

# The AUSTRALIAN AND NEW ZEALAND COLLEGE *of* PERFUSIONISTS GAZETTE

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# 2019 BC (BEFORE CORONAVIRUS) – AN INTERNATIONAL EXPERIENCE

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Jane Ennor CCP, FANZCP

## LivaNova Deutschland GmbH, Munich, Germany

In the sunnier times of travel and overseas explorations being only a measly 24-hour flight away, I was invited to attend a pre organised tour of the manufacturing facility of LivaNova (Figure 1). In September of 2019, fully self-funded, I ventured to Munich in Germany to embark on an overseas learning experience. I arrived at the LivaNova's manufacturing facility for the factory tour and was greeted by a vast display of previous and current components of Heart Lung Machines (HLM) in the foyer.

Participating in the factory tour was a great opportunity as I was able to observe the process and steps involved with the manufacturing of HLMs – the tool of our craft. It was impressive to learn about the manufacturing of roller pump raceways that are cut from a single piece of aluminium, with all waste post cutting sent for recycling. Prior to the production of the raceway, the aluminium is left outside in the weather for two weeks to undergo thermal expansion as the metal is exposed to a variety of temperatures and weather conditions. The process of using a single piece of aluminium, whilst more expensive, allows for a smoother raceway and aids in ensuring an even distribution of the raceway once produced. I was impressed to learn that whilst the majority of the roller pumps are manufactured by machines, LivaNova still trains a portion of their staff to manufacture these components entirely by hand using only manual tools, this includes only working from hand drawn plans. This process ensures these skills and techniques are not lost and would enable their workforce to continue manufacturing roller pumps in a crisis; however, at a much slower pace. Postproduction, each raceway is individually measured in a climate-controlled room at a consistent temperature and humidity. Measurements are conducted down to the nanometre, using a laser measurement device. All measurements are automatically electronically recorded and stored in a database, which is then accessed at random for independent auditing. There are very narrow margins for error with an allowed detectable failure rate of less than 1% for the raceways measurements.

Similar to the roller pumps, the computer circuit boards for each HLM component are also manufactured and assembled on site by highly skilled technicians. Due to the local expertise in Munich, employees of a high calibre and experience are retained by LivaNova, enabling them to maintain control over production, and for the development of a high-quality product.

Once a completed module has been manufactured and assembled, it is subjected to rigorous testing, which is inclusive of running at a maximum output for 24 hours to ensure no faults occur. If an entire S5 system has been ordered, this will also be assembled to the specified configuration of the ordering hospital and be re-tested prior to packing and shipping. LivaNova does not have storage capacity at their warehouse, meaning all HLM and individual modules are 'built to order' only.

Overall, I feel as though I benefitted from seeing where my primary piece of equipment is manufactured and the process it undergoes to come together. I gained a whole new insight into how a piece of equipment we specialise in, is developed and the rigorous testing it undergoes before it arrives in the hospital. I would highly recommend anyone else afforded the opportunity to go to Munich to visit LivaNova and participate in the same tour – when borders reopen and international travel resumes of course!



Figure 1: LivaNova. Munich, Germany

## Karolinska University Hospital, Stockholm, Sweden.

The next stop on my overseas educational expedition was to a major cardiac centre in Sweden – the Karolinska University Hospital (KUH), located in Sweden's capital, Stockholm. As always with visiting perfusion units, certain similarities and differences were observed among the local hospitals I have worked in.

The first and major difference was the division and operation of two intensive care units, which are split by only a corridor. They are two completely separate and independently run ICUs, both offering different variants of ECMO therapy. I am unsure of the history behind this institutional preference, however it seemed to function as a well-oiled machine.

The first ICU consisted of a general respiratory ICU for both adult and paediatric non-surgical ECMO patients and includes KUH's ECMO retrieval service. This ICU ECMO team does not have a perfusionist on staff but rather is intensivist driven, with specialised ECMO retrieval technicians and ECMO trained nursing staff. The cardiothoracic team's involvement is

limited to the cannulation of these patients, therefore ECMO is initiated without a perfusionist present.

The other ICU consists of a post-surgical and cardiothoracic ICU that manages cardiothoracic patients requiring ECMO, ECLS and VAD therapies. The ECMO therapies offered in this unit are run under a collaborative model with specialised ECMO trained nursing staff and perfusionist involvement. This is an adult only area and includes KUH's ECPR program. The ECPR criteria align with that of other units I have worked in or visited within Australia, including:

- Patient are aged 65 or under, experiencing an out of hospital cardiac arrest or are aged up to 70 for inpatients
- ECMO initiation must occur within 60 minutes of a witnessed cardiac arrest with less than five minutes of 'no flow' time before CPR is commenced
- There are additional considerations for extended time in the event of hypothermia, intermittent return of spontaneous circulation and for patients displaying appropriate neurologically responses
- There are exclusion criteria for patients with known malignancy, organ failure, unwitnessed arrest or delay in commencement of CPR, presence of aortic dissection or aortic incompetence or an end-tidal CO<sub>2</sub> < 9.8 mmHg

A key differences between ECPR programs I have worked with was that in KUH the perfusionist first receives notification from a healthcare worker 'on the road' to alert them of the ECPR to enable a quick response time for the initiation. All patients for ECPR are immediately fast tracked to the cardiac catheterisation lab for ease of cannulation with imaging readily available.

The two ECMO teams described above, have a good working relationship and often lend a hand helping one another. The general ICU always has an ECMO intensivist onsite, and will therefore initiate the ECPR if the perfusionist will not make the time sensitive deadline. Each ICU uses different equipment for their craft. The general ICU team, who participate in excess of 100 retrievals and VV ECMOs, use a sophisticated customised circuit consisting of a Levitronix pump and Medos oxygenator. Counterintuitively, the adult Cardiothoracic ICU team, who remain in house and participate in 50 or more ECPR and post-surgical ECMOs, use a standard Cardiohelp System.

The KUH also has a busy cardiothoracic surgical program consisting of over 1,200 bypass cases per year. Their surgical unit is comprised of four cardiothoracic theatres that often do eight bypass procedures per day. The procedures are an assortment that include a mini-mitral valve program, complex aortic work and routine adult procedures. The perfusion team includes six full time perfusionists and one trainee.

It was interesting to discuss their heater cooler unit (HCU) cleaning policy. At KUH they do not have access to an appropriately ventilated room for the cleaning chemicals required, therefore they refill their heater cooler units with water sterilised using ultrasound. Their heater cooler units undergo the same routine water testing every eight weeks and are also sent offsite for a chemical clean periodically (Figure 2).

For potential overnight emergencies, a dry pump is left plugged in one of the cardiothoracic theatres. All possible connections are made for time management purposes, therefore the HLM is left with water, power and gas lines pre-connected.

Karolinska also had additional safety redundancies built into their practice. They have emergency trolleys with all consumables for different emergency situations including aortic dissection, ECMO initiation and return to theatre for bleeding. KUH also have a manual backup gas delivery system for their electronic blenders and an emergency roller pump system (Figure 2), which is continuously housed in a designated location.

I relish the opportunity of visiting perfusion units globally and locally. I always learn new techniques or ideas to implement into my own practice and it enables me to continue to evolve and grow as a clinician. As a result of my visit to KUH a new system was implemented, the manual gas delivery backup and roller pump has since been integrated into The Children's Hospital at Westmead's emergency and redundancy planning.



Figure 2: Emergency gas delivery & roller pump

### Scandinavian Association for Thoracic Surgery Conference

4–6 September 2019

Stockholm, Sweden.

My final destination on my learning voyage was to attend the annual Scandinavian Association for Thoracic Surgery (SATS) conference. This collaborative meeting incorporates multiple allied organisations and societies including the Scandinavian Society for Extracorporeal Technology (SCANSECT). This annual meeting is held across Scandinavia and is continuously presented in English. The content of the conference covers a vast range of topics spanning multiple professions including perfusion, surgery, anaesthetics, intensive care, and nursing – for both the perioperative and postoperative period. Delegates of the conference can select and create their own program of the different presentations which appeal to them and their interests.

One of the more interesting, and discussion inducing, presentations was a dual centre comparison of mini mitral valve procedures comparing and contrasting the different surgical techniques, cardioplegia, venous and arterial cannulation, and aortic occlusion methods used at two hospitals in Sweden. The

first hospital was Kaolinska University Hospital (KUH) and the other was Uppsala University Hospital (UUH). The two centres varied in their practice, however the most noteworthy variance was the aortic occlusion method. KUH used the more commonly seen transthoracic aortic clamp compared to UUH who preferred to use an endo-aortic balloon occlusion device.

There was a large session dedicated to aortic surgery with the discussion of different approaches to temperature management, different cannulation strategies and different approaches for antegrade and retrograde cerebral perfusion (ACP; RCP). All centres who presented at SATS use ACP as their baseline cerebral perfusion strategy, with RCP only used as a deairing method prior to the termination of circulatory arrest. However, one unit still routinely used RCP for cerebral perfusion via a retrograde cannula placed in the superior vena cava. I found it particularly interesting when one unit in Finland discussed their approach to ACP using triple vessel perfusion; this is done to ‘capture collateral circulation’ from the left subclavian artery. It was noted that while this showed no statistical benefit, it was their preferred method and approach. I was also captivated by this discussion of a technique I was unfamiliar with. Another unit from Linz, Austria presented on their unilateral ACP technique which runs ACP flows to a target pressure of 80 mmHg, leading to overflowing based on standard calculations and common practice, with an average of 1.6 L/min delivered. It was of great interest and benefit to listen to a passionate discussion centred on the surgical techniques and management of aortic procedures, including the moderate versus deep hypothermia debate. It could have been concluded from the presentations and discussions that many units appear to be making a shift towards moderate temperature management strategies for their aortic work in Scandinavia and Europe.

There was a product discussed that has recently been made available in Australia – the CytoSorb filter. This device aims to reduce circulating cytokines and other inflammatory mediators whilst preserving the patient’s immune system. This filter is designed for integration into both HLMs and ECMO circuitry. A few units discussed their experiences using the CytoSorb filter and how it was implemented into their practice. One unit discussed the benefit they found when using the CytoSorb filter in the presence of a ticagrelor or rivaroxaban loaded patient suffering from an acute condition, requiring emergent cardi thoracic surgery, such as aortic dissections. KUH also use this filter in the presence of infective endocarditis.

A presentation was given from KUH on a program, developed by one of their perfusionists, called HeProCalc. This mathematical program and algorithm is used to calculate the predicted heparin response of each individual patient, giving a real time coagulation overview and guidance of an individual patient’s response to heparin. The program also generates a suggested heparin dose to maintain the patients activated clotting time (ACT) at the desired target, KUH have used this program clinically for over five years. The advantage of this system is that it does not require any additional blood sampling and independent tests to calculate the result, it simply requires entering the of patient’s physique data and periodic ACTs. From this it performs calculations and predicts the patient’s response to heparin overtime, and will also calculate an expected protamine dose.

There was a noteworthy yet unexpected guest in the trade display area of the conference – it would appear that aprotinin is returning to adult cardiac surgery throughout Europe and Scandinavia. Speaking with a representative from Trasylol, more recent and contemporary articles were cited suggesting the risks associated with the use of aprotinin are not as significant as previously suggested by Mangano’s 2006 controversial article ‘The Risk Associated with Aprotinin in Cardiac Surgery’.

The conference also hosted enjoyable social events including pre-organised group running, a walking tour of Stockholm, with their Gala dinner held at the historic seventeenth century Vasa Ship Museum (Figure 3).

Overall, my experiences in September of 2019 have been beneficial and I would encourage others to get on-board the same journey – naturally when we are able to travel globally again. The next SATS meeting has been moved to September 2021 in the exceptionally beautiful Bergen, Norway.

I’d like to take the time to thank my colleagues from Royal North Shore Hospital who supported my study leave whilst I embarked on this journey and to Steven Krithinakis from LivaNova who facilitated my tour of the LivaNova Manufacturing Facility in Munich, Germany.



Figure 3: Author at Vasa Ship Museum, Stockholm

# SAVE THE DATES



# 12TH – 15TH AUGUST 2021

**PERFUSION DOWNUNDER**



The Heritage, Queenstown, New Zealand.

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# OPEN MIND, OPEN UNIT – THE VALUE OF PEER VISITS – ONE PERFUSIONIST’S OPINION

Carla Zazulak CCP, FANZCP

Director of Perfusion, Queensland Children’s Hospital, South Brisbane, Australia.

I was fortunate to begin my perfusion career back in the 90’s at Green Lane Hospital where I was trained in all aspects of adult perfusion including ECMO and heart, lung and liver transplants, as well as all types of paediatric perfusion. At that time there was no need to visit another unit as part of my CCP studies as I was able to be involved in all types of perfusion cases within our one hospital/unit.

While I did not at that time visit another unit, there was a part of the Green Lane Hospital Perfusion staffing that was incredibly valuable during my training, as well as my new-grad period – and that was the existence of an FTE that was almost exclusively dedicated to international locums!

I have great memories of meeting and working alongside perfusionists from all over the world including Denmark, Canada, USA, UK, Belgium etc. Each of them added value and in turn gained knowledge and had fun – it made for an interesting department, and was a fantastic (and necessary) staffing resource put in place by Tim Willcox and Jude Clarke.

Working with international locums kept our practice fresh and meant we naturally kept an open mind and were also used to mentoring/passing on our own knowledge. It ‘kept us on our toes’ in the best possible way.

It wasn’t just international locums either, Tim brought Gerald Buckberg into the pump room to say hi one day. I was certainly privileged and a little nervous to meet the person responsible for the cardioplegia that I still use now in 2020!

In this edition of The ANZCP Gazette you will read two articles – one by Angela Horsburgh – a UK perfusionist who did a maternity cover Locum at The Queensland Children’s Hospital in Brisbane and one by Britney Westbrook – a trainee perfusionist from Waikato Hospital in New Zealand who was able to (pre-Covid) visit both The Queensland Children’s Hospital in Brisbane and Westmead Children’s Hospital in Sydney as part of her professional development requirements for her CCP.

The articles by Angela and Britney highlight nicely the fact that no matter whether you are 24 years into your perfusion career in a single unit and embarking on a fixed term locum on the other side of the world, or whether you are a trainee undertaking professional development, visits to other perfusion units, both nationally and internationally, are vital in showing different types of practice, techniques, networking with peers – and in Angela’s case, growing her confidence in a way that led to a new job opportunity back in the UK. Angela also experienced a very different work/life balance and was able to relax poolside even when on-call, as her rented apartment was a short bike ride along the river from work. Angela remains a friend to many in our unit and we wish her well in her new job/life back in the UK.

We welcomed Britney, who was able to see not only paediatric heart surgeries but emergency ECMO initiation on a child receiving CPR. Our Clinical Leader Anthony Black also took the time to run a wet lab in the pump room so that Britney could have hands on with a neonatal circuit. We enjoyed Britney’s visit and were also impressed with her enthusiasm and knowledge – it certainly reassures us that the future of perfusion is in good hands with our upcoming new grads.

Once COVID restrictions ease, I would hope that perfusion unit visits once again become possible.

Food for thought: Should the ABCP consider awarding CME points for visits to other units in the future? I believe it is a great opportunity for professional development and benefits both the person visiting as well as the unit welcoming the peer visit. I hope that one day it might be included as a part of recertification – not just for trainees.



*The 'old' team at Green Lane Hospital, Auckland circa 2000.*



*Queensland Children’s Hospital*

# QUEENSLAND CHILDREN'S HOSPITAL AND THE CHILDREN'S HOSPITAL AT WESTMEAD

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Britney Westbrook BSc, (Clinical Trainee), Waikato District Health Board (NZ)

Wow what an adventure I am having with my career in perfusion so far! And I am loving it! It is hard to believe it has only been 22 months, and what I have experienced during this time at the tender age of 23 is crazy to look back on.

I was first exposed to perfusion straight out of my undergraduate degree in pharmacology, from the University of Auckland. After showing interest, I had the privilege of being invited by the perfusion team at Waikato DHB to voluntarily observe cases, which I did every Friday for six months. During this time, I got to understand many of the ins and outs around perfusion. A trainee role then came up, and I was lucky enough to become the first trainee in 12 years.

The traineeship has been amazing so far, providing me with many experiences that are setting the foundation of me as a perfusionist and as a person. I have presented at the New Zealand Cardiac Surgery conference in Tongariro and the Waikato Cardiothoracic evening. I was a part of the inaugural three-person team demonstrating to the public the cardiopulmonary bypass machine at the National Fieldays [The Fieldays is an annual national agricultural show and field day event held in mid-June near Hamilton, New Zealand–Ed.]. I have also demonstrated the same decommissioned cardiopulmonary bypass machine at the community Science Spinners volunteer programme in Hamilton. The programme allowed low decile schools [Lower decile schools have more students living in poorer communities, and are consequently better funded–Ed.] to be exposed to uncommon careers in science. I taught the children the basics of the bypass machine and made them aware of cardiac disease.

All the while, I was hitting the books and always aiming to stay ahead with the trainee course. In the OR environment I acquired a range of new perfusion skills under the stewardship of perfusionists from the USA and England. Then of course there are my amazing mentors, our great perfusion team at Waikato DHB, Emma Peplow and Jack Bhana. With support from Susan Arnold-Barron, our semi-permanent locum from Wellington.

So, what an adventure so far. But yes, there's more! I was lucky enough to have both Carla Zazulak from Queensland Children's Hospital and Killian O'Shaughnessy from Westmead Children's Hospital in Sydney to organise my experience through their perfusion units, introducing me to paediatric perfusion.

I arrived in sunny Queensland and was welcomed by Carla their team leader. The hospital was a wonderful experience in itself – the kid friendly colours and smiles created a beautiful atmosphere for not just the children and their families, but also the staff.

After changing into our scrubs, it was action stations after they received an emergency request for VA ECMO in PICU on a four year old, who previously had an MVR a few days prior. We walked into the patient receiving ECPR, having active external then internal cardiac massage prior to cannulation. Carla made me aware that ECPR is a unique group of ECMO patients that Queensland Children's is seeing more of every year. In Waikato, we have only put two patients on ECMO in the last two years. Watching Tony and Carla prepare the primed ECMO circuit in this emergency situation was inspiring, their coordination and communication was seamless for the complexities I now know for paediatric ECMO. The transition in each step of the procedure from cannulation to going-on and running the ECMO was great to observe. The following day I watched Carla perform a VSD case. The difference between adults and paediatrics was again reinforced very quickly, opening my eyes to the next world of perfusion that I had not experienced. Carla's technique was an example of the precision and accuracy that is essential in paediatrics. Her style was inspiring to observe, teaching me intricate skills with flawless communication that is priceless in perfusion. The next day I observed Tony perfuse an ASD procedure, his style was different to Carla's, but just as enlightening. He enjoyed quizzing me and ensuring, that as a perfusionist in the making, I had obtained one of the ultimate skills – of always being one step ahead! This kept me on my toes and reminded me there is still a lot for me to learn in perfusion. This case had a 16 minute clamp time, a new found surgical, perfusion, anaesthesia pace that I had never experienced before, introducing me to the new generation of surgical speed.

Their unit ran flawlessly, with thorough checklists and intricate and precisely chosen disposables for each patient. Their non-clinical time was filled with research projects, stock-taking and informative conversations. I learnt numerous skills that I was unaware were on offer. An example of this is when Nicole taught me the differences in their disposables and Mahesh walked me through the different ways of priming their ECMO circuit. This allowed me to bring home new practices and knowledge from this unit, making the trip hugely worth-while.

My next trip was to Westmead Children's Hospital, with Killian the team leader, Hannah, Casey and their locum Vicky. The timing of my trip meant I walked into a VA ECMO, which Hannah had instituted the night before, after a complicated TGA procedure with a seven hour bypass. This enabled me to compare the two ECMO procedures. Queensland Children's Hospital used the Jostra Rotaflow and QuadroxD oxygenator combo whilst Westmead Children's used the Levitronix CentriMag system with the Medos oxygenator. I then deciphered their strategies and reasonings for their preferences, exposing me to the vastness of not only bypass, but also ECMO.

The cases in the following days were TOFs with two different surgeons and perfusionists, Casey and Killian. It was great to watch the different perfusionists interact with others in the OR and perform their perfusion techniques. The light-hearted humour and amicable behaviour that one of their surgeons permitted in the operating theatre was a unique experience.

Being welcomed with open arms to two different paediatric units who showed their way in perfusion was amazing. It enabled me to up skill in many aspects of perfusion that I did not know existed. From a trainee's point of view, many can get immersed and lost in their own units and regimented to the walls of their practice, but getting out and reminding yourself

and others of the varying aspects in perfusion is a great way to keep your skills updated, technology advanced and eyes open.

I would like to again thank Carla Zazulak, Tony Black, Mahesh Naidu and Nicole Shrimpton from Queensland Children's Hospital, and Killian O'Shaughnessy, Hannah Lea and Casey Edwards from Westmead Children's Hospital for allowing me to step into their perfusion worlds. In the near future, I am hoping to visit other units from around New Zealand.

We from Waikato would love to reciprocate this experience to other trainees from around Australasia.



*L-R: Nicole Shrimpton, Mahesh Naidu, Tony Black, Britney Westbrook, Carla Zazulak; Queensland Children's Hospital*



*Britney Westbrook & Hannah Lea; Westmead Children's Hospital*



*Britney and Anthony discussing a neonatal 'wet lab' circuit*