Chicago for giving her the foundation of her future in perfusion.

The Effect of Intraoperative Hyperglycemia During Cardiopulmonary Bypass on Postoperative Complications: Is There a Better Way to Manage Intraoperative Hyperglycemia?

Blood glucose management plays a crucial role in the outcome of cardiothoracic surgeries, particularly in procedures using cardiopulmonary bypass (CPB), where patients are at high risk for hyperglycemia.1 Maintaining optimal glucose levels during these surgeries is essential for minimizing post-operative (post-op) complications and improving patient recovery and long-term outcomes. With heart disease being the leading cause of death in the United States and rates of diabetes increasing globally, determining proper glucose management in the perioperative setting has become increasingly important in the field of cardiothoracic surgery.2,3

Hyperglycemia contributes to a range of post-op complications, including a increased occurrence of wound infections, longer hospital stays and overall mortality.4 This appears to be due to higher levels of systemic inflammation, which can complicate recovery and lead to adverse events such as infections, poor graft patency, and death.4 Therefore, maintaining appropriate glucose levels intraoperatively is critical to the reduction of post-op complications.

Two commonly debated methods for intraoperative glucose management are tight glucose control and moderate glucose control. Tight glucose control involves maintaining blood glucose levels within a narrow range, while moderate glucose control allows higher levels of glucose but sets a maximum glucose value that should not be surpassed. Many studies show conflicting data on which method leads to fewer post-op complications. Some studies found that tight intraoperative glucose control results in fewer post-op infections, improved wound healing and better cardiovascular outcomes.5-8 Other research suggests that moderate glucose control may be just as effective and less resource-intensive, particularly for patients who are not critically ill.9 It is also noted that tight glucose control may put patients at higher risk for hypoglycemia.9

In tight and moderate glucose management, glucose is tracked and maintained within specific ranges. Due to the conflicting research on tight versus moderate glucose control, this study will investigate a new technique for glucose management. The purpose of this study is to investigate whether the percent increase in glucose from the baseline glucose level will predict post-op complications. The goal is to find a more reliable and consistent method for determining safe intraoper-

Clay is a current Rush University Perfusion student graduating in May 2026. He is a former Nurse and ECMO Specialist. He would like to thank the faculty at Rush University, and the staff at Loyola University Medical Center, Lurie Children's, Ochsner Health Systems for helping him get started on his perfusion journey.

ative glucose levels.

The study conducted was a retrospective cohort study with 150 participants. Participants were sourced from Rush University Medical Center (RUMC) and included individuals aged 18 or older whom received cardiothoracic surgery utilizing sternotomy and cardiopulmonary bypass (CPB) at RUMC between the years 2018-2024. Patients were excluded from the study if they were receiving minimally invasive surgery or had previously had a sternotomy. The primary outcome of this study is to determine if intraoperative percent increase of glucose (IPG) is associated with increased rates of post-op complications. IPG was measured using baseline glucose levels measured before anesthesia induction and maximum intraoperative glucose level while on CPB. The post-op complications investigated include wound infection, urinary tract infection (UTI) and blood infection. The secondary outcome of this study is to determine if banked blood received (BBR) and length of hospital stay (LOS) are associated with increased rates of post-op complications.

Of the 150 participants, only 18 (12%) had a post-op complication. This is a limitation of the study because there is a large difference in the size of the samples being compared (18 with post-op complications (12%) and 132 without post-op complications (88%)). Data analysis revealed no significant relationship between IPG and post-op complications (p-value = 0.93). There were three significant relationships revealed. Females were at significantly increased risk of post-op complications (12 (66.6%)) compared to males (6 (33.3%)). This relationship has a p-value of 0.014 making it a statistically significant relationship. BBR was also found to have a significant relationship with rate of post-op complications (p-value = 0.022). When looking at BBR, participants who had a post-op complication received a median of one unit of banked blood compared to a median of zero units received for patients without post-op complications. The final significant relationship seen is between LOS and rate of post-op complications (p-value = <0.001). The median LOS for patients with post-op complications is 18.5 days compared to 8 days for participants without post-op complications.

Though this study did not provide support that IPG is an effective way to predict rate of post-op complications, it did show three significant factors in the rate of post-op complications. Future research should investigate the relationships between sex, BBR and LOS on post-op complications. Due to this study being a one center study, it would be interesting to conduct this study at other facilities to see the variance amongst hospitals with respect to rates of females compared to males with post-op complications. If there is a large variance amongst hospitals, then research will aid in identifying hospital practices that decrease rates of post-op complications.

If this statistically significant relationship between sex and post-op complications is consistent amongst other hospitals, then it is important to identify what factors are contributing to this relationship. These considerations and other future research will aid in identifying factors that increase patient chances of post-op complications and adverse events, hopefully leading to changes in protocols and best practices to lead to improved patient outcomes.

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From Pump to Prompt: Evaluating an AI Chatbot in Perfusion Education

Advancements in artificial intelligence (AI) are transforming healthcare education by introducing innovative approaches to clinical skill development. In cardiovascular perfusion education, a field characterized by high-stakes decision-making, technical precision and time-sensitive problem-solving, these technologies are reshaping how students learn and prepare for practice, with the need for innovative educational strategies being particularly evident. Perfusionists must synthesize physiologic data, anticipate complications and respond rapidly to evolving clinical conditions, all while maintaining patient safety during cardiopulmonary bypass.

To meet these demands, simulation-based education has become an essential component of perfusion training. Our research introduced an AI chatbot we named ByPass Buddy built by Virmedex (Barcelona, Spain) to aid in perfusion simulation training. This study sought to evaluate the impact of incorporating artificial intelligence support for troubleshooting during simulation-based perfusion training on student outcomes. As educational technology continues to evolve, emerging tools such as AI-driven chatbots may further enhance this experiential learning model by providing interactive decision support, guided troubleshooting and immediate feedback during simulation exercises.

In *Artificial Intelligence in Education: Challenges and Opportunities for Supporting Effective Teaching and Learning* (U.S. Department of Education, 2023), the authors describe how AI has been shown to assist students during complex problem-solving tasks by offering adaptive prompts and structured guidance step-by-step through problem-solving processes. This aligns closely with troubleshooting applications, where learners must systematically identify a problem, evaluate possible causes and implement corrective actions. This gap in the perfusion literature prompted the development of our randomized controlled trial, which included 21 first-year students in the Rush University Master's Program in Cardiovascular Perfusion. Participants were randomly assigned to either an experimental group that had access to ByPass Buddy during simulations or a control group that completed simulations without the AI chatbot assistance.

In our study, we focused on one primary performance measure: time of scenario completion. This allowed us to determine whether participation in the simulation and use of ByPass Buddy when applicable aided in completing the simulation scenario. We compared total completion times between the control and experimental groups to assess

About the Authors

Giovanni is a second-year student in the Rush University Cardiovascular Perfusion Program and is expected to graduate this May. Before perfusion school, he worked as the first perfusion assistant at Mount Auburn Hospital in Cambridge, Massachusetts, where he developed a strong passion for the field and a drive to keep learning. He would like to thank the faculty at Rush University and the staff at Northwestern Memorial Hospital, Beth Israel Deaconess Hospital, Riley Children's Hospital, and Lahey Hospital & Medical Center for helping him begin his journey in perfusion.

Hieu is a current student in the Rush University Cardiovascular Perfusion Program, with an anticipated graduation date of May 2026. Prior to pursuing perfusion, she practiced as a Doctor of Chiropractic, bringing a clinical foundation and patient-centered perspective to her advanced training. She extends her sincere gratitude to the faculty of the Rush University Cardiovascular Perfusion Program and to the clinical teams at the University of Illinois Chicago (UI-Health), Mayo Clinic (Rochester), and Corewell Health Grand Rapids for their mentorship and support throughout her perfusion education.

Mark is a current second-year student in the Rush University Cardiovascular Perfusion Program, with an expected graduation in May 2026. Before perfusion school, he worked in and around the Denver Metro area as an autotransfusionist and perfusion assistant. He extends his sincere appreciation to the faculty of the Rush University Cardiovascular Perfusion Program and gratitude to the staff at Henry Ford Hospital, Cedars-Sinai Medical Center, and Mercy-One Medical Center for their warm welcome and for helping launch his career in perfusion.

whether AI assistance influenced workflow speed and ability to complete the scenario in an allotted amount of time.

Secondary outcomes included measures of assessment scores (change in knowledge acquisition, evaluated through pre- and post-simulation assessments) and frequency of reservoir eye checks. Reservoir monitoring is a critical safety behavior in perfusion practice and let us assess whether the chatbot use affected attentional focus.

Data collection occurred at multiple points: before the simulations, throughout scenario execution, and immediately afterward. Knowledge assessments, structured observation tools and participant surveys were used to capture both cognitive performance and practical skill application. Statistical comparisons were performed between groups to evaluate differences in outcomes. Baseline characteristics included demographic data, prior healthcare experience and familiarity with artificial intelligence. We also analyzed these characteristics to control potential confounding factors.

As we continue to analyze the data to fully assess the strength of our findings, early impressions suggest that AI-supported tools may offer meaningful benefits within perfusion simulation training. If validated, this approach could extend beyond basic simulation support to more individualized educational strategies. Future applications may include adaptive simulation models that dynamically adjust scenario complexity to encourage progressive skill development and high-quality training outcomes.

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Article Review: Decreased Serotonin Transporter Activity Contributing to Degenerative Mitral Regurgitation

A Translational Perspective

Degenerative mitral regurgitation is one of the most common heart valve diseases, with surgical repair or replacement being the only treatment option in severe cases (1-2). The molecular mechanisms driving abnormal extracellular matrix remodelling that lead to mitral valve thickening and structural disorganzation remain poorly understood (3). In *Science Translational Medicine*, Castillero et al. demonstrate that decreased serotonin transporter (SERT) activity accelerates pathological mitral valve remodeling and progression to mitral regurgitation. Using an integrated translational approach that incorporates human clinical data, genetic associations, animal models, and cellular studies, the authors link reduced SERT activity with selective serotonin reuptake inhibitor use and specific SERT promoter genotypes to enhanced HTR signaling and fibrotic remodeling. This study illustrates how an integrative, translational approach can advance understanding of structural heart disease. Although these approaches are more common across multiple biomedical research disciplines, they remain underrepresented within the perfusion literature. As perfusion continues to evolve as both a clinical and scientific discipline, engaging in mechanistic, translational research may strengthen the field's scientific foundation and support its expanding clinical role. This author was a contributing author to the original study.

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Awards Committee Selects Winning Paper Presentations

Vedashree Meher

Seven presenters received awards for their paper presentations at the Annual Seminar in St. Petersburg.

2026– Jeffrey B. Riley Best Student Paper Presentation Award ($1000)
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AnnMarie Marquis - From Heuristics To Frameworks: A Patient-Specific Approach To Blood Exchange Planning During Cardiopulmonary Bypass

2026 - Lawrence Awards ($500)
Ashley Fellows - The Impact Of Protamine On ACT

Ashley Fellows

Bailey Reitsma - Post-Menopausal Women And Acute Kidney Injury Following Cardiopulmonary Bypass

Kelly Russell - An Exploration In The Utilization Of Visual Aids In Perfusion Education: A Randomized Control Trial

Michael Vespe

2026 - Palanzo Best Paper Presentation Award ($500)
Awarded for the Best Non-Student Paper Presentation.
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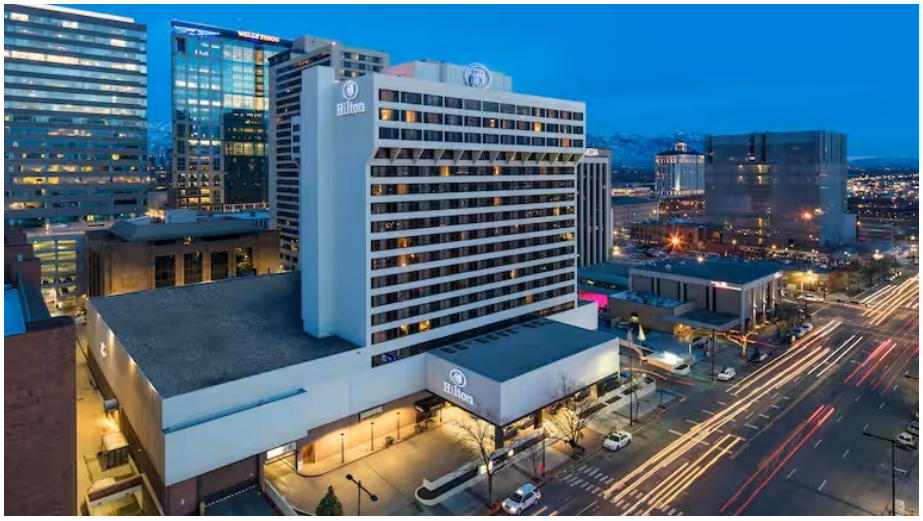

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