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OF
CARDIOVASCULAR PERFUSION
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Fall 2023

The Academy Newsletter

Message from the AACCP President - Fall 2023

"A lot of people have gone further than they thought they could because someone else thought they could"

- Zig Ziglar

As the season changes from summer to fall, many of us are witness to the magnificent changes in nature. The crisp fresh air, the beautiful color changes in foliage, and the auburn glow at sunset. For others, the fall represents the return of football, scary Halloween movies, and the re-emergence of pumpkin spice lattes. Since moving to Charleston in 2015, I have increasingly appreciated the change in seasons. It won't be long before the high-humidity weather and the tropical storm threats are in our rear-view mirror.

Fall is also a special time of year in perfusion education for two reasons. First, it's the time most programs will accept a new cohort of perfusion students. Admittedly, it's one of my two favorite moments as an educator, second only to the day they graduate. Experiencing the excitement that new students share as they begin their journey into perfusion is among my most rewarding moments as a perfusionist. Admission into perfusion schools has become increasingly



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competitive, with many schools experiencing historically high application numbers and low acceptance rates. Those students fortunate enough to get in have truly worked hard to earn acceptance. Second, Fall may represent the transition for senior students entering clinical rotations. Like other programs, MUSC students are assigned to both internal and external clinical sites across the United States in their 2nd year of school. It is here where they learn to apply the cognitive and psychomotor skills learned from the first year to serve cardiothoracic surgical patients. They learn from some of the most dedicated and professional preceptors in our industry to further advance their skills in teamwork, communication, and decision-making. These experiences are integral to the student's professional growth. In many cases, the bonds students make with their preceptors will last a lifetime. They often serve as role models- both clinical and professional. A survey conducted several years ago among congenital cardiothoracic surgical residents indicated that the attending physician was more influential in the resident's life than their childhood heroes, friends, or even their parents! Perhaps now more than ever, mentoring the next generation of perfusionists should be at the forefront of our current leadership groups in promoting the future successes of our profession.

While perfusion education programs are always seeking great learning opportunities for their students, one doesn't need to be a clinical preceptor to be a mentor. Perhaps it is a new member of your team, or an existing team member ready to accept a new responsibility for the department. Mentor and mentee relationships can also develop across professional organizations like the Academy. Nominating a member for fellowship, encouraging first-time speakers and moderators, or even recommending committee work are wonderful ways to engage our newest colleagues. We've all had our share of mentoring over our careers. Mentors don't always have to be people who are older or more experienced, rather, they are individuals who care enough to share advice for the purpose of helping others grow. Some of us choose the path to provide mentorship to pay homage to those who were so focused on mentoring us.

As we look ahead to Nashville, I provide this as a gentle reminder to take a moment and reflect on the immense value we can provide to our next generation of leaders. Our Annual Meeting has provided a warm and welcoming environment for all perfusionists, new and "seasoned". Please encourage your colleagues, students, and mentees to register to attend. We're always looking for new contributors to the conference program. Part of our mission is to inspire continuous learning through collegiality. We have sessions focused on bringing together the past, present, and future of our profession. It will be an exciting time for all!

Have a great Fall season. I hope to see you soon.

Yours in service,

Dave Fitzgerald
AACP President



Sylvia J. Jaroslowski , BSN, RN
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Born and raised in Colonia, New Jersey, Sylvia Jaroslowski is a senior at Thomas Jefferson University. Prior to pursuing perfusion, she obtained her Bachelor of Science Nursing degree from Widener University where she practiced as an intensive care registered nurse and strengthened her knowledge in ventilation and perfusion by additionally practicing as a trach/vent nurse in home care nursing. As a bilingual first-generation American student, she is the recipient of various clinical and academic awards and maintains a high passion for learning. She currently sits on the AmSECT student council committee and intends on representing Jefferson University by becoming a student ambassador for the American Academy of Cardiovascular Perfusion.

Case Study of Hemophilia B Patient Undergoing Cardiac Surgery

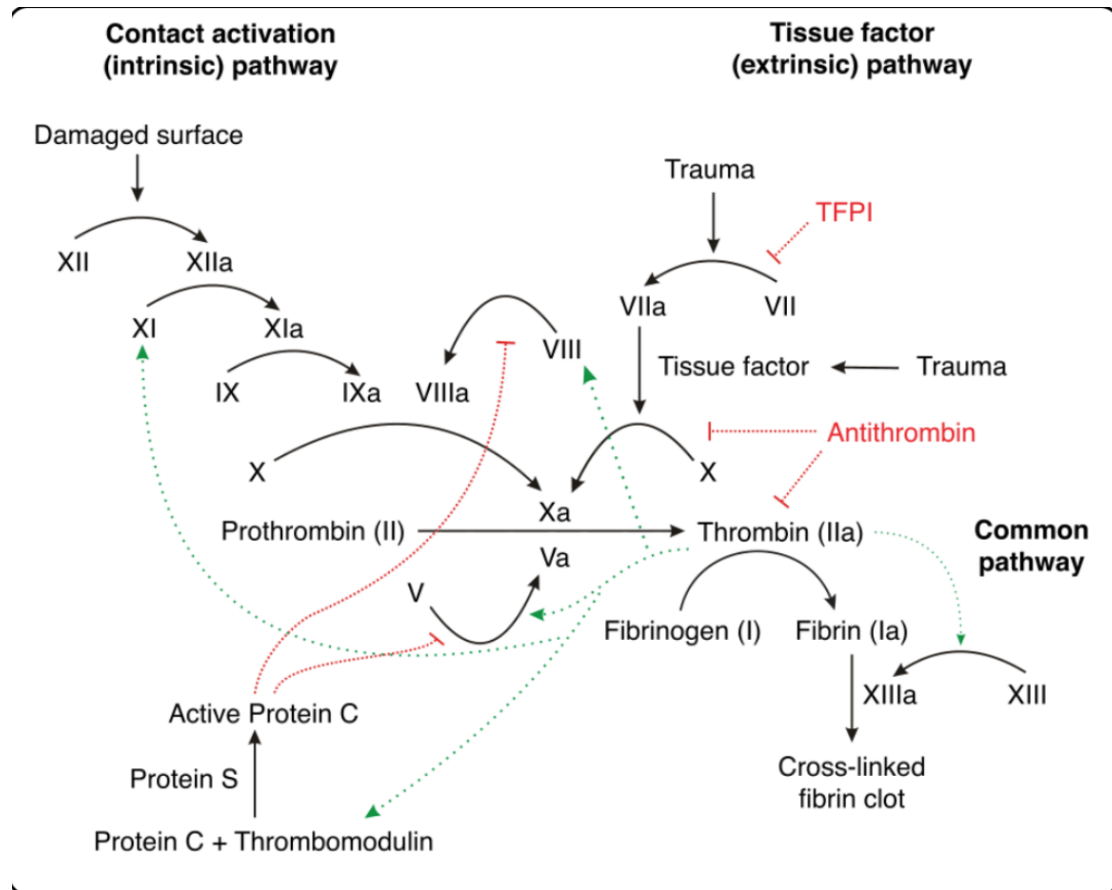
Abstract

Hemophilia B is a rare X-linked recessive bleeding disorder more common in males than females with an incidence of about 1 in 34,000 male births resulting in a problem with coagulation secondary to hemostasis because of a factor IX deficiency. On July 11, 2023 an 80 year old African American male underwent a three vessel coronary artery bypass graft surgery at Robert Wood Johnson University Hospital. Despite recent improvement with replacement therapies and increased life expectancy, more patients with hemophilia are presenting with age-related cardiovascular disease. This demonstrates the need for awareness in the profession of cardiovascular perfusion as it is extremely challenging to balance bleeding, hemostasis, and coagulation during cardiopulmonary bypass surgery in this patient population. With the help of a multidisciplinary approach, this patient successfully underwent cardiac surgery due to the administration of pre-operative, intra-operative, and post-operative factor IX replacement therapy.

Introduction

Hemophilia B is a rare hematologic disorder with various deficiencies in coagulation Factor IX (FIX). Hemophilia A is much more common than Hemophilia B, however both types are classified based on factor activity level as mild (5%-40%), moderate (1%-5%), or severe (<1%). In the model of coagulation, the extrinsic pathway will first initiate the process of coagulation and then the intrinsic pathway will amplify the generation of thrombin. A person diagnosed with hemophilia will have poor generation of activated Factor X and as a result, poor thrombin generation with poor clot stability. Since a patient diagnosed with Hemophilia Type B has a problem with the intrinsic pathway, this results in a prolonged activated partial thromboplastin (aPTT) clotting time. The coagulation cascade pathway that highlights the position of factors VII and IX in the intrinsic pathway is shown in Figure 1. In order to prevent and control acute bleeding intra-operatively, FIX levels need to be adequately restored. This is one of the main goals of hemophilia management. According to the Journal of Cardiothoracic and Vascular Anesthesia,³ there are very few published replacement protocols for patients with hemophilia undergoing cardiac surgery. The importance of precisely timing factor IX administration is imperative for minimizing bleeding and maintaining ACT levels compatible with cardiopulmonary bypass. Factor IX replacement protocols for hemophilia B patients are scarce, but as an increasing number of them are presenting for cardiac surgery this deficit needs to be addressed. The following is a report of a Hemophilia B patient successfully undergoing coronary bypass graft surgery while on cardiopulmonary bypass with BeneFIX administration.

Figure 1: Coagulation Cascade In Intrinsic Pathway



Paul Armitage: Haematology: October 22, 2020 · (2021, November 12). *Haemophilia A & B: Clinical summary*. Geeky Medics. <https://geekymedics.com/haemophilia/>

Case

An 80 year old African American male presented to the emergency department with leg swelling on June 28, 2023 and was found to have a heart failure exacerbation. The patient was diagnosed with moderate Factor IX deficiency 3%, no factor IX inhibitor in 2012 and previously seen outpatient by a hematologist in 2016. The past medical history includes B-cell Non-Hodgkin lymphoma status post chemotherapy in 2012 and coronary artery disease status post PCI. The patient past medical history also includes chronic kidney disease. A left heart catheterization was prepared for ischemic evaluation for the patient on July 5, 2023 which showed coronary artery disease involving native coronary artery without angina pectoris. A professional team composed of hematologists, a cardiac surgeon, anesthesiologists, nurses, and perfusionists was jointly established for a complete management system. Hematology was consulted for peri-procedural hemophilia B management. After hematology consulted with anesthesia and perfusion, a specific protocol was followed before cardiopulmonary bypass for the first time for the perfusion student and the preceptor, the cardiac surgeon, and the anesthesiologist assigned to the case. The clinical protocol is outlined in Table 1 that was discussed among all operative staff involved.

Table 1. Operative Planning for CABG 7/11/23

WITH EACH BENEFIX DOSE	FOR THE INTRAOPERATIVE DOSES	PRIOR TO PROCEDURE	DURING PROCEDURE	AFTER PROCEDURE
Draw a factor IX level just prior to the dose and 30 minutes after the dose	SEND FACTOR IX LEVELS STAT	(1) FULL DOSE IMMEDIATELY PRIOR TO PROCEDURE	(2) FULL DOSE PROCEDURE ONCE BYPASS MACHINE STARTED	(4) HALF DOSE (ADJUSTED BASED ON FIX LEVELS Q8 HOURS BEGINNING 8 HOURS AFTER DOSE #3 END DATE TO BE DETERMINED
			(3) FULL DOSE DURING PROCEDURE IMMEDIATELY AFTER BYPASS MACHINE STOPPED AND PROTAMINE GIVEN	

At 10:43 am on July 11, 2023 the patient was seen in the pre-operative area where the risks, benefits, complications, treatment options, non-operative alternatives, expected recovery and outcomes were discussed with the patient. Pre-operative antibiotics and a beta blocker were given and ejection fraction on transesophageal echocardiogram probe was found to be 30% and the patient's weight was 86 kg. Prior to cardiopulmonary bypass, 8500 IU of BeneFix Coagulation Factor IX (Recombinant) was administered in the cardiopulmonary bypass reservoir and a Factor IX level was sent to the lab 30 minutes after administration and on bypass. The dosage calculation from Pfizer Medical Information is presented in Image 1. Clinical presentation of pre-and post bypass activated clotting times, intra-operative activated clotting times and intra-operative activated clotting times are outlined in Table 2. The total time for coronary artery bypass graft surgery with three arterial grafts took 62 minutes on cardiopulmonary bypass along with an aortic cross clamp time of 36 minutes. The patient tolerated the procedure well and the ejection fraction improved to 35%.

Image 1: Calculating Initial Dose

Calculating Initial Dose

Use the following formula to calculate the initial dose of BeneFIX:

number of factor IX IU required (IU)	=	body weight (kg)	x	desired factor IX increase (% of normal or IU/dL)	x	reciprocal of observed recovery (IU/kg per IU/dL)
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Pfizer Medical Information

Table 2: Pre-Test, Clinical Presentation, Post-Test

Characteristics	Pre-Cardiopulmonary Bypass	During Cardiopulmonary Bypass	After Cardiopulmonary Bypass
Activated Clotting Time (ACT)	119	909, 848, 774, 709	110
Platelets Drawn?	Yes (anesthesia)	Yes (perfusion)	Yes (anesthesia)
Temperature(Degrees Celsius)	35.6	32 Degrees Celsius	36.0
Hemoconcentrator Used?		2000mL removed	
Cross Clamp Time		36 minutes	
Mean Arterial Pressure		60-65	
DO2		280 mL/min/m ²	
Flow Index		2.2-2.4L/min/m ²	
Target Flow Rate		4.9 L/min	
Total Bypass Time		62 minutes	
Bleeding			300 mL (cell saver)

Prior to cardiopulmonary bypass, the starting hematocrit was 29.0 g/dL. Every 30 minutes during cardiopulmonary bypass arterial and mixed venous blood gases were drawn to measure trends in overall perfusion and hematocrit. On pump, hematocrit levels were 19.0g/dL, 21.0g/dL, 20.0g/dL, 22.0g/dL, and 27.0g/dL. Post cardiopulmonary bypass hematocrit was 28.0g/dL. Retrograde autologous priming was performed on both arterial and venous cardiopulmonary bypass lines to reduce cardiopulmonary bypass associated hemodilution. A hemoconcentrator was used during bypass to increase hematocrit delivery of oxygen improving perfusion to the patient. A total of 2 Liters of plasma free water was removed from the patient. Post-bypass, 300 mL of cell saver was given back to the patient. In summary, retrograde autologous priming, ultrafiltration, and cell salvage were specific patient blood management strategies used to reduce hemodilution. Hematology followed the patient post operatively for 10 days after surgery where the patient reported to be feeling well with no complaints and no evidence of bleeding where his BeneFIX doses were adjusted accordingly each day. Pzifer Medical Information for dosing on-demand treatment, control of bleeding episodes and preoperative management is shown in Image 2. The patient remained clinically stable and was successfully discharged on July 20, 2023.

Image 2: Dosing for On-Demand Treatment and Control of Bleeding Episodes and

Perioperative Management

Type of Hemorrhage	Circulating Factor IX Activity Required [% of normal or (IU/dL)]	Dosing Interval [hours]	Duration of Therapy [days]
Minor Uncomplicated hemarthroses, superficial muscle, or soft tissue	20-30	12-24	1-2
Moderate Intramuscle or soft tissue with dissection, mucous membranes, dental extractions, or hematuria	25-50	12-24	Treat until bleeding stops and healing begins, about 2 to 7 days
Major Pharynx, retropharynx, retroperitoneum, CNS, surgery	50-100	12-24	7-10

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Pfizer Medical Information

Discussion

For the first time for the perfusionist, the student assigned to the case, anesthesia, and the cardiac surgeon, an extremely rare case of a patient with Hemophilia B underwent a successful cardiac surgery using BeneFIX Coagulation Factor IX (Recombinant) at Robert Wood Johnson University Hospital in New Brunswick, NJ. According to Pfizer Medical Information¹, “BeneFIX is a human blood coagulation factor indicated in adults and children with Hemophilia B. This is a congenital factor IX deficiency or Christmas disease for on-demand treatment, control of bleeding episodes, preoperative management of bleeding, and routine prophylaxis to reduce the frequency of bleeding episodes.” According to Xiaokun et al., (2022) “Factor replacement therapy used before and on the first day after surgery is highly effective in maintaining the coagulation deficit factor levels greater than 80% of normal”(p. 81). According to Kwak et al., (2020) “The World Federation of Hemophilia recommends that FIX activity be maintained at 60%-80% before cardiac surgery and throughout postoperative day (POD) zero” (pp.247-248). Concentrations of plasma coagulation factors were monitored during the preoperative period. Post cardiopulmonary bypass, the peak FIX level was 238%. This is significant in cardiac surgery because Hemophilia B is a rare disease and the risk of bleeding is a huge concern. Our case being successful has demonstrated and confirmed the effectiveness and safety of replacement therapy.

According to an editorial in the Journal of Cardiothoracic and Vascular Anesthesia⁷, patients with hemophilia are becoming more prevalent in cardiac surgery. There is limited evidence for hemophilia B which is why this case deserves attention. “Evidence-based guidelines are difficult to establish for rare diseases much less for cardiac surgery on patients with rare diseases. Case reports describing the man-

agement of patients undergoing cardiac surgery has been increasing over the years and most show that cardiac surgery can be safe with good patient outcomes” (Kwak et al., 2020, p. 247). Recent reviews have commented on expert opinion and insights into preoperative management, but specific case studies to hemophilia B patients are limited. A case report by Fernando et al. in an issue of *Journal of Cardiothoracic and Vascular Anesthesia* comments on “notable recommendations for preoperative management of hemophiliacs including adequate laboratory support for monitoring of clotting factors, inhibitor levels, preoperative assessment with inhibitor screening, and adequate supplies of patient-specific factor and inhibitor levels” (p. 553). Although it is important to publish recommendations for dosing and duration of factor replacement during surgery, expert multidisciplinary care is one of the main reasons for the favorable outcomes.

Cardiac surgery on hemophilia patients is an extreme challenge dealing with hemostasis. Coagulopathy is a huge concern, particularly to perfusionists, as a result of total heparinization along with extracorporeal circulation raising the concern for a bleeding risk. In the *Journal of Cardiothoracic Surgery*, Shalabi et al., (2020) mentions that “a standardized hemostatic treatment protocol seems to be an unlikely solution based on the small number of hemophilia patients who undergo cardiac surgery and the span of hemophilia severity”(p.4). Based on a limited literature review, it appears that the best approach is to individualize the treatment protocol and introduce a policy of multidisciplinary teamwork.

There are many multifactorial causes of coagulopathy associated with cardiopulmonary bypass to be considered that were mentioned earlier such as: hemodilution, hyperfibrinolysis, and platelet abnormalities. Kwak et al., (2022) makes an interesting comment about coagulation management:

“The role of platelets in hemophilia patients is not yet clear. Observations from studies include the following: platelets have increased influence on coagulation in the presence of low FVIII levels; platelet function is improved at higher factor levels, but a cutoff level has not been defined; and reduced thrombin generation impairs platelet function.”(p. 253)

In this particular case study, the patient had adequate platelet levels but is something worth noting where more research should be investigated. For example, antifibrinolytic drugs such as tranexamic acid can be given if necessary. Another consideration would be the importance of a thorough history and physical in the event that an emergency surgery is crucial. Kwak et al., (2022) mentions that “pertinent details to obtain include factor product used, last known factor replacement, and inhibitor history. If FVII or FIX are not replaced before CPB, an intravenous heparin bolus of 300-400 IU/kg can be given and CPB safely initiated” (pp.246-257). Although the patient at our institution did not have known inhibitors, this is another interesting point to consider. Kwak et al., mentions that, if in an emergency surgery and the patient has not previously received intensive treatment with factor concentrates, the patient is at an extremely high risk for developing new inhibitors, mainly because of the high doses of factors used for surgery. The current literature is sparse on the need for long-term anti-thrombotic treatment in hemophilia patients after cardiac surgery.

In summary, although patients with moderate and severe hemophilia have some protection from thrombotic events, cardiovascular risk factors are common such as atherosclerosis and hypertension which can ultimately lead to valvular degeneration. The importance of FIX in thrombin generation may lessen thrombus generation however, thrombotic events still do occur in these patients based on the references. After an extensive literature search, there is limited data focused on hemophilia B patients and the effectiveness of BeneFIX replacement therapy administration prior to cardiopulmonary bypass. Thanks to expert consultation and a multidisciplinary approach along with guideline directed therapy, cardiac surgery can be successfully performed on Hemophilia B patients at our institution. It is imperative to continue management after surgery which the specialists at our institution were able to do. This case study is valuable for our institution because maintaining those levels of coagulation factors all affect wound drainage postoperatively, surgical area swelling, hemoglobin levels, and the need for blood transfusion(s). The perfusion team was able to adequately monitor hematocrit and hemoglobin levels the entire time on cardiopulmonary bypass to maintain adequate DO₂ levels so that the surgeon was able to successfully operate on a bloodless, motionless field and the patient have an increased quality of life. Our institution has demonstrated the effectiveness and safety of replacement therapy hopefully

expanding research for those few patients diagnosed with hemophilia that need cardiac surgery and extracorporeal technology. Our institution also highlighted the need for a complete multidisciplinary team and the importance of a new, successful protocol in use for the first time for many operative staff included in this specific case.

Conflicts of Interests

There are no conflicts of interest. Permission was obtained from the cardiac surgeon assigned to the case along with the division chair, department of surgery and chief, division of cardiothoracic surgery at Robert Wood Johnson University Hospital, New Brunswick.

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New Executive Director Chosen

As you may know, after 24 years of extraordinary service and leadership, Jill and David Palanzo will be retiring from their Executive Director position, effective April 2024. Much of the Academy's success in inspiring continuous learning through education, research, mentorship, and collegiality has been achieved with strong and steadfast support from the National Office. While Council members come and go, stability in the Executive Director position has been essential in meeting the needs of our membership and perfusion community at large. The fellowship has been fortunate to have Jill and David at the helm over the last two and a half decades.

Following the 2023 Annual Meeting, an Executive Director Search Committee was formed to recruit and retain an eventual successor. The committee was comprised of Council members, the Executive Director, and several volunteers from the fellowship. The 13-member committee was chaired by James Beck. A review of the job description and expectations was conducted in March. A request for proposal was then distributed across the Academy membership and select association management groups. Proposals were received in May, and interviews with candidates were conducted in July.

What became clear to the committee was the value of having someone enter this position with intimate working knowledge of the council. We are a brotherhood/sisterhood brought together by our collective commitment to fellowship. To that end, the relationships between the Executive Director, Council, and Fellowship are integral to accomplishing the strategic goals of the Academy.

The search committee is pleased to announce that Molly Bryant will be the next AACP Executive Director, effective April 1, 2024. Molly has been an Academy Fellow since 2017. She served on the AACP Council from 2018-2023 and is the current Chair of the Student Liaison Committee. Molly has supported our annual meetings as a planning committee member, scientific session moderator, and fire-side chat moderator. During the interview process, Molly shared an exciting vision for fostering new member and fellow engagement initiatives while maintaining our organization's rich tradition and history.

While Molly will perform most of the executive director's duties and responsibilities, her husband Keith will provide ancillary support and serve as a resource to manage time-sensitive duties. Molly and Keith have collective experience in meeting planning, sponsor recruitment, and fund-raising. Their experience in developing student programs and social media marketing will help recruit and secure the next generation of AACP Fellows.

Molly graduated from the University of Minnesota with a bachelor's degree in chemistry. She obtained her Perfusion Certificate from Vanderbilt University Medical Center in 2014 and earned her master's degree in healthcare administration from Walden University in 2018. She currently serves as an adult and pediatric perfusionist at the Mayo Clinic in Rochester, Minnesota.

To help with Molly's successful transition, David and Jill have agreed to serve as part-time consultants for the upcoming 2024 year. This will provide the Palanzos and Bryants with sufficient overlap to help facilitate a seamless transition. We are deeply appreciative of David and Jill's ongoing commitment to mentoring our new executive leadership.

I would also like to recognize the members of the search committee for their contribution and guidance: Isaac Chinnappan, Edward Delaney, Joseph Deptula, Kenmund Fung, Robert Grimmett, Richard Melchior, Justin Resley, Tami Rosenthal, Steve Sutton, Allison Weinberg and David and Jill Palanzo. A special thanks to Jimmy Beck for his leadership as committee chair.

We look forward to exciting opportunities that lie ahead for the Academy. Please join me in congratulating our next Executive Director, Molly Bryant.

Yours in service,

Dave Fitzgerald
AACP President



Sherry C. Faulkner

February 19, 1947 -

August 19, 2023

*2005 Thomas G. Wharton
Memorial Lecture*

Sherry C. Faulkner

Benton, Arkansas

*Reprinted from the 2005
Proceedings of the American
Academy of Cardiovascular
Perfusion.*

In Memoriam **Sherry C. Faulkner**

Sherry Faulkner passed away Aug. 19, 2023, at the age of 76. She was a member of Our Lady of Fatima Catholic Church and the Benton Master Gardeners. Sherry also had a distinguished career as a cardiovascular perfusionist at Arkansas Children's Hospital where she was hired to develop and open an ECMO unit. She served as the ECMO coordinator for a decade helping countless children. In 1999 she won the "Perfusionist of the Year" award from the American Society of Cardiovascular Perfusion and authored many scientific articles concerning ECMO in her career. She was a Fellow Member of the American Academy of Cardiovascular Perfusion and served as its President in 2004. Even though she had many professional achievements, it was helping people that she loved. Sherry was an avid supporter of animals.

Perfusion: The Missing Link

It is with great humility I stand at this podium to deliver at the 26th American Academy of Cardiovascular Perfusion meeting, the Thomas G. Wharton Memorial Lecture. Tom Wharton was a man of vision—a vision centered on perfusionists rising from their multiformity to become contributing health care professionals. Unknowingly, I saw the early years of perfusion when, as a student in radiologic technology, I observed Charles Reed performing cardiopulmonary bypass at Baptist Hospital in Little Rock, Arkansas. The year was 1966. At that time only one or possibly two cases were performed every few months in Little Rock.

I remember one particular patient who had a single graft coronary bypass. There was concern of bleeding. Not knowing what any of this meant, I was picked to be the "rabbit." Somehow, I felt this was very important but was not sure what the rabbit did—I just knew it must be important. I went with the technologist to perform a portable x-ray, and I only stood by and watched as the nurses, Charlie, and two cardiovascular surgeons gingerly placed the x-ray cassette under the patient. Alarms went off, nurses grabbed things, Charlie was right in the middle of everything (saying a few choice words), and the surgeons just backed away. The x-ray was taken and the cassette removed with again alarms going off, nurses grabbing things, and Charlie in the middle of everything saying those few choice words.

Charlie turned to me with the cassette and grinned that silly grin he had and said, "Quick, like a rabbit." At last, my mission had been declared, and quick like a rabbit I ran down five flights of stairs, across the length of the hospital to the radiology department to process the film. I stood waiting for the film to come through the processor when the phone rang. It was Charlie calling to see if I had made it to radiology yet. I grabbed the film, ran across the length of the hospital, up five flights of stairs and completed my mission by handing the film to Charlie.

Many years later, Charlie and I were laughing about this story when he told me he had a reason for making me the rabbit. It seems my first rotation as a student was through the operating room. And as I dressed out and went with my supervisor through the swinging doors into the OR I fainted. I fell like a stiff board and got my feet stuck on one side of the door with my body on the other side. Bets had been taken as to how long I would last in the Baptist Hospital School of Radiological Technology. Charlie was the only one who bet I would make it. He later told me he based this upon my attitude. Another time he had watched as I was manipulating an x-ray table when the patient was shocked and accidentally defibrillated me. He was impressed that I continued to work the rest of the day when most people would have gone to employee health and been excused for the day. I thought it was part of induction into the class.

So where do these adventurous stories lead me? In a roundabout way, they lead me back to Tom Wharton's vision of perfusion as a health-care profession. We have come a great distance in this profession's short time of existence. And yet we have a great distance to go towards accomplishing Tom's vision, as well as our own. Perhaps realizing where we have come will aid us in achieving where we wish to go.

Perfusion was not created just by desire, such as nursing or respiratory therapy were. Perfusion was created by courage and confidence in the pioneer perfusionists' hearts. These pioneers had what was then "state-of-the-art" equipment, most of which was made in a garage or workshop. They realized that at any moment the equipment could stop working, and they would be required to try and correct the problem within a brief period of time. Much like early aviators with bailing wire and bubble gum, some of our essential tools in a crisis were bone wax, a 21-blade, and lots of adhesive tape.

The learning curve was steep in those early days of perfusion, yet most stayed with the job. Where did these individuals come from? Many came from research laboratories; some came from nursing, but

a majority of them were simply interested in research and medicine. They had no specific training but were wandering in search of a purpose. They were hungry for knowledge. Purpose and knowledge allowed these individuals to evolve into what is now known as perfusion.

We often hear of the “Missing Link.” This is a term used to somehow explain an unknown entity, which brings an organism from point A to point B in the organism’s advancing development. I feel that cardiovascular perfusion is the “Missing Link” in medicine today. In order to understand this phenomenon we must realize where we have come from and how we reached this point. Again, the pioneer perfusionists were persons with great imagination and courage. They would train with buckets of water in order to maintain their skills, and if they were real lucky they would have an animal lab available to find out the limits of their equipment and how quickly perfusion could cause harm if not managed properly.

Back then, patients requiring cardiovascular surgery were the sickest patients who could not survive unless operated upon. This meant that the odds were stacked against a good outcome even before the perfusionist came to the Operating Room. Yet the surgeon, the patient, and the perfusionist came to the Operating Room in the name of humanity.

A large price was paid for the advances made during this time. The first survivors fueled encouragement to continue the evolution of perfusion. There were no great meetings to share the information, there were very few articles generated to document the techniques, there was merely word of mouth. Surgeons coveted their perfusionist. Nursing staff stood in awe at what these individuals did.

And so was born “the pumper.” Success brought more and more patients, which resulted in more surgeons, which created a need for more perfusionists. On-the-job training became the catch phrase in perfusion. There were no schools to really speak of. And so it was back to the buckets of water and animal laboratories to train the new recruits to this exciting field. The OJTs came from nursing, respiratory, radiology, laboratory, and other hospital-based jobs. Perfusion was growing but from a very diversified field of medical disciplines. Schools began to appear along with textbooks. Local gatherings of “pumpers” to share war stories began to occur. The sharing of knowledge had taken hold, and the patient survival increased.

Larger gatherings of “pumpers” evolved into national meetings. As the knowledge grew, the natural desire to share it with others led to the first medical literature regarding perfusion. This knowledge evolved into the desire to set a standard whereby patients were guaranteed to receive the best perfusion possible. And so accreditation of training programs and certification of perfusionists took center stage. Desiring to raise their dignity and achieve formal recognition from physician organizations, the “pumpers” began referring to themselves as “perfusionists.”

I have taken you through the evolution of perfusion in a few short paragraphs. However, the cost of not only development of equipment but of human life has been almost insurmountable. The benefits are beyond belief and yet the benefits for patients continue to grow. Along with the growth comes new technology but, alas, the sickest patients. Still perfusion continues to evolve.

The evolution of perfusion has not been without a price. The original mystic person that ran the big machine in the Operating Room is suddenly cast out among the rest of the caregivers. Our vulnerability is where all can see. Tragically it is realized we are not mystical but actually human,

equal to all other humans. Herein lies where difficulties can arise.

The first law of chaos according to the Foundation of Inner Peace in “A Course in Miracles” says each person has their own truth.¹ In our profession we are constantly in a life or death situation. We are trained to think two steps ahead of the moment. We are trained to anticipate the worst-case scenario and have the answer. That is our job. That is what we do every day we walk into the Operating Room. We are periodically reminded that this is what we are paid for. We hold each patient’s life in our hands.

Surgeons and anesthesiologists know this and trust us, just as we know their roles and trust them. Yet those outside our arena do not have this insight into our world. Fear of the unknown along with loss of control in their environment causes nursing, respiratory, cardiology, and other professions to view us with reservation. Their reluctance sometimes evolves into skepticism and mistrust, all of which will eventually lead to negative feelings. It is a well-documented psychological fact that animals will instinctively try new behavior. However, if the result is not what the animal wishes to accomplish they will always revert to what they know has worked. Humans behave in the same way. Summed up, chaos and conflict often dominate our workplaces. All of this is felt by the one common denominator each health care professional is there for, the patient.

What is the solution? What is the “missing link” to complete the circle of all round good patient care? I feel strongly that perfusion can be that golden link. You may ask why? We must look at the diversity of our backgrounds. In the beginning our pioneers came from a multitude of professions, each bring their unique backgrounds and diverse expertise.

Today, we still have a multitude of professions represented in the students entering perfusion school as well as those that have graduated and are certified perfusionists. This remarkable mixing pot is having a phenomenally positive impact on development of techniques, devices, and, most important, patient care. The close bond between perfusionist, surgeon, and anesthesiologist has been loosened as larger and larger teams are formed. However, with the rapid growth in perfusion technology the bond is returning as surgeons hear of success stories from their colleagues and then ask the perfusionist to incorporate the technology into their practice. Yet there is one group, which is still not being included in this affirmation—those who work outside the Operating Room. This is where the “missing link” can be placed to complete the circle.

We as perfusionists have the opportunity to reach out and embrace those who push us away. Impossible? For the profession that has played such a vital role in ventricular assist, extracorporeal membrane oxygenation, extracorporeal CO₂ removal, artificial heart assist, I say nothing is impossible. A strategy from Sun-Tzu in “The Art of War” is called, “conquering the enemy and growing stronger.”² How can we conquer those who impede our objectives? Through knowledge and inclusion we can circumvent the negative. Through strong leadership in our institutions we can build a reputation of professionalism while demystifying our profession. By taking the unknown out of what we do during emergency procedures we can build a stronger union of individuals working toward one goal, to save the patient. Abraham Lincoln expressed this strategy in a slightly different way; he said, “The best way to destroy your enemies is to make them your friend.” Think about that next time you are confronted by someone in the hospital in a confrontational or adversarial way.

I worked with a surgeon, Jonathan Drummond-Webb, who would sit down and quiz me about what I had seen or learned whenever I went to a meeting or even to another hospital. He made it clear that it was my responsibility to him, the patient, and the team to grasp every opportunity to gain knowledge and share that knowledge. The first time I was quizzed I made the mistake of saying I had not learned that much at a particular meeting. He proceeded to inform me that I had not paid attention, that each experience had vast knowledge of what worked or did not work. It was the professional's job to sift through the information and identify portions that were useful. Thus was instilled in our perfusion group the desire to bring our individual areas of expertise to medicine for the collective good and a sum much greater than simply adding up each part.

I challenge each of you to return after this meeting to your institution and make an appointment with your surgeon for five minutes. Explain to him or her what you saw, learned, or, even better, ask a question that you discovered here. Set up a journal club with not only the perfusion staff but also with the Intensive Care Unit caregivers and share the knowledge. Include in the meeting the nursing managers and nursing administration. Explain to them these are techniques or maneuvers that could someday be used during an emergency. Their involvement could make the vital difference between success and loss of a patient.

Take the lead, step forward, and show your courage, confidence, and strength. Become the "missing link," which for so long has been invisible. Make the commitment to be the strongest link, and I assure you those who do not join will become the weakest link. Some will come. Note those individuals; they are genuinely ready to follow your example. Do not be deterred if only a few come the first time. Stay true to your commitment and others will follow.

Above all else remember the first law of chaos, "Each person has their own truth." This is your truth. You are a perfusionist. You are the missing link.

In closing, I would like to share with you something I heard several years ago from an Academy member. It has been carried around in my heart all these years. The gentleman that made this profound statement was Richard Berryessa. Walking out of the Wharton Memorial Lecture that year just ahead of me, Mr. Berryessa spoke to the lady beside him saying, "For awhile now I have not felt as good about being a perfusionist. But today I really feel good about being a perfusionist."

I hope that in some way, this lecture has instilled in you the pride and admiration each of you deserves. All of you are perfusionists by choice. You do not get the "Good job!" or "Well done" accolades you deserve everyday. But remember the old Charlie Reed quotation, "Any landing you walk away from is a good landing." To that I add my own at this point, "Everyday you face death and battle as hard as you can for the patient is a day that you are a good perfusionist."

Thank you.

References

Foundation of Inner Peace. A course in miracles, second edition. Tiburon, CA: Foundation for Inner Peace, 1975.

Sun-Tzu. The art of war. Indianapolis, IN: Book-of-the-Month Club, Inc., 2002.



Kelly Hedlund
Manhattan, Kansas

Remembering the Stedman Packing Film Oxygenator

For the most part, early oxygenators were conceived and built by the surgeons who used them. Gibbon's revolving cylinder and stationary screen devices are obvious examples. Others include Bjork's spinning disc oxygenator, Dennis' rotating screen apparatus, and Cooley's stainless steel "coffee pot" bubbler. And lest we forget DeWall and Lillehei's simple helical coil design fashioned from corks and flexible beer hose. These primitive gas exchangers were both crude and ingenious. A lesser known device from that era, the brainchild of Philadelphia surgeon Charles Bailey, was the Stedman Packing film oxygenator.

Bailey began his foray into oxygenator development in the early 1940s. Of course, his primary interest, then and for the duration of his medical career, was mitral valve disease. It's a certainty that he knew his cross-town contemporary Gibbon would soon return from the war and resume his own pump oxygenator research. Filming was long held as the preferred method of arterializing blood going back to von Frey and Gruber's classic 1885 description. With input from the Drexel Institute of Technology (now Drexel University), Bailey and his team at Hahnemann Medical College devised an 18-inch cylindrical filming oxygenator using Stedman Packing as the gas exchange material (see Figure 1). Developed in the 1930s, Stedman Packing was used by the chemical engineering industry for processes requiring intimate contact between liquids and gases. Essentially, cloth discs containing fine wire mesh were embossed, perforated, and stacked so as to create a vertical pattern of pyramids, valleys, and holes (see Figure 2). Bailey incorporated 150 six-inch diameter discs inside a round metal casing, resulting in a surface area of seventy-one square feet. Blood entered the top of the oxygenator and flowed downward in a continuous stream from disc to disc. No foaming occurred because the oxygen, entering at the bottom, moved upward passed the blood rather than through it. The static priming volume of the device was 900 ml. However, at a flow rate of 3 LPM the dynamic holdup exceeded 1,500 ml of blood. In order to make full use of the filming surface and avoid channeling, the Stedman Packing oxygenator was flooded with saline prior to use.

In December 1950, Bailey spoke to the Ohio Chapter of the American College of Chest Physicians in Cleveland and reported his experience. During the prior seven-year period, 15 dogs supported by the Stedman Packing oxygenator survived experimentation. In fact, one ani-



Figure 1. Stedman Packing discs used for gas exchange in Bailey's film oxygenator (photo reprinted with permission from Elsevier Publishing).

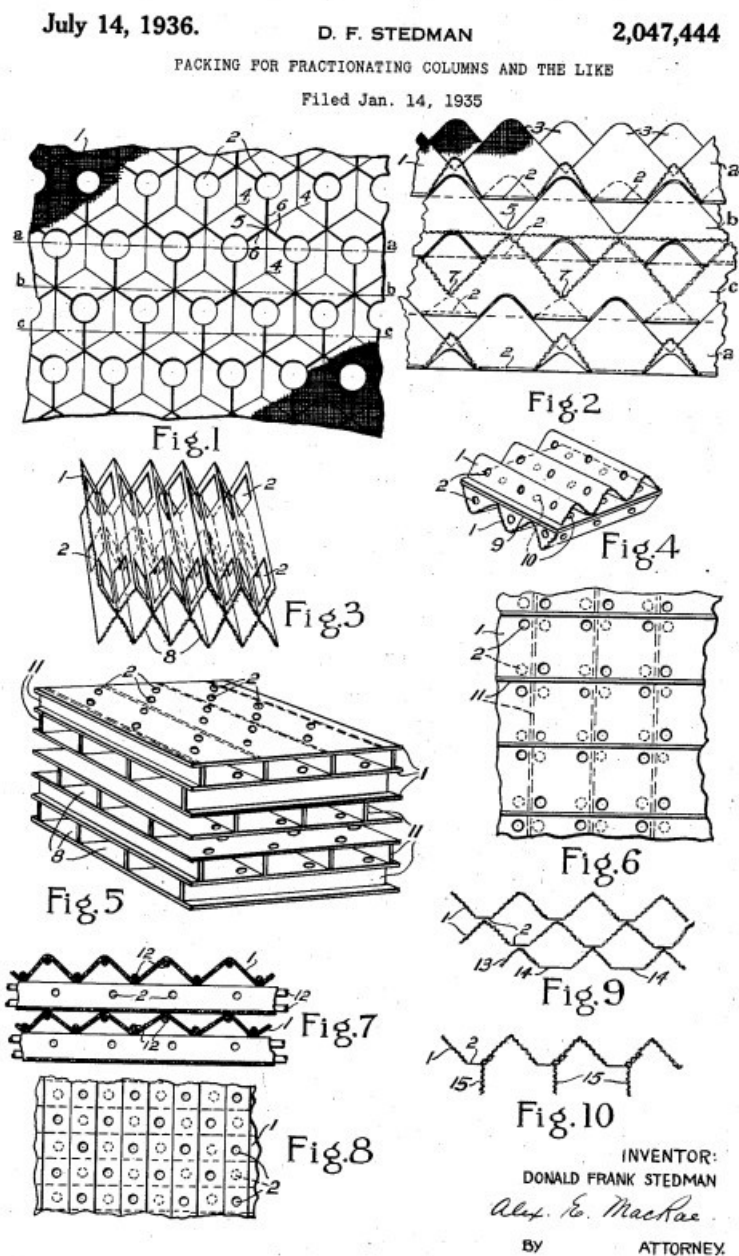


Figure 2. Depiction of pyramids, valleys, and holes present in the Stedman Packing material for gas exchange (reprinted with permission from the U.S. Patent and Trademark Office).

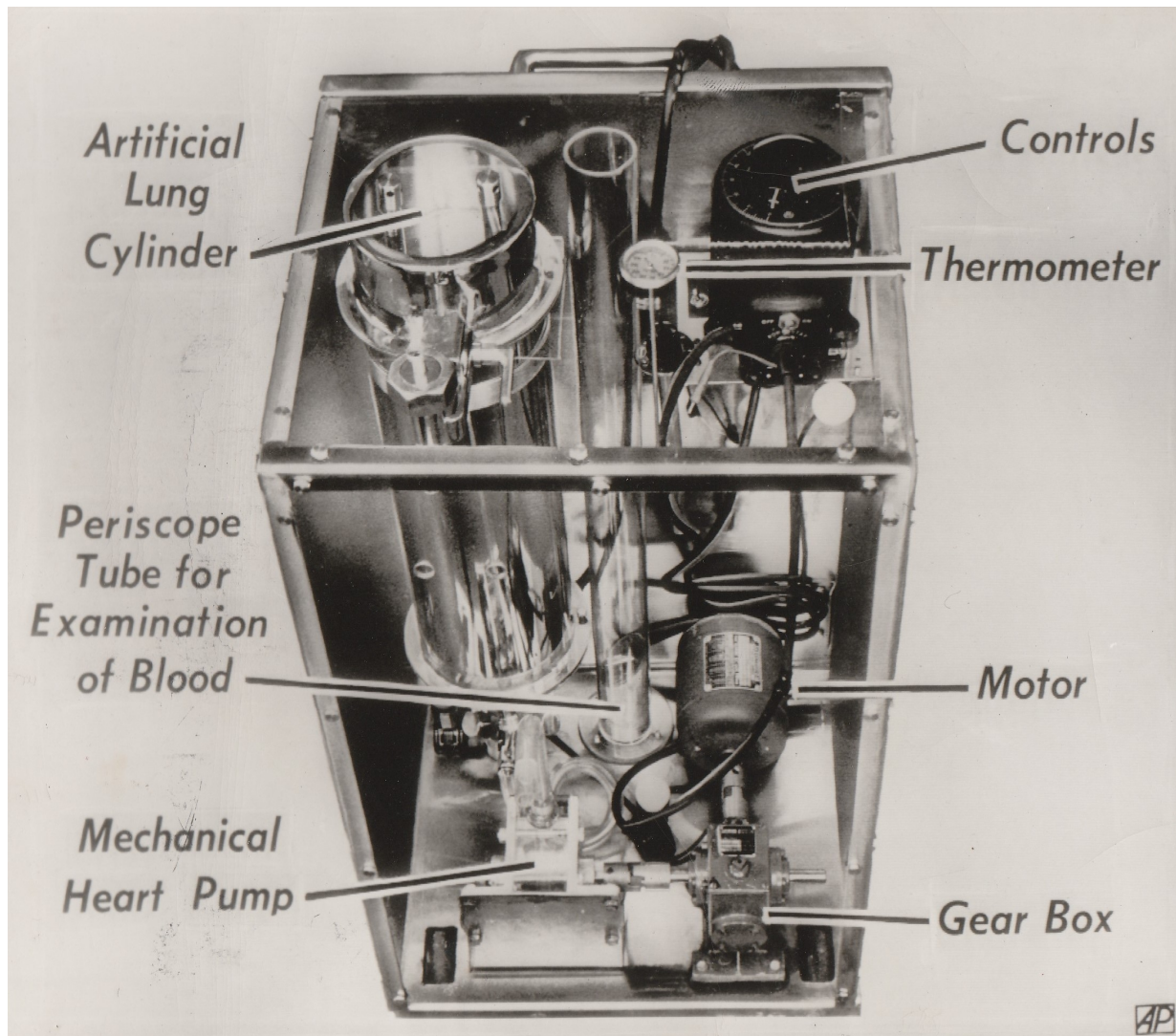


Figure 3. Bailey's miniaturized heart-lung machine with Stedman Packing film oxygenator in upper left corner (photo reprinted with permission from Associated Press - Cleveland Bureau).

mal endured over an hour of perfusion and was still alive a year later. Bailey cleverly combined his film oxygenator with a miniaturized pump inside a glass case (see Figure 3). Despite hopes of eventual use in humans, the Stedman Packing oxygenator never gained a foothold. In 1953, it was critically studied by two researchers in Philadelphia who found its efficiency rather low when compared to the foam oxygenator. Sadly, in his 1955 textbook "Surgery of the Heart", Bailey never mentions his Stedman Packing oxygenator despite devoting an entire chapter to heart-lung machine development. Instead, he lauds Gibbon's stationary screen oxygenator as "... probably the best of its kind in the world today ...".

Some things just aren't meant to be – even for the imaginative and pioneering Bailey.

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Important Academy Dates

The ACADEMY ANNUAL MEETING DEADLINES

ABSTRACT DEADLINE **October 15, 2023**

MEMBERSHIP DEADLINE **December 1, 2023**

PRE-REGISTRATION **January 18, 2024**

HOTEL REGISTRATION **January 18, 2024**

2024 ANNUAL MEETING **February 7-10, 2024**

**45th Annual Seminar of The American Academy of
Cardiovascular Perfusion
Loews Vanderbilt Hotel
2100 West End Avenue, Nashville, TN 37203
February 7-10, 2024**

(Tentative Program)

Wednesday, February 7, 2024

- 11:00 AM – 4:00 PM **REGISTRATION**
- 3:30 PM - 4:00 PM Opening Business Meeting
 Fellow, Member, Senior and Honorary Members
- 4:00 PM – 7:00 PM **Manufacturers' Breakout Rooms**

Thursday, February 8, 2024

- 7:00 AM **REGISTRATION**
7:00 AM – 8:00 AM Video Presentations
- 8:00 AM – 09:30 AM **Scientific Paper Session**
- 9:30- AM – 11:30 AM **Fireside Chats**
- Everything ECMO
 - *Collaborate with colleagues about the intricacies of what goes into all parts of ECMO*
- Pediatrics
 - *An open forum to discuss standards of care and new practices in the field*
- Perfusion accidents
 - *If you can think of it, it has either happened to someone else or will to you. Let's share and learn.*
- Simulation: from low to high fidelity
 - *See what other centers are doing to build and grow this important technique (Combo: chat and simulation)*
- Students Only Forum
 - *A forum to meet and greet for students only*
- 11:30AM – 12:30PM Lunch (Speaker)
- 12:30 PM – 2:30 PM **Special Scientific Panel Session - Our Early Years of Cardiopulmonary Bypass: A Blast from the Past**
 Moderator: Thomas Frazier
- Pumps and Hardware - Steven Sutton*
 Circuit Components - David Palanzo
 Myocardial Protection - James MacDonald
 Perfusion Safety - Mark Kurusz
 ECMO- John Toomasian
 Panel Discussion

2:30 PM – 2:50PM	Break
2:50 PM – 4:20 PM	Special Scientific Panel Session - Future Innovation: AI and HLMS <i>Moderators: Vincent Olshove, John St. Onge</i> <i>Big Data / Predictive Analytics – James Beck</i> <i>Future of Hardware / Safety – Kathryn Gray DeAngelis</i> <i>Future of Simulation – Edward Darling</i> <i>Future of Education – Laura Dell'Aiera</i> <i>Panel Discussion</i>
05:00PM	Sponsor's Hands-On Workshop & Reception

Friday, February 8, 2024

7:00 AM	REGISTRATION
7:00 AM – 8:00 AM	Video Presentations
8:00 AM – 9:30 AM	Scientific Paper Session
9:30- AM – 11:30 AM	Fireside Chats Pediatrics and Pediatric ECMO <i>- What's new, what's not and what struggles do we face as the specialty moves forward</i> Shortages <i>- From human resources to material resources</i> Simulation: from low to high fidelity <i>- See what other centers are doing to build and grow this important technique (Combo: chat and simulation)</i> What they didn't teach us in school/Dealing with stress/Work life balance <i>- Round table discussion on situations you never anticipated after graduation, and how to navigate</i> Women in Perfusion <i>- Collaborate with some special situations and challenges of other women in the field</i>
11:30AM - 12:30PM	Lunch (Historical Videos)
12:30 PM – 2:30 PM	Special Scientific Panel Session – ECMO Update <i>Moderators: Allison Weinberg, Dana Mullin</i> <i>Adult ECMO - TBA</i> <i>Pediatric ECMO - TBA</i> <i>Hybrid Cannulations / MCS - TBA</i> <i>ECPR – Thomas Preston</i> <i>ECMO Patient Interview</i> <i>Panel Discussion</i>
2:30 PM – 3:00PM	Break
3:00 PM – 5:00 PM	Memorial Session <i>Moderator: Justin Resley</i> Introduction – Justin Resley, CCP, MM Charles C. Reed Memorial Lecture (James Abernathy, MD, MPH) Thomas G. Wharton Memorial Lecture (David Fitzgerald)
6:30 PM	Induction Dinner <i>All Attendees and Guests</i>

Saturday, February 10, 2024

7:00 AM	REGISTRATION
7:00 AM – 8:00 AM	Video Presentations
8:00 AM – 9:30 AM	Scientific Paper Session
9:30 AM – 10:00 AM	Break
10:00 AM – 11:30 AM	Special Scientific Panel Session - Pediatrics <i>Moderator: Joseph Deptula</i> <i>Adult Congenital – Bradley Kulat</i> <i>Fetal Cardiology and Interventions – Jamie N. Colombo, DO, FACC</i> <i>Pediatric Registry - TBA</i> <i>Complicated Cases – Joseph Deptula</i> <i>Panel Discussion</i>
11:30 AM – 12:30 PM	Lunch (Historical Videos)
12:30 PM – 1:30 PM	Special Scientific Panel Session – Pro / Con Debate <i>Flow vs. Neo-Syneprine</i> <i>Recredentialing for all CCPS</i>
1:30 PM – 3:00 PM	Special Scientific Panel Session – Heart Transplantation <i>Donation After Circulatory Death (DCD) Organ Procurement – Fred Hill</i> <i>Normothermic Regional Perfusion (NRP) – Dr. Ashish Shah</i> <i>Partial Domino Heart Transplant – Michael Brewer</i> <i>Panel Discussion</i>
3:00 PM – 5:00 PM	Fireside Chats ECMO and VAD Challenges: Scenarios and Transports <i>- Let's learn from each other as transports (intra and inter hospital) are becoming their own new specialty.</i> Electronic Medical Records: The Good, the Bad, and the Glitchy <i>- See how centers are tackling and incorporating this evolving standard of care.</i> Industry and CCP <i>- What it's like to go from clinical to industry, combine both, and maybe back again with all the challenges faced.</i> Myocardial Preservation <i>- Everything from the OR, to NRP to DCD</i>
5:00 PM	Closing Business Meeting <i>Fellow, Senior and Honorary Members Only</i>

THE ACADEMY TO OFFER LIVE WEBCAST AGAIN THIS YEAR

The American Academy of Cardiovascular Perfusion will again be offering a live webcast of our 2024 Annual Meeting in Nashville, Tennessee. The General Sessions of the meeting and two virtual Fireside Chats each day will be broadcast in high quality streaming video. There will also be an opportunity for attendees to ask questions, thus qualifying for Category I CEUs from the American Board of Cardiovascular Perfusion.

2024 Annual Meeting



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