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Winter 2025

The Academy Newsletter

Message from the AACP President

The Layers of Life

Every single one of us has had a life filled with impactful relationships and momentous experiences, which lead to the development of our core values and an eventual life path. This collage of events helps establish a buildup of layers that help define us as human beings and lets us navigate life's obstacles. As our lives mature, these layers continue to build upon each other, which allows us to become hopefully wiser and fulfilled in life's journey. As we continue into our careers, it is important to understand these layers have been crucial to our development as professionals. At this year's meeting, "The Layers of Life" will be the focus of my Wharton Lecture. This lecture will concentrate on understanding these layers and how each layer helps us value the important aspects of life by understanding our "why", harnessing our passions and translating these experiences into optimizing care for our patients.

Along with the Wharton Lecture, the 2026 AACP meeting will be filled with invigorating special sessions, perfusion science abstracts, thought provoking fireside chats and a very entertaining Sponsors' Workshop. The special sessions will include a pro/con debate focusing on perfusion education regarding AI and education levels, an adult congenital session concentrating on the aging single ventricle, a special industry panel covering the economic impact along with other hard topic items, the evolving NRP landscape with considering the ethical and religious ramifications and an in-

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novative pediatric session diving into the latest research, technology and techniques. There are two separate scientific paper sessions that will display the latest in some of the most advanced perfusion research, database analysis, and case study scenarios. The ever-popular fireside chats will allow our attendees to have a safe and open forum to discuss many topics including the latest development in state licensure, OR team dynamics, pediatric MCS, simulation with low/high fidelity, women in perfusion, religious and ethical aspects to NRP, and many more. The only perfusion meeting that allows its attendees to meet the sponsors in a fun themed environment is back with the Sponsors' Workshop that features a pirate theme for the night.

This year's meeting will feature several great speakers including **Dr. Katsuhide Maeda, Dr. Manchula Navaratnum, Dr. Aaron Dewitt**, and **Dr. Tiffany Ko**. Our featured speaker for the Reed Lecture is **Chief Master Sergeant (Retired), USAF Jeremiah Grisham**. Each of these speakers will shed light on their area of specialty by bringing a high level of science and life experience to the meeting.

The program committee has been hard at work throughout the year developing the meeting and recruiting great speakers for each session. I would like to thank Kathryn Gray DeAngelis, Edward Delaney, Adam Fernandez, Carmen Giacomuzzi, Richard Ginther, Ronald Gorney, Robert Grimmett, Frederick Hill, Emily Kahring, Bradley Kulat, Ashleigh Leblanc, Mark Martin, William Riley and Allison Weinberg for all their efforts and commitment this year.

As the holiday season is upon us, we always pay thanks to areas of our lives. I am very thankful for all the experiences this career has afforded me, which has enriched my life in so many ways. To have the opportunity of being part of the American Academy of Cardiovascular Perfusion for so many years and making amazing memories with so many of you at our annual meeting has been a true honor. The experiences from this meeting have developed another impactful layer of my life, which I cherish wholeheartedly. Please consider attending this great meeting in February; it will be one to remember!

Happy Holidays!

Richard W. Melchior , MPS, CCP, FPP, FACCP
AACP President

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I am a critical care nurse and ECMO specialist with extensive experience in high-acuity cardiovascular and surgical intensive care. I earned my Bachelor of Science in Nursing from Troy University in 2018, and I began my career in the Surgical Intensive Care Unit. Later, I further expanded my skill set by becoming an ICU float nurse from 2020-2022.

From 2021–2024, I worked as an ECMO Specialist at the University of Alabama at Birmingham (UAB) Hospital, where I assisted with various aspects of care for adult ECMO patients: Cannulation, oxygenator changeouts, critical-care transport, ECPR, physical therapy, settings changes, etc. During my time at UAB, I completed both the amSECT Adult ECMO Specialist (CES-A) and Pediatric ECMO Specialist (CES-P) certifications.

In 2024, I began training as a perfusion student at The Texas Heart Institute, and I am on track to graduate in December of this year. After school, I plan on providing exceptional care to both cardiac and extracorporeal life support patients with CCS in Birmingham, AL.

Comparing Bivalirudin to Heparin for Anticoagulation of the Patient on ECMO

Abstract

Achieving safe and effective anticoagulation has been a challenge for patients requiring extracorporeal membrane oxygenation (ECMO) due to the numerous associated complications of anticoagulation therapy: excessive bleeding, depletion of clotting factors, thrombus formation, and other difficulties such as the challenges of lab monitoring (Brogan et al. 2017). The effective drug of choice used in the anticoagulation management of these patients has been via intravenous heparin infusion mostly because of its vast availability, familiarity among providers, inexpensive cost and ease of reversal through the use of protamine sulfate (Navaei, Kostousov, and Teruya 2023). The intention of this report is to examine the benefits and disadvantages of both bivalirudin and heparin in the management of anticoagulation for the patient receiving ECMO therapy.

Bivalirudin Overview

Bivalirudin is a direct thrombin inhibitor that works by directly inhibiting thrombin by specifically binding to the catalytic site and to the anion binding exosite of both free circulating and clot bound thrombin (U.S Food and Drug Administration 2010). Per bivalirudin's Federal Drug Administration label for usage, when paired with aspirin, it is indicated for patients experiencing unstable angina undergoing percutaneous transluminal coronary angioplasty and patients undergoing percutaneous coronary intervention (U.S Food and Drug Administration 2010). Its half-life, which depends on patient renal function, is approximately 25 minutes, and it has a 20% renal elimination and the remaining majority of the drug is eliminated by proteolytic enzymes (Navaei, Kostousov, and Teruya 2023). Its listed adverse effects include bleeding and less common effects included headache, fever, and thrombocytopenia. For patients who develop heparin-induced thrombocytopenia (HIT), bivalirudin is a widely used alternative anticoagulation therapy. Unlike heparin's mechanism of action which, in the case of HIT, causes a platelet factor 4 (PF4)-heparin-IgG complex to bind to the Fc receptor of platelets and eventually causes thrombocytopenia, bivalirudin's anticoagulant effect causes direct inhibition of Tissue Factor II (Thrombin) and does not have to bind to PF4 (Brogan et al. 2018). Due to its ability to avoid complications associated with HIT and other additional benefits, bivalirudin has emerged as a favorable medication used for the anticoagulation of patients receiving ECMO.

Heparin Overview

Heparin is an anticoagulant that works by forming a complex with antithrombin III (AT III). Heparin increases the effect of AT III by 1000-fold and inhibits activated coagulation factors involved in the clotting cascade (U.S. Food and Drug Administration 2008). Specifically, it affects tissue factor IIa (thrombin) and tissue factor Xa of the common pathway. Depending on the dosage amount, heparin's half-life is anywhere between 30-90 minutes and it is removed from circulation by the liver (U.S. Food and Drug Administration 2008). Its most common adverse effects include bleeding, thrombocytopenia, heparin-induced thrombocytopenia (HIT), heparin resistance, and hypersensitivity (U.S. Food and Drug Administration 2008). Its effect is reversed by administering protamine sulfate.

Comparing Bivalirudin and Heparin

Bivalirudin, unlike heparin, does not require an adequate level of ATIII to exhibit its effect. Unlike heparin, it is able to bind to both freely circulating and clot-bound thrombin. Interestingly, ECMO patients receiving bivalirudin potentially experience fewer blood transfusion requirements, longer ECMO circuit lifespans, lower overall costs, reduced mortality, a more stable pharmacokinetic profile, and obviously do not develop HIT (Kartika et al. 2024). Some of bivalirudins disadvantages include not having a reversal agent, ineffectiveness in low-flow states within areas of stagnation. Potential areas of low-flow and stagnation include ECMO pigtail catheters, distal reperfusion catheters, areas of ventricular dysfunction, and during veno-arterial ECMO clamp trials (Šoltés et al. 2023). Another primary disadvantage was the lack of distinct lab monitoring tests to accurately measure the effectiveness of bivalirudin (Navaei, Kostousov, and Teruya 2023). However, most institutions utilize activated partial thromboplastin time as the primary lab monitoring parameter for bivalirudin's effectiveness (Brogan et al. 2017). The advantages of heparin include its wide availability and familiarity of use, the presence of protamine sulphate as a reversal agent, validated lab monitoring methods, and heparin's flexibility of use in other aspects of patient care for ECMO patients (Navaei, Kostousov, and Teruya 2023). For disadvantages, heparin requires adequate levels of ATIII to work and, without it, heparin would be a useless drug. Heparin is only able to bind to free circulating thrombin and not clot bound thrombin (Valdez et al. 2023). Compared to bivalirudin, it has a less stable pharmacokinetic profile (Ma et al. 2022). Heparin dosage titrations are made more frequently and therapy may be interrupted more commonly compared to bivalirudin due to elevations in plasma free hemoglobin and total bilirubin levels causing falsely low estimates of heparin activity (Khan and Chandler 2019). When compared to those treated with bivalirudin, ECMO patients treated with heparin experienced more dose titrations, and interruptions in therapy (Li et al. 2021). Lastly, patients receiving heparin are at risk for developing the potentially fatal complication of HIT.

Heparin-Induced Thrombocytopenia

As mentioned, heparin can cause formation of a platelet factor 4 (PF4)-heparin-IgG complex to bind to the Fc receptor of platelets and eventually cause heparin-induced thrombocytopenia.

HIT is classified into two types. Type 1 HIT is usually a mild reaction not associated with any major complications and platelet counts typically self-correct even if heparin is continued (Šoltés et al. 2023).Type 2 HIT takes time to develop because of the time it takes for the antibodies to form which typically occurs in about 5-14 days after the start of heparin therapy and results in at least a 50% decrease in platelet count (Šoltés et al. 2023). This reaction can lead to the development of venous and arterial thrombi. Heparin-induced thrombocytopenia is arguably the main reason for switching ECMO patients to bivalirudin and ECMO centers everywhere are looking into using bivalirudin instead as the primary agent to anticoagulate these critically-ill patients. Reported instances of HIT in ECMO patients range anywhere from 0.36% - 8.3% of all patients receiving heparin (Rajsic et al. 2022). This may not appear to be a staggering percentage, but when you consider that these are reported percentages and the amount of ECMO runs per year (almost 17,800 runs in 2021 during the pandemic), theoretically, these figures may represent hundreds of patients developing HIT each year (Šoltés et al. 2023).

ECMO Considerations

There are many considerations to take into account when dealing with patients on ECMO and trying to determine the best way to maintain therapeutic anticoagulation. Some of the different challenges to overcome with these patients include dealing with turbulent flow which may encourage clot formation. This is certainly difficult to avoid in ECMO circuits due to turbulent flow induced by the presence of an oxygenator. In addition, ECMO-associated shear forces induce thrombocytopenia due to faster clearance of glycol protein Iba-negative platelets (Rauch et al. 2023). Heparin-based coatings are commonly used to coat the various components of ECMO circuits, though they are said to be non-leaching, they still come into contact with the patient's blood and thus should be a factor considered in associated thrombocytopenia (Doyle and Hunt 2018). Another issue faced in dealing with ECMO is the potential for hemolysis and resulting thrombocytopenia and production of plasma free hemoglobin which can attribute to the need for blood transfusions (Doyle and Hunt 2018). Simply being exposed to the artificial components of an ECMO circuit causes activation of the clotting cascade and complement system, and it too may be a reason for the consumption and depletion of platelets and other essential blood components (Doyle and Hunt 2018). Lastly, all of these previously mentioned considerations can alter and potentially misrepresent these patient's lab values. This makes it even more complicated to determine what is causing all of these associated coagulopathies.

Conclusion

Bivalirudin potentially offers a more stable pharmacokinetic profile, decreased transfusion requirements, greater thrombin inhibition, longer ECMO circuit life, decreased major bleeding events, and better in-hospital mortality (Valdez et al. 2023). Despite these potential advantages when using bivalirudin, both bivalirudin and heparin have uses for the patient on ECMO. Heparin will still most likely be used in anticoagulation therapy for ECMO patients due to its availability, effectiveness in low-flow states, and luxury of having protamine sulphate as an antidote. Bivalirudin should continue to be researched to determine if it is, in fact, a superior anticoagulant to heparin for ECMO patients.

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Reflection In One's Rear View Mirror

Welcome to another of my, "right index finger", submission (😉) entitled "Reflection In One's Rear View Mirror": within this writing we will take a look back into a much earlier era of our initial extracorporeal circulation (ECC) "membrane oxygenator" (MO) having been, personally experienced, by yours truly (👍). As in past AACP Newsletters, I had selectively quoted the American poet, Henry David Thoreau in that, he had written, "how vain it is to sit down to write when you have not stood up to live"! Indeed, a thought-provoking inference (😮)! Within my birthplace, of Nova Scotia, there is a somewhat similar expression, albeit nautical in nature, which states, "you were there for either the laying of the keel or for the launching of the ship"? In full disclosure, although not nautically inclined (😉), I was very much present, in 1967, but just a few years after the Halifax historical, Tuesday, November 24, 1964, "first use of the pump oxygenator" within the former Children's Hospital, Halifax, Nova Scotia! It was just, four years later, that I was to train as their first Heart Lung Technician (Pump Tech) student. Within that precise time frame so provided, the reader might agree, I was indeed there, shortly thereafter, the launching of "their cardiac ship", eh (😉)"!

It has been written, "history helps individuals understand their own identities and backgrounds, by revealing how different historical experiences have shaped diverse cultures and perspectives. Our past experiences that would serve to guide future developments is appropriate in terms of our gleaning insight into the genuine reality of today's ECC experience! Similarly, history would have many facets! It would also provide us with the opportunity to learn from our past mistakes (😮). Being specific to our extracorporeal history would also show that change is a constant and past experiences would serve to guide our future development! The development and growth of both Cardiopulmonary Bypass (CPB) and open-heart surgery would lend itself to many years of historical layers - its path being well trodden given the many experienced footprints having been left behind by others(👍)! In this earlier era, CPB was to be, initially described, "as a tool for cardiac surgery, used to meet a surgical demand and was to be discontinued as soon as was possible"! Given that credo, in the presence of a desirable shorter surgical intervention, it would appear that not much had changed but, given today's open-heart reality, of course, MUCH CPB change, has indeed occurred, for the better (👍)! Our ECC history, as such, was an ever-constant pursuit that would, slowly be realized, into the modern open heart surgical reality that YOU would now, be a direct witness, into your daily reality (👍)! Similarity, that "never a constant" was to be proven accurate given the historical devel-

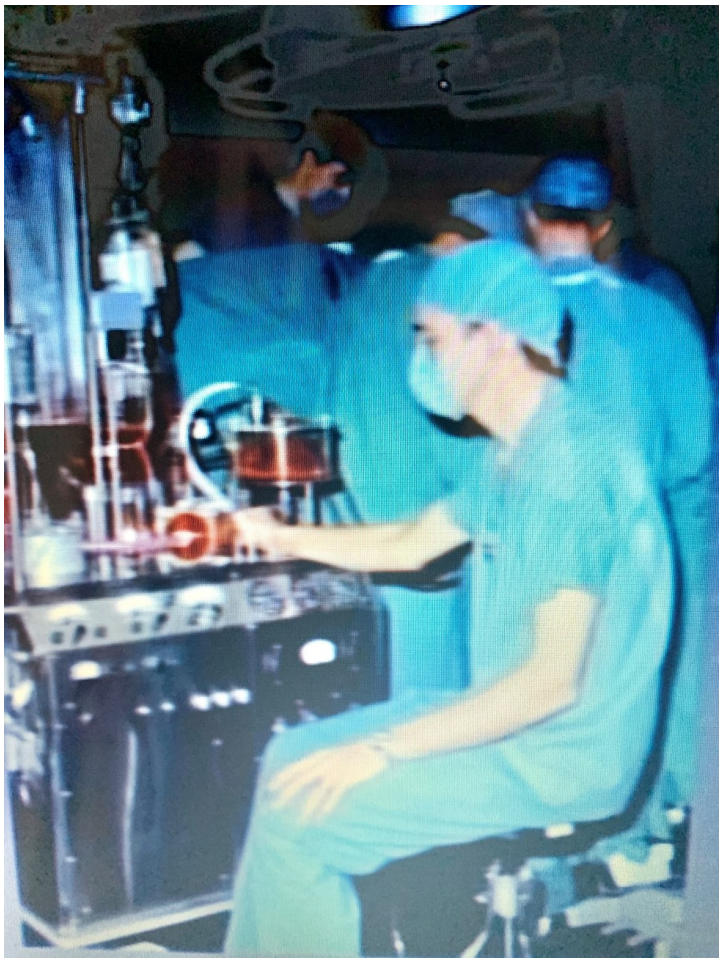
opment of our second, cousin, Cardiac Anesthesia, which has enjoyed, a unique and special historical consideration, in and of itself! As was soon realized, success would find its ongoing growth out of its clinically related failures - failures that would provide the genesis for "our constantly, having moved forwards"!

Dipping a bit further back into our initial ECC history, would bear witness to the first theoretically based artificial oxygenator, going back to the time of Jean Le Gallois, von Frey, Gruber and Brown-Sequard, etc, (circa, 1812 to 1850), and beyond, that is, into our present day ECC reality. While not all readers might necessarily be interested in our extracorporeal history, these initial pioneering individuals, and the many that were to follow should, therefore, not be thought of as, "just mere names within a history book"? Each of their contributions were unique and, as such, would lay the conceptual gravestones for future and ongoing generational ECC developments. It is duly noted, "World War II" would interrupt further progress into the possibility of a much earlier, CPB realization! That said, all former efforts were, to finally, "become a clinical reality, on Wednesday, May 6, 1953"!! On that historical Wednesday, the worlds "first direct vision open heart surgery", would be performed by Dr. John Gibbon, Jr. at Thomas Jefferson Medical College Hospital, in Philadelphia! Dr. Gibbon had developed the first clinical prototype, Model Il - Gibbon "pump oxygenator" finally, having been realized into an historical but clinical reality! Dr. Gibbon and his wife, Mary, had left their singular (🫆) within our, open heart history books! A timely but deserving "shout out", to my friend and colleague, Mark Kurusz, for his thorough investigation into Dr. John Gibbons, Jr. historical background reality - a reality that had led to this pivotal, and most important, corrective open-heart surgery, historical day(1)! This singular open-heart success, in and of itself was almost, NOT, to have been realized!! However, the theoretical concept of artificial oxygenation had, finally, been realized into a renewed clinical reality by the nexus of this much earlier direct blood contact screen type, "Gibbon pump oxygenator". This pump oxygenator was designed "for the purpose of maintaining either a partial and or of, ALL, of the cardiorespiratory function in the human patient"(2)! Of equal importance to also note, this historical open heart surgical event, had also provided "the suitable vehicle" for the "FIRST historical delivery of systemic oxygenated blood, "(via a modified De Bakey roller pump) from out of - and into, the systemic circulation of this, 18 year old female patient", thereby having defined the word "extracorporeal circulation" given the associated use of the "modified roller pump" used to bypass the beating "human heart"! That being sited our extracorporeal journey, having been successfully initiated, would be long in its tenure and, could never, to be thought of as, ever being, rather straight forward (😅)! My apologies for this rather elongated background but, as I had previously stated, "there is no reason to go back into past history unless we can find out something that would relate to our present"! It is so true to say, whatever ECC components you would use today, would have an interesting but unique past (👍)!

Historical CPB linkage, such as this, would provide myself an opportune sequel into my personal "pump oxygenator and open-heart surgery", remembrance. These remembrances are inclusive of other clinicians, who had "shared" in this earlier era Maritime open heart and pump oxygenator, realization! Within that earlier era reality, I have chronicled, mine and others initial clinical experiences, within my published, Halifax, Nova Scotia remembrances (3). That noted, on May 6, 1953, the historical nexus/marriage of "the pump oxygenator and the open-heart patient", would provide the much needed stimulus, towards our constant and ever evolving, CPB history! As such, it would also be witness to our ongoing scientific investigation by way of other heart centers direct vision open heart sur-

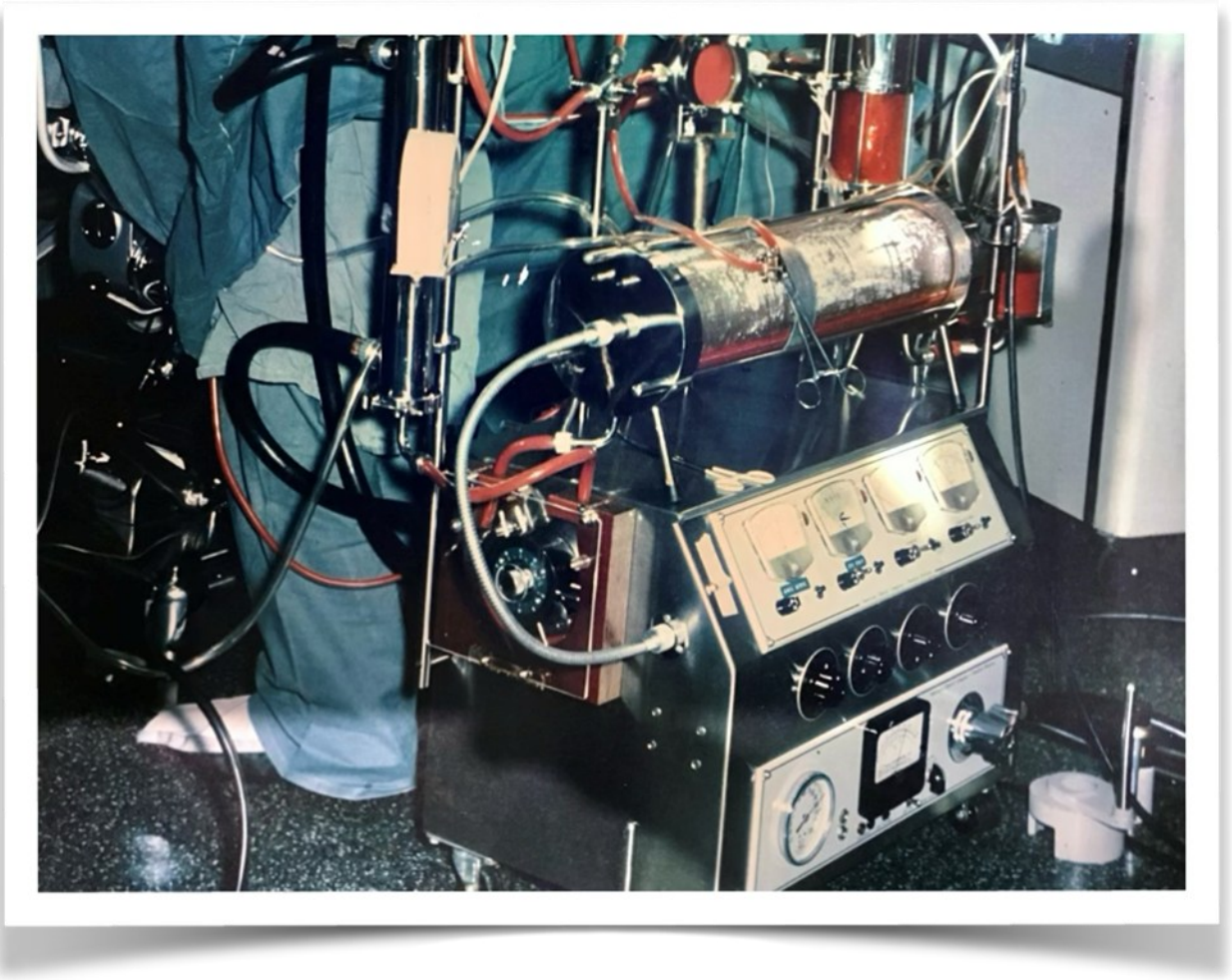
gery reality, having witnessed a similar era experience! That noted, the well-trodden path, by many clinical investigators, would continue with renewed investigative research and ever evolving clinical interests (4-9)!

On a personal note, I had begun my tenure, as a student "Pump Technician" (Pump Tech), in 1968. I had originally trained on one of, the ONLY two original, "direct blood contact pump oxygenators", having been used, during that earlier introductory CPB era. The pump oxygenator, previously mentioned, and having been initially used by Dr. John Gibbon, Jr, the Gibbon Model II Flat Vertical Screen Type Film Oxygenator, is shown below during open heart surgery in Montreal, Quebec, in 1968:



My "Pump Tech" friend, Ian M. Ross, shown operating the Gibbon "pump oxygenator, at the Royal Victoria Hospital, with Dr. Anthony Dobell, Cardiac Surgeon and Dr. Earl Wyands, Anesthesiologist, Montreal, Quebec, 1967

The other "direct blood contact pump oxygenator", having also been previously referred to during that same period, was the one I was initially trained on, by the late Allan Smith, formerly of The Birmingham Children's Hospital, Birmingham, England - that being, the Adult, Pediatric and Infant, Kay Cross Rotating Disc Film Type Oxygenator (KCRDO). The "Adult pump oxygenator" shown below, in this personal Victoria General Hospital (VGH) open heart photo with its 120 rotating discs (😅) each one being directly exposed to blood within an 95 % oxygen and a 5% CO2 rich atmosphere:



The Adult Kay Cross Rotating Disc Film Type Oxygenator, with its "whole blood prime", and the American Optical HLM, VGH, Halifax, Nova Scotia, 1968

Of historical note, during the early 1970s, our extracorporeal attention would witness the gradual withdrawal from the above "non-disposable pump direct blood contact oxygenators"! As a tincture of time would lay witness, this pump oxygenator would become associated with "some degree of trauma to the blood, resulting in hemolysis and protein denaturation and, as such, could, in theory, not to be used for more than a few hours before serious complications might occur" (😆)! In reality, the open-heart surgery in the day, could and would take several hours which had compounded the above stated clinical observations! The overall mortality rate would be around 15 to 20% in the day (😱)! Hematuria was always present and was used as a marker to remove the patient from CPB as soon as was humanly possible? This very clinical interface reality would lay the very foundation for the timely introduction of its first cousin, "the newer and, much simpler to set up and to use, the "Disposable Bubble Oxygenator (BO)" - key emphasis on the word, "DISPOSABLE" - finally being realized (😉)! Our repetitive workload, of washing, assembly, reassembly, muslin wrapping and steam autoclaving, to mention but only a few, of the KCRDO, was soon to become a lost perfusion-related art (😅). The daily life of the "pump tech" was to suddenly become, MUCH easier and, more importantly, the CPB was also to become, much more dependable (😳)! Similar to the earlier so named, "mechanical pump

oxygenator" these new "disposable hard shell and soft-shell BO" would soon to have acquired, the agreed upon title, of "The Bubbler". As our history would show, it would be a decade before the BO would also find its "sedentary shelf life", secondary to its associated incidents of "gaseous micro emboli" being perfused into the systemic circulation, of the open-heart patient. These sequelae among several others, thus stimulating continued clinical investigation resulting into an increasing but steady interest, in this newer MO lung technology (😭)! Being very honest, the sequelae of the "pump oxygenator" was not to be truly appreciated, nor to be readily understood, that is, until ongoing investigation would give birth to the newer realized terminology, "the pathophysiology of CPB" given, among other things, its specific deteriorating associated organ related disfunction! The inference, "pathophysiology of CPB", being gleaned from the initially observed negative clinical realization having slowly been realized and, therefore, having steady moved towards improvement, within our associated CPB, corrective cardiac surgical interventions (😱)!

The introduction of the "commercially available disposable MO", would have a unique historical story, in and of, itself. Intentionally designed so as to mimic "our normal alveolar capillary membrane physiology" its unique principle of oxygenation was the exact opposite given the intentional "design characteristic of the BO"! Looking back to this era, the initial introduction of this new MO technology would introduce the solid silicone design which, a few years later, was to become the microporous semipermeable membrane (😳). An interesting story there! No matter the material used, over the preceding years, this MO technology, would find its continued usage, "never being placed, on to the retirement shelf", to join other predecessors. To this very day, the MO would still find its clinical home within, your daily CPB armamentarium! The coincidence of, "timing, having been driven by clinical necessity", had proven its worth, once again! Speaking of timing, it is interesting to note, the interest given improvements into direct myocardial revascularization, was also on "the immediate horizon"! That sited, this specific 1970's interests, was soon followed by "the explosive growth of open-heart surgery" secondary to the introduction of aorto-coronary bypass surgery (CABG) thus "allowing, the easier to use, disposable BO to enjoy, a few more years, of clinical popularity. Obviously, during this period, there would be several very important CPB components, being added, to our CPB armamentarium, i.e, arterial line filtration, cardiotomy reservoir filtration and direct arterial line pressure monitoring - each being deserving of a more, in depth, discussion (😁)! On a personal note, as we were entering the late 1970's into the early 1980's, the BO, would join other oxygenators in its final resting place, on our "historical oxygenator storage shelf", proof, as ever, that ECC was witness to an ever evolving, step by step, CPB change (👍)!

I thought it opportunistic to provide my clinical impressions in regards my initial utilization of, but one, of the much earlier generational MO. It is of interest to note, inventors' names, as seen below, would attached their names to specific MO models, initially developed by individuals such as EC Peirce, A.J Lande, T Kolobow, WJ Kolff, GH Clowes, JH Bartlett, ML Bramson, etc. I would, once again, refer to the reader to another AACP Newsletter article by my friend and colleague, Kelly Hedlund who offers, yet another specific historical look back, into the earlier days, specifically, within sited Travenol Corporation (10). Within the early 1980's, most cardiac hospitals, would gradually gravitate to "these more physiological membranes", proven to be clinical associated with the observed, "scientifically proven and clinical acceptability and dependability" given its more physiological extracorporeal indirect blood gas membranes exchange interface. It is interesting to note, over the last

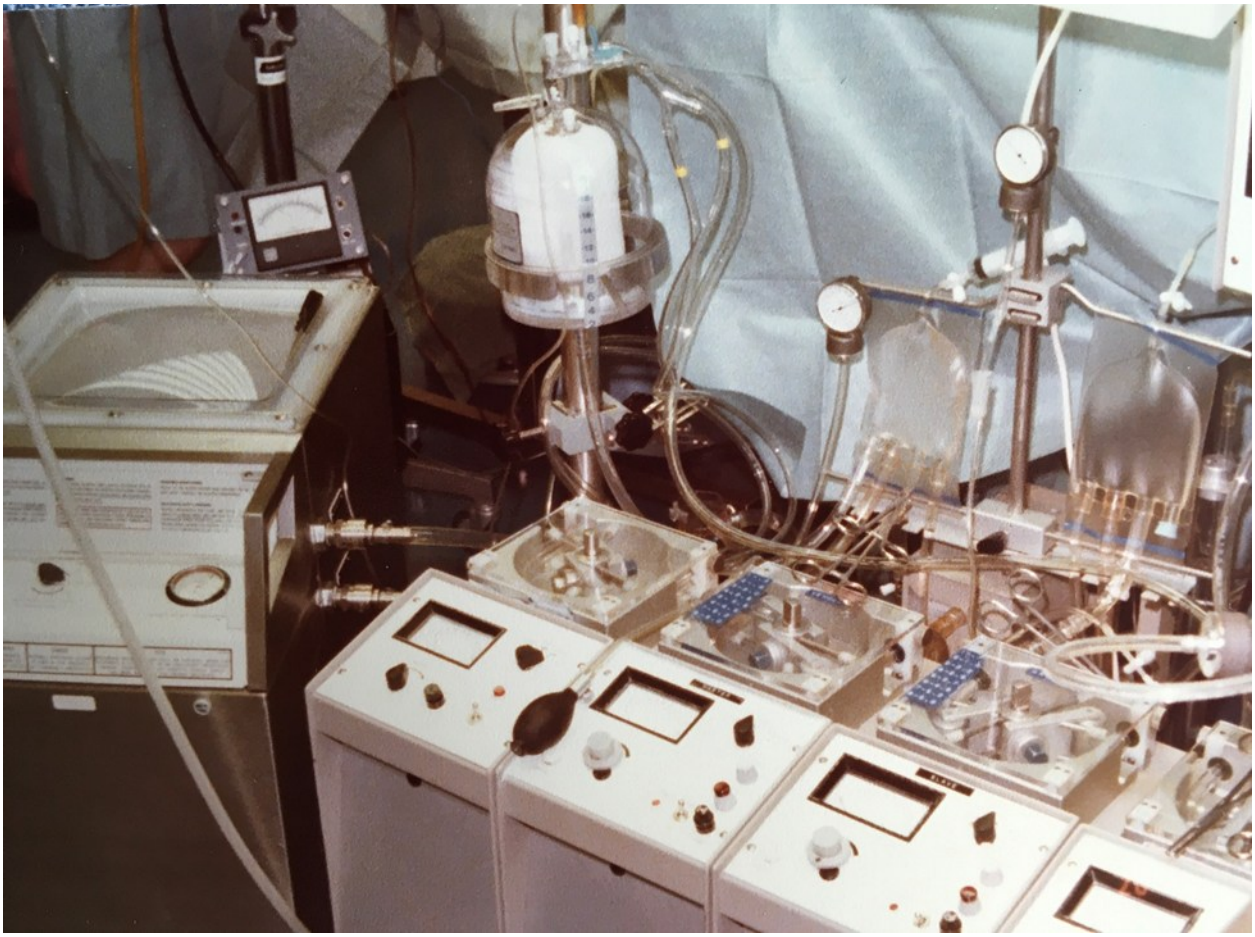
decade, the MO design had not been, patently, altered!
That mentioned, please join me as we journey into, but one specific much earlier, MO clinical interface reality. The Travenol Membrane Oxygenator (TMO) polypropylene microporous MO design was representative of pivotal steps in improving the efficiency and safety of these devices by way of the Baxter Travenol Microporous TMO, as shown in the below, Baxter Tra-

T*he TMO would be locked into its metallic case allowing one's ability to increase and or to decrease "shim pressure capability" thus affecting a desired PaO2 change.*

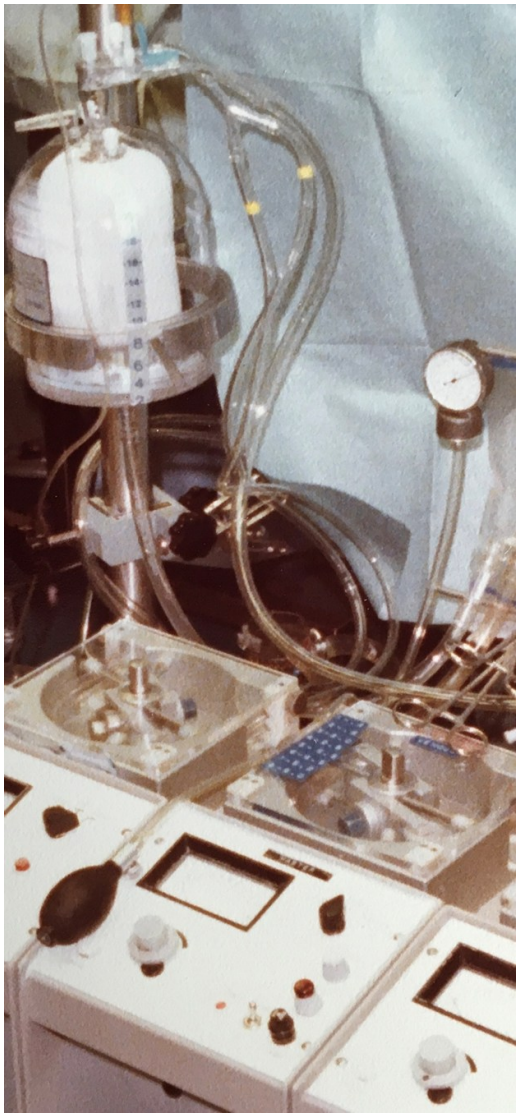
In October of 1978, at 32 years of age, I was to clinically inherit the TMO (😊), after having accepted my new position within University Hospital. I distinctly remember my drive from Halifax, Nova Scotia to London, Ontario, that now approaching five decades earlier, in my "new 1977, blue Honda Civic Coupe (🚗) (salary increase 👍) with its incorporated "new generational tape deck" (😀). I was to begin my tenure, as their new Chief Perfusionist. While on that very drive, I was to listen to the repeated, playing and replaying, of their Baxter Travenol educational TMO tape recording, (I was a slow learner (😰)? These fortuitous tapes were to provide myself with, up to date theoretical information, in regards "the safe clinical interface of the TMO"- while also listening to a smattering of musical interludes being provided by notables such as "The Bee Gees" and "The Rolling Stones" (👍)! In time, I would come to, very much, appreciate the clinical interfacing of the TMO! As such, I thought it opportune to provide, a detailed clinical description (😊) of its specific extracorporeal interface, for you, the readers, historical background consideration (😱).

INTRODUCTION TO MY FAVOURITE, TRAVENOL MEMBRANE OXYGENATOR (1978): in the day, it would come as no surprise, the Cardiovascular Perfusionist (CP), might be so inclined to have, his/her favorite MO? Within that reality, I to, was not to have been, the exception (😊). Looking back, it seems, somewhat coincidental, that I was to make an invitational visit, to The Artificial Organs Division of Travenol Laboratories, Inc, in Deerfield, Illinois, on

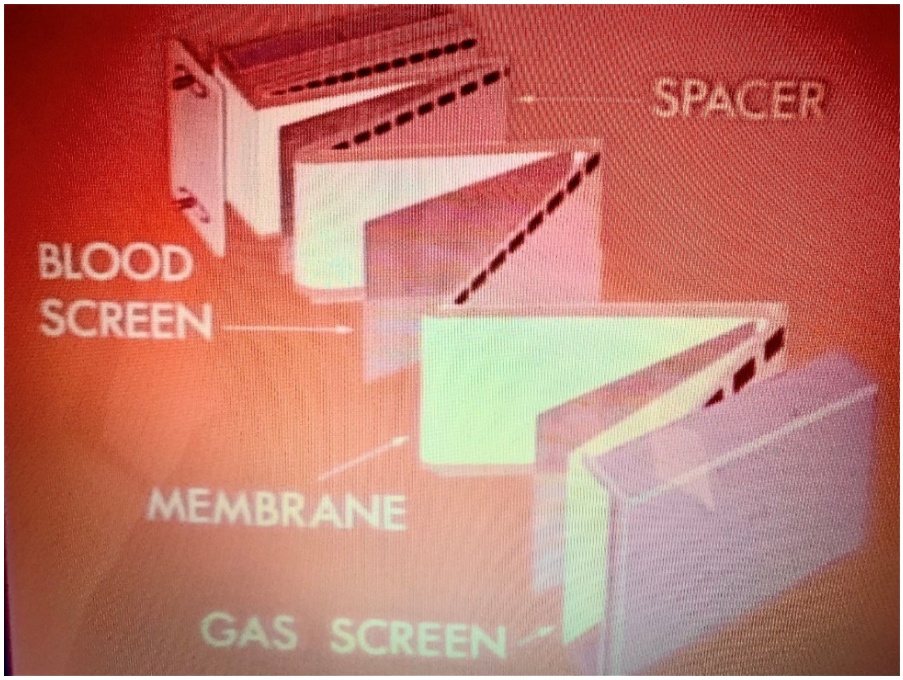
October 8th, 1976 - (the reader might remember my reference to my contemporaneous notes (😉)? I was to attend their first MO Seminar. I would always remember the skillful teaching of their Clinical Consultant, Richard Jensen, who had furnished myself with, not only the theory base of the TMO but, also, "the complete tape recordings" in reference to the clinical interfacing of their new, TMO which was to, ironically, prove to be most beneficial, only a few years later (😉)! Could it be my educational visit to Travenol Laboratories, in retrospect, to be considered a precursor to my future moving to UH, London, Ontario, in 1978 (😱)? I always, jokingly, refers to the Extracorporeal Gods as being our overall influencer (😳)! When I had arrived at UH, I was to join my colleague and, soon to become "very close friend", Andrew Cleland! Andy was to tech myself, "the extracorporeal, ins and outs" providing myself my initial clinical introduction to the TMO, with Andy having previously used the TMO, prior to my arrival (we would work together for 32 years (👍)! For your perusal, enclosed are operative photos of our clinical interfacing of the Baxter Travenol Membrane Oxygenator (TMO). These photos were taken by our UH medical photographers either, Kathy or Steven, who had demonstrated much patience while taking, these specific photos, I had sometimes requested, on very short notice (😉). Their photos would serve to illustrate the TMO, as shown below, fully primed and made ready for routine CPB, within UH:



The TMO, not visible within its posterior metallic membrane holder, in use with the Sarns dual venous/arterial modular roller pump configuration, marked with blue tape - above these synchronized roller pumps, the incorporated venous and arterial reservoir, are shown, with ECC fully primed, in preparation for our routine CPB, UH, 1978.

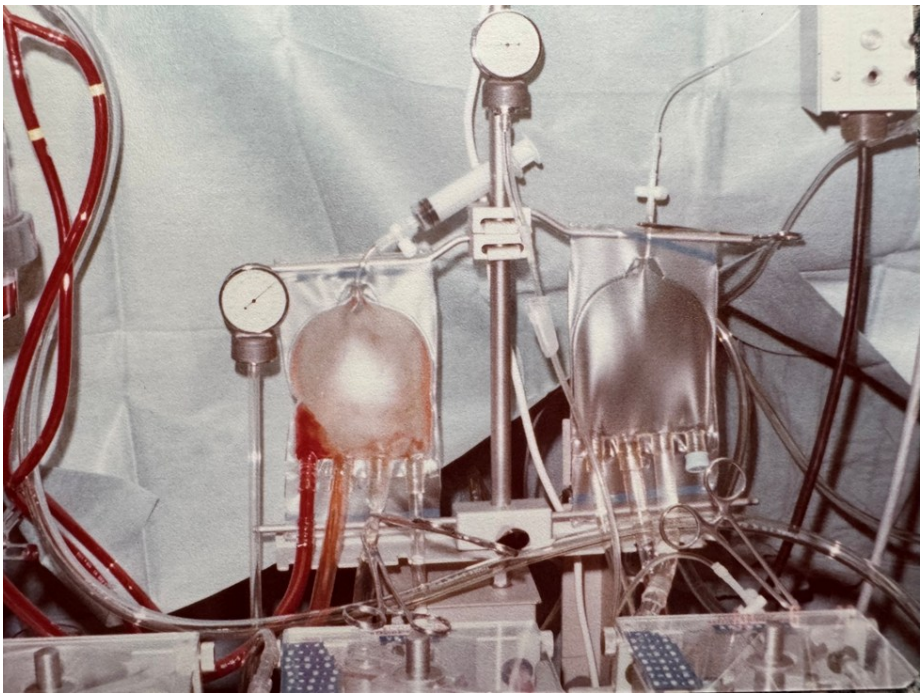


Close up of the Bentley Cardiotomy with returning coronary suction and decompression vent return - the Sarns modular pump heads showing the pressure bulb manometer, with its attached Tycos pressure gauge, used to "manually increase and/or decrease the TMO "shim pressure", i.e., blood layer film thickness, thus affecting "a desired, increase or decrease in PaO2 gas transfer, resulting in a desired PaO2" ( )!!



Baxter Travenol schematic of the TMO with its fan folded, sandwiched microporous polypropylene, semipermeable membrane

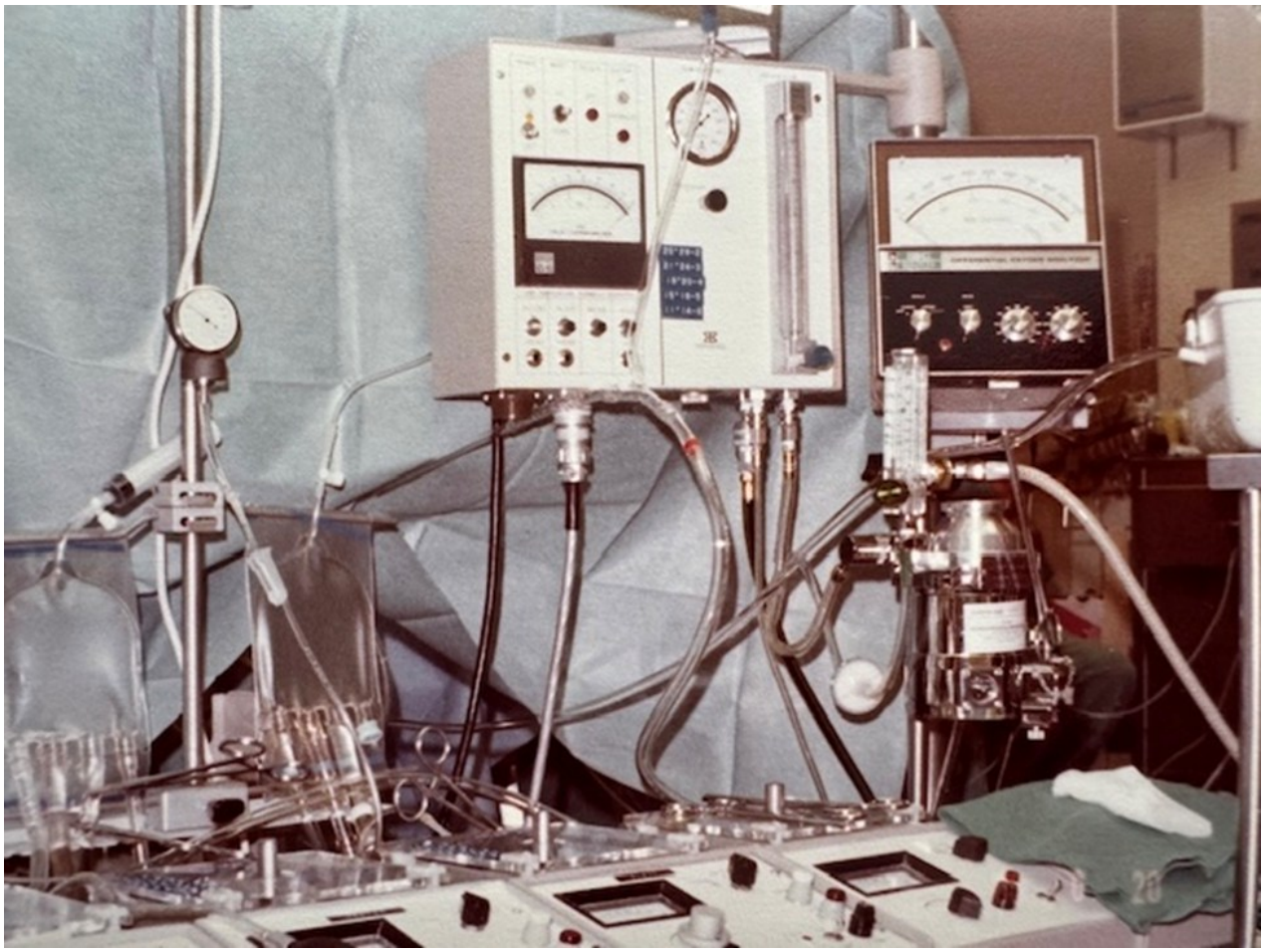
THE ANATOMY OF THE TMO CLINICAL INTERFACE: with the confines of our UH cardiac OR 5, whenever teaching Perfusion Students, Residents, Nursing, etc., it was easier, for myself, to describe the TMO as a "more physiologically designed membrane oxygenator" given its ECC being, somewhat, anatomically similar, to our normal cardiopulmonary physiology. In this unique Baxter Travenol design the TMO, also known in the day, euphemistically, as the "thinking man's oxygenator (the actual male pattern staffing reality of the day (😊), was utilized with the newer, Sarns Modular Roller Pump System, being one of the new HLM iterations, during that late, 1970s, era, as is shown below:



The venous and arterial reservoir shown with Cardiotomy blood entering the venous reservoir, just prior to commencing CPB.

These two separate low volume, venous and arterial reservoirs, might be thought of as being representative of one's anatomical left and right atrium, as shown above, with their corresponding, Sarns dual roller pump head configuration. As such, these reservoirs and roller pumps, when teaching, were representative of one's anatomical atriums and ventricles. The incorporated venous roller pump would pump, gravity feed venous return line blood, from the venous reservoir into the TMO, where upon, oxygenation had occurred. After transit through the TMO, "which was not gravity fed", the arterialized blood was next pumped, by the same venous pump, into the adjacent arterial reservoir, where upon the second synchronized, main arterial roller pump would pump the oxygenated blood, into the patients systemic arterial circulation - thus the requirement for these two, side by side, Sarns Modular dual roller pump head configuration - if you might

catch my anatomical drift (😳). Paramount to the proper "synchronization of these two roller pumps" was an existing, small shunt line, situated between both the arterial and the venous reservoirs - if you might allow a kind of, Eisenmenger right to left shunt. This shunt line would allow the Perfusionist, while conducting CPB, to visually inspect the "slight shunting of arterial blood, from the arterial reservoir and into the venous reservoir thereby, visually insuring the very important, "slight off set synchronization", being so necessary between the arterial and the venous roller pump heads. That being explained, in detail, one might readily understand the TMO configuration as being similar to our native cardiopulmonary anatomy - an easy anatomical teaching tool, thus being provided (😭)! This to explain my having acquired a personal preference for the TMO and, more importantly, its inherent trustworthy clinical predictability with its inherent independent and easily adjustable, PaO2 transfer rate capability - a unique design capability ONLY available, in the day, within the TMO (👍)! The ongoing controversy in regards the clinical adequacy in our continuing to utilize, these earlier generational bubble oxygenators versus these newer membrane oxygenator designs, during routine open heart surgery, was certainly under continued clinical investigation and overall scrutiny given the suggestion of a much safer CPB interface provided by the membrane oxygenator, i.e., the suggested less occurrences of micro gaseous emboli and massive air embolism, etc.! UH was one of the Canadian hospitals to use the TMO, only!



The venous and arterial reservoir, the TMO control panel and the Bentley Labs Differential PaO2 Analyzer used to demonstrate the desired PaO2 - also, note the incorporated use of the Anesthetic Isoflurane Vaporizer.

As I had cited in the opening paragraph, I think it appropriate to, once again, recall the reflective wording of the philosopher, Henry David Thoreau, in his having said, "how vain it is to sit down to write when you have not stood up to live" (⌛)! Having personally experienced, these past several decades, of our constantly evolving ECC growth, I thought it wise to, while one still could, to do just that, "to sit down and to write" - you might get my intended, drift (😉)! That said, I thank you for your allowing myself to share, with yourselves, my past shared clinical interface reality! As our history has shown, these past CPB experiences, having been thus cited, continued to provide the building blocks, which serve as an important historical guide, in respect to your ongoing ECC development! As in the past I would, respectfully remind the reader, of the following daily reality: when next YOU might be conducting CPB, within those quiet moments (😉), please give thought to the following actuality: every single component, of your specific CPB circuit, that you would touch every day, would have "its singular, unique but shared, ECC history" (👍)! That reality would invite you to join in that history!

I thank you, for your sharing in this, "a look back by way of my rear-view mirror"! I am happy to have "shared" this duty of ECC remembrance", with YOURSELF, that is, while my memory remains, "firsthand and, hopefully, not considered to be, just mere words within a historical remembrance (😉)!

"All of you are the shared hands, in the care of our cardiac patient"(11)

With kindest regards, your extracorporeal colleague,

Jim MacDonald CPC (retd) CCP (Emeritus)

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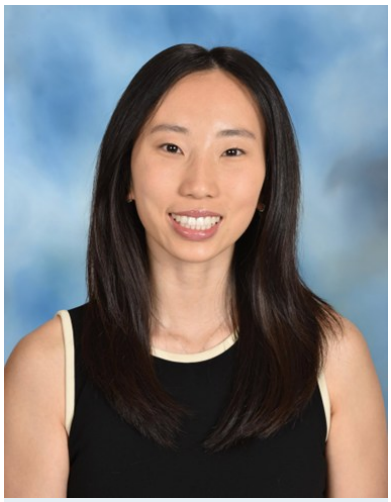

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How Delivered Oxygen Index Affects Kidney Function in Patients Undergoing Cardiopulmonary Bypass and Calculating Ideal Blood Flow for High BMI Patients

Each year, an estimated one million people undergo cardiac surgery and are put on cardiopulmonary bypass (CPB) which is a means of mechanically replacing the function of the heart and lungs. Of these, the prevalence of patients that experience significantly diminished kidney function, which can also be referred to as Acute Kidney Injury (AKI), is around 20-50% [1]. This is significant given that AKI puts patients at higher risk for extended ICU stays, stroke, chronic kidney disease, and mortality [1,2]. It is unavoidable that patients will need to go on CPB for certain cardiac surgeries, so finding improved methods of perfusing these patients to better preserve their kidney function will greatly increase their post-operative success.

Since 2007, AKI has been assessed by monitoring changes to the patient's serum creatinine (sCr) levels over 48 hours. Higher pre and postoperative sCr levels have substantial detrimental impacts on kidney function and even a 1mL/dL increase in these levels raises the risk of AKI by 4.8 fold [2]. While on CPB, sCr is expected to increase by 0.1-0.2 mg/dL on average but identifying what causes dramatic increases in sCr would allow perfusionists to make the necessary changes to minimize raising sCr [3]. Recent research indicates that elevated lactate levels have been correlated with renal insufficiency. Patients who had severe hyperlactatemia, which is classified as having lactate levels that are greater than 5 mmol/L, experienced renal insufficiency at a rate of 30.7% compared to those with lactate levels between 2-5 mmol/L who had a rate of 8.6% and those with normal lactate levels, under 2 mmol/L with a rate of 5.5%. This difference proved to be significant and is the reason lactate will also be used as an indicator for post-operative kidney function [4].

Though there are many factors during CPB that can have potential effects on renal function, Delivered Oxygen Index (DO2i) is strongly correlated with postoperative AKI incidence. Our study will assess how different DO2i levels throughout the case will affect creatinine and lactate levels, using the lowest oxygen delivery and comparing its effects to the largest/cumulative area under the curve (AUC) below the oxygen delivery threshold. A study completed in 2020 identified that the largest AUC was an independent risk factor for postoperative AKI and that maintaining an AUC below 880 would benefit in preventing AKI [5].

Another factor that we are interested in looking at is determining the optimal blood flow for patients who have an obese BMI, which is defined as having a BMI over 30 kg/m2. BSA is typically used to determine the proper flow rate for patients on bypass which can lead to an overestimation of the prime volume and blood flow requirements of patients with a high BMI. A study completed at the Mayo Clinic suggested that using lean body mass for high BMI patients to select a CPB circuit and determine flow would better represent the actual metabolic demands of the patient because adipose tissue does not require as much perfusion [6]. Decreasing the target blood flow for high BMI patients would allow for a smaller CPB circuit, decreasing foreign surface area, and the amount of prime volume required reducing the amount of hemodilution.

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The Role of Biocompatibility in Cardiopulmonary Circuits

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Cardiopulmonary bypass (CPB) and other extracorporeal circulation modalities remain indispensable tools in cardiac surgery and critical care. However, blood contact with nonbiologic surfaces triggers coagulation, complement activation, platelet aggregation, leukocyte recruitment and hemolysis that contribute to postoperative morbidity. Improving circuit biocompatibility through material selection, surface coatings and circuit design aims to minimize these host responses. This manuscript reviews mechanisms of blood–surface interaction, summarizes current strategies to enhance hemocompatibility, assesses clinical evidence for benefit, and outlines emerging technologies and regulatory considerations. While heparin-bonded and other commercially available coatings reduce surrogate markers of activation and some intermediate clinical outcomes such as transfusion requirement and atrial fibrillation, evidence for reductions in major endpoints (e.g., mortality, long-term organ dysfunction) remains inconclusive. Continued development of biomimetic and nanoscale coatings, real-time monitoring, and rigorously designed clinical trials are needed to translate improved surface science into meaningful patient benefit (Ranucci et al., 2009).

Cardiopulmonary bypass circuits, oxygenators and extracorporeal life support systems replace or support native cardiopulmonary function during cardiac surgery and in critical illness. The interface between circulating blood and synthetic materials produces immediate protein adsorption, activation of intrinsic coagulation pathways, complement activation and platelet/leukocyte responses that together constitute a broad host reaction to foreign surface exposure (Hsu, 1997; Ranucci et al., 2009). These biologic processes underlie commonly observed clinical sequelae after CPB including increased transfusion requirements, systemic inflammatory response syndrome (SIRS), postoperative atrial fibrillation, pulmonary dysfunction and acute kidney injury. Contemporary biocompatibility efforts aim to reduce this activation cascade through coatings, surface chemistry modifications and circuit design improvements. Recent years have seen renewed interest in next-generation biomimetic and nanoscale surface strategies intended to further attenuate blood activation during extracorporeal circulation (Li et al., 2024; Sancheti, 2024).

Mechanisms of Blood–Surface Interaction: The first event after blood contacts an artificial surface is immediate protein adsorption, often with conformational changes in adsorbed proteins that expose procoagulant or pro-inflammatory epitopes. Adsorbed fibrinogen, von Willebrand factor and other plasma proteins mediate platelet adhe-

sion and activation, while factor XII (the contact system) promotes intrinsic coagulation cascade activity and kallikrein–kinin pathway signaling. Parallel activation of complement (generation of anaphylatoxins C3a and C5a) recruits and activates leukocytes and amplifies cytokine release, contributing to SIRS-like physiology. Shear forces and nonlaminar flow zones in circuit components induce platelet activation and hemolysis, with downstream effects such as nitric oxide depletion and oxidative stress. Taken together, these interactions create a multifaceted host response that is influenced by material chemistry, surface topology, wettability and circuit hydrodynamics (Hsu, 1997; Ranucci et al., 2009).

Strategies to Improve Biocompatibility of Cardiopulmonary Circuits Material and coating approaches, circuit design optimization, and adjunctive pharmacologic and monitoring strategies have all been pursued to reduce blood activation.

Material coatings and surface chemistry Historically, heparin-bonded surfaces were among the first widely adopted approaches, intended to provide a local antithrombotic milieu that mimics endothelial heparan sulfate and reduces thrombin generation and platelet adhesion. Phosphorylcholine and other biomimetic polymeric coatings aim to mimic the zwitterionic character of cell membranes to minimize protein adsorption and complement activation. More recently, researchers have investigated nanoscale and bioinspired strategies such as superhydrophilic/hydrophobic layer engineering, polydopamine-based primers, nanoparticle-functionalized layers, and membrane-mimetic coatings that actively suppress coagulation and complement activation (Li et al., 2024; DeFlorio et al., 2024). Bench and preclinical reports show promising reductions in protein adsorption, platelet activation markers, and complement split products with some of these technologies, but full clinical translation is ongoing.

Circuit design and hemodynamic optimization Biocompatibility is also a function of circuit geometry, flow patterns and the extent of air–blood interface. Minimizing prime volume, using closed or miniaturized circuit strategies where appropriate, avoiding areas of stagnation, and selecting pump/oxygenator combinations that reduce shear stress can reduce hemolysis and micro-emboli generation. Innovations in oxygenator fiber design and cannula surface finishes have been paired with coatings to reduce thrombi-inflammatory responses in prolonged extracorporeal support settings (Shetty, 2025).

Monitoring and adjunctive pharmacologic approaches Advanced monitoring of biomarkers—platelet microparticles, complement split products, markers of hemolysis—and devices such as bubble/microemboli counters can provide real-time assessment of circuit performance and hemocompatibility. Pharmacologic adjuncts (antiplatelets, direct inhibitors of complement effectors) are areas of active research but are not yet routine for most CPB cases. Recent methodological work has emphasized standardized biomarker panels and experimental methods to compare coatings under controlled conditions (Sancheti, 2024).

Clinical Evidence: What Do Trials and Meta-Analyses Show? Randomized trials and meta-analyses conducted across decades have examined whether biocompatible circuits produce clinically meaningful benefits. A well-cited systematic review and meta-analysis by Ranucci and colleagues (2009), combining 36 randomized trials (≈4,360 adults), reported that biocompatible circuits were associated with lower packed red cell transfusion rates, reduced atrial fibrillation incidence and modestly shorter intensive care and hospital stays, but no difference in mortality. The effect sizes were small and heterogeneity across studies was substantial, and subgroup analyses suggested attenuation of benefit when only higher-quality trials were considered (Ranucci et al., 2009). These findings support a modest clinical benefit on intermediate outcomes but do not demonstrate a robust impact on major endpoints such as death or persistent organ failure.

More recent observational and single-center studies continue to explore coating-specific effects. Retrospective analyses from 2023–2024 have investigated heparin consumption, inflammatory biomarker trajectories, and resource use relative to circuit coating selection; some show differences in perioperative inflammation but not always consistent effects on transfusion or hemostatic requirements (Mathieu et al., 2023). Meanwhile, newer bench and preclinical studies describe advanced endothelium-mimetic and nanoscale coatings that markedly reduce markers of activation and permit longer extracorporeal durations in animal and ex vivo models (Li et al., 2024). However, these newer technologies require translation into larger clinical trials before their impact on patient-centered outcomes can be established (Li et al., 2024; Sancheti, 2024).

Limitations of the Existing Evidence: Several factors limit the ability to draw firm conclusions. First, many randomized trials evaluated first- or second-generation coatings and device designs; present-day coatings and oxygenator technologies differ substantially from those tested decades ago. Second, endpoints have often been surrogate or intermediate (biomarkers, transfusion, lengths of stay) rather than major patient-centered outcomes. Third, studies vary in anticoagulation protocols, surgical techniques and patient populations, creating heterogeneity that complicates meta-analytic pooling. Finally, economic and regulatory constraints mean that new coatings must clear safety testing (ISO 10993 and related FDA guidance) and demonstrate a favorable cost-benefit ratio before broad clinical adoption (FDA, 2023; ISO 10993 guidance).

Emerging Technologies and Translational Pathways: Recent high-impact preclinical work has described "endothelium membrane mimetic" antithrombotic coatings that couple surface passivation with active biological signals to attenuate thromboinflammation and permit longer extracorporeal use in animal models (Li et al., 2024). Nanoengineered hydrophilic coatings and superhydrophobic strategies aim to reduce protein adsorption and bacterial adhesion while minimizing hemolysis; these approaches have demonstrated promising in vitro and small animal results but require toxicity and leachable testing and thorough hemocompatibility evaluation under ISO 10993-guided frameworks (DeFlorio et al., 2024; FDA, 2023). Miniaturized and closed extracorporeal platforms reduce prime volume and air–blood interaction and represent another pathway toward improved hemocompatibility that may synergize with advanced surface chemistry (Shetty, 2025). Regulatory considerations and standardized preclinical test methods are critical to ensure that novel surfaces translate safely to patients (Jiao, 2024).

Practical Implications for Perfusionists and Clinical Teams: For the practicing perfusionist and surgical team, selecting circuit components should consider the totality of evidence, device availability, institutional protocols and patient risk profile. Using biocompatible surfaces is only one element: minimizing prime volume, tailoring anticoagulation strategies, employing comprise an integrated approach that is most likely to reduce complications. Adopting new coatings or circuit technologies should be accompanied by local outcome tracking (transfusion rates, hemolysis indices, cytokine/biomarker trends and clinical endpoints) to confirm benefit in the institution's patient population. ELSO and other professional guidance documents provide general recommendations for extracorporeal practice but do not mandate specific coating choices, underscoring the need for local quality-improvement oversight when implementing new technologies (ELSO, 2021).

Future Research Priorities: Key priorities to accelerate translation of improved biocompatibility into patient benefit include: (1) standardized preclinical test batteries and biomarker panels to compare coatings in bench and animal models; (2) randomized clinical trials of modern coating + circuit combinations powered for patient-centered outcomes or high-value intermediate endpoints (e.g., major bleeding, need for renal replacement therapy); (3) integration of real-time monitoring technologies to allow dynamic perfu-

sion adjustments tied to hemocompatibility markers; and (4) health economic analyses to balance incremental device cost against reductions in transfusion, ICU stay and complications. Cross-disciplinary collaboration between materials scientists, perfusionists, surgeons and regulatory specialists will be essential to design feasible trials and ensure safety and manufacturability (Li et al., 2024; Jiao, 2024).

Conclusion

Biocompatibility remains a cornerstone objective in the design and implementation of cardiopulmonary circuits. Existing coatings and circuit optimizations confer measurable reductions in blood activation markers and improve some intermediate clinical outcomes, but evidence of large effects on major patient-centered outcomes is limited. Advances in nanoscale and biomimetic coatings, combined with circuit miniaturization, real-time monitoring and rigorous clinical evaluation, hold promise for the next generation of extracorporeal systems. Clinicians should view biocompatible materials as one component of an integrated perfusion strategy and pursue outcome monitoring when adopting new devices. Continued multicenter collaboration and appropriately powered trials will be necessary to demonstrate that improved surface science meaningfully improves patient outcomes.

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AACP Student Travel Reimbursement Fund

Dear Colleagues,

As perfusionists, we share a deep commitment to excellence, innovation, and patient safety. Every day, we balance life in our hands — and we do it with a dedication that extends far beyond the operating room. It is this same commitment that drives me to reach out to you today.

Each year, the American Academy of Cardiovascular Perfusion (AACP) strives to bring students from accredited perfusion programs across the country to our Annual Meeting. For many of these students, attending the meeting is a defining moment in their education: it is where they first participate in case discussions, hear from leaders in the field, build professional connections, and begin to understand the broader community they are about to join.

Unfortunately, the cost of membership, registration, and travel has become a barrier for many students — especially those coming from programs with limited financial support. Some students work multiple jobs while in school, some carry heavy loan burdens, while some are the first in their families to enter the medical field. But all of them share the same goal: to become safe, skilled, compassionate perfusionists who will one day stand beside us in the OR.

This year, we are asking the perfusion community to come together and help us remove these barriers.

A donation of any amount directly supports student attendance at the AACP Annual Meeting in February. Every dollar goes toward registration fees, membership support, and conference participation. Your contribution ensures that students can learn, grow, and become active members of the profession we all care so deeply about.

If you have ever benefitted from a mentor, attended a meeting that changed your perspective, or relied on the support of colleagues early in your career, then you know how much this opportunity can mean. We have all been that student once.

Your generosity today becomes the strength of our profession tomorrow.

Thank you for considering a donation and for helping us shape the next generation of perfusionists. If you have any questions or would like to discuss how your support can make an impact, please feel free to reach out.

With appreciation,
Allyson Aquino, RN, CCP, LP, FPP
American Academy of Cardiovascular Perfusion
Student Liaison Committee Chairperson

Please Make a Donation

47th Annual Seminar of
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Wednesday, February 4th, 2026

1:00 pm – 5:00 pm	REGISTRATION
2:30 pm – 5:00 pm	**Manufacturers' Breakout Rooms**
5:00 pm – 5:30 pm	Opening Business Meeting *Fellow, Member, Senior, and Honorary Members*
5:30 pm – 7:00 pm	**AI, New Technology and Education Pro/Con Debates** *Moderator: Allison Weinberg* *Progressive Education Model (AI/VR) - Edward Delaney vs* *Traditional Education Model (Didactic/Clinical) - Edward Darling* *What is the Appropriate Level of Education?* *MS (Adam Fernandez) vs Certificate (Deborah Adams)*

Thursday, February 5th, 2026

7:00 am – 10:00 am	REGISTRATION
7:00 am – 7:45 am	Historical Video Presentation and Breakfast
7:45 am – 9:30 am	**Special Scientific Panel Session – Adult Congenital Surgery: An Aging Single Ventricle, How Do We Handle Them?** *Moderators: Karen Jones and Robert Grimmett* Surgical Considerations and Correction - Katsuhide Maeda, MD, PhD Anesthesia Care Plan – Manchula Navaratnam, MD Perfusion Management – Gerald Broniec, CCP, RRT-ACCS, CES-A ICU Intensivist Care Plan - Aaron G. DeWitt, MD Panel Discussion
9:30 am – 11:30 am	**Fireside Chats** Current State of the States OR Team Dynamics Pediatric / Adult Congenital MCS Simulation: From Low to High Fidelity Including VR & AI Student Only Forum
11:30 am – 12:30 pm	Lunch (Historical Presentations)
12:30 pm – 2:30 pm	**Special Scientific Panel Session – Healthcare Economics with Industry Partners** Industry Partners and the Economics of Cardiac Surgical Supplies *Moderators: William Riley and William DeBois*
2:30 pm – 2:50 pm	Historical Presentation and Break

2:50 pm - 5:00 pm **Scientific Paper Session**

LONG-TERM CLINICAL OUTCOMES AND COMPARATIVE FINANCIAL CONSIDERATIONS OF SINGLE DOSE CARDIOPLEGIC SOLUTIONS IN CORONARY ARTERY BYPASS GRAFTING
Orhan Eren Gunertem[1], Abducelil Yildirim[1], Kevin McCusker[2], William Nicotra[3], Serdar Gunaydin[1]
Medical Park Hospital-Turkey[1], Lawrence Technical University-MI[2], St Clair Hospital-PA[3]

THE IMPACT OF PROTAMINE ON ACT
Aneri Patel, Nancy Torres, Ashley Fellows, Julie Collins, Allison Weinberg
Rush University Medical Center, Chicago, IL

AN EXPLORATION IN THE UTILIZATION OF VISUAL AIDS IN PERFUSION EDUCATION: A RANDOMIZED CONTROL TRIAL
Allison Weinberg, Kelly Russell, Marisa Michi, Madison Walny
Rush University Medical Center, Chicago, IL

PEDIPERFORM DATABASE ANALYSIS OF HLHS LESION PATIENTS REGARDING THE PREOPERATIVE, INTRAOPERATIVE AND POSTOPERATIVE CARE PLAN OF THE NORWOOD PROCEDURE WITH COMPARISON OF ALL PLN CENTERS
Richard Melchior, Justin Farr, Tami Rosenthal
Children's Hospital of Philadelphia

MISSION TRINIDAD: TIPS, TRIALS & TRIBULATIONS.
Bharat Datt
CanAmerica Cardiopulmonary

ANALYSIS OF MICRONANOPLASTIC ACCUMULATION IN PATIENTS POST CARDIOPULMONARY BYPASS
Vedashree Meher[1], Raymond Wong[1], Toshinobu Kazui[2] and Tally Largent-Milnes[1]
[1]Perfusion Sciences Graduate Program, Department of Pharmacology, University of Arizona; [2]Department of Surgery, University of Arizona

HYPOTENSION DURING CARDIOPLEGIA ADMINISTRATION: PLAUSIBLE ORIGINS IN A VAGALLY MEDIATED CARDIAC DEPRESSOR REFLEX
Michael Vespe, MS, CCP
Mount Sinai Hospital, New York, NY

5:30 pm – 8:30 pm **Sponsor's Hands-On Workshop & Reception**

Friday, February 6th, 2026

7:00 am – 10:00 am REGISTRATION
7:00 am – 7:45 am Historical Video Presentation and Breakfast with Sponsors/Exhibitors

7:45 am – 9:30 am **Special Scientific Panel Session – Current State of NRP**
Moderators: Kathryn Gray DeAngelis and Mark Martin
NRP - How to measure outcomes and develop best practice - *Frederick Hill*
Physiology of NRP and reperfusion injury/recovery - *Murphy Rayle*
Ethical Considerations on NRP from a Clerical POV- *Mark Martin*
Gift Of Life Video - Story from Parents of a Donor advocating for NRP (*Courtesy of Kathryn DeAngelis*)
Panel Discussion

9:30 am – 11:30 am **Fireside Chats**

NRP - Religious and Ethical Considerations
Pediatric Practice Developments
Simulation: From Low to High Fidelity Including VR & AI
The Education and Precepting of Our Future Colleagues
Women in Perfusion

11:30 am – 1:00 pm Historical Video Presentation and Lunch

1:00 pm – 2:45 pm **Special Scientific Panel Session – Innovative Pediatric Practice & Translational Research**

Moderator: Ronald Gorney and Justin Farr

The Wisdom of LTOWB: Transforming Information and Knowledge into Meaningful Pediatric Practice - *Isaac Chinnappan*
Three-Region Perfusion for Norwoods and Aortic Surgery - *Richard Ginther*
Neurometabolic optical monitoring for brain-directed management of ECLS - *Tiffany Ko, PhD*
Acute Heart Failure and Care Considerations - *Katsuhide Maeda, MD, PhD*
Panel Discussion

2:45 pm – 3:15 pm Historical Video Presentation and Break

3:15 pm – 5:00 pm **Memorial Session**

Introduction—Allison Weinberg
Charles C. Reed Memorial Lecture
Jeremiah Grisham, Chief Master Sergeant (Retired), USAF
Thomas G. Wharton Memorial Lecture
Richard Melchior, President, AACP

6:30 pm **Induction Dinner**

All Attendees and Guests (pre-registration required)

Saturday, February 7th, 2026

7:00 am – 10:00 am REGISTRATION
7:00 am – 7:45 am Historical Video Presentation and Breakfast
7:45 am – 10:00 am **Scientific Paper Session**

DECREASED SEROTONIN TRANSPORTER ACTIVITY IN THE MITRAL VALVE CONTRIBUTES TO DEGENERATIVE MITRAL REGURGITATION
Vivian Moreno, Dr. Giovanni Ferrari (Department of Surgery, Columbia University Irving Medical Center, New York, NY) and Dr. Robert J. Levy (Department of Pediatrics, The Children's Hospital of Philadelphia, PA).

DOES RACE EFFECT THE PREVELANCE OF ATELECTASIS AFTER CARDIOPULMONARY BYPASS?
Nadine Kadadu
Rush University Medical Center, Chicago, IL

MATHEMATICAL MODEL FOR BLOOD EXCHANGE DURING CARDIOPULMONARY BYPASS TO MINIMIZE DONOR BLOOD EXPOSURE IN PATIENTS WITH BLOOD-BORNE PATHOLOGIES
AnnMarie Marquis, Bruce Searles, Edward Darling
State University of New York Upstate Medical University

POST-MENOPAUSAL WOMEN AND ACUTE KIDNEY INJURY FOLLOWING CARDIOPULMONARY BYPASS
Bailey Reitsma, Charleston Robinson, Allison Weinberg, Julie Collins
Rush University Medical Center, Chicago, IL

QUANTIFYING CARDIAC SURGICAL ACCESS THROUGH SPATIAL DRIVE -TIME MODELING
Alyssa Hickerson, Will Sydzyik, Nishad Pandya, Scott C. Sanderson
University of Nebraska Medical Center

SURVEY OF UNITED STATES DE-AIRING TECHNIQUES IN ADULT CARDIAC SURGERY
Mira Makanji, Erin Doherty
Caleb Lange Emory University

CAN VIRTUAL REALITY SERVE AS A STRESS-INOCULATION TOOL IN CARDIOPULMONARY BYPASS TRAINING?
Tommy Nguyen, Paul Ingrassia, Jordan Hope, Edward Delaney, Robert I. Gluck
Hofstra University, Hempstead, New York

10:00 am –12:00 pm **Fireside Chats**
Career Development and Progression
ECMO and VAD Challenges
Errors and Terrors

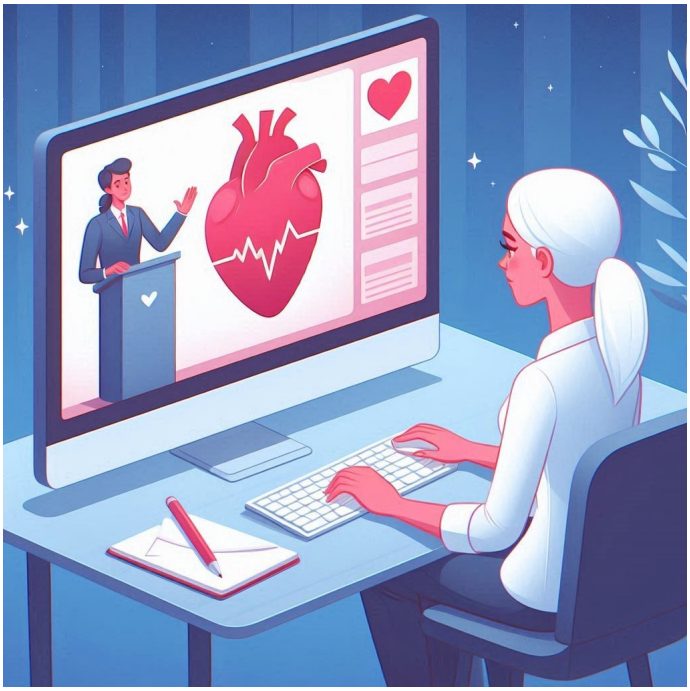
12:00 pm Closing Business Meeting
Fellow, Senior, and Honorary Members Only

Live Webcast of the AACP Conference

The AACP will be offering a Live Webcast of the 2026 Annual Seminar in St. Petersburg, FL.

Virtual attendees will be able to stream all of the General Sessions, as well as have two virtual Fireside Chats each day, exclusively for virtual attendees, ensuring qualification for Category I CEUs.

Virtual attendees will have the opportunity to again ask questions of the moderators,



Contact Information for Our Sponsoring Partners

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Important Academy Dates

The ACADEMY ANNUAL MEETING DEADLINES

ABSTRACT DEADLINE	**October 15, 2025**
MEMBERSHIP DEADLINE	**December 3, 2025**
PRE-REGISTRATION	**January 10, 2026**
HOTEL REGISTRATION	**January 10, 2026**
2025 ANNUAL MEETING	**February 4-7, 2026**

2026 Annual Meeting

St. Petersburg, Florida
February 4-7, 2026

Our Host Hotel

Hilton St. Petersburg Bayfront
333 1st Street S St. Petersburg FL 33701

Reservations: 1-800-HILTONS
(1-800-445-8667)

Single/Double Occupancy: $245.00

Remember to mention that you will be attending the Annual Conference of The American Academy of Cardiovascular Perfusion (AACP).

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