

The Journal of
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Cardiological
Science
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SCST

President's Letter



The dark days of winter are behind us and it's so lovely to leave work when it's actually still daylight. I'm really enjoying going for a walk when I get home – blows away all the stresses of the day!

I think a lot of us are feeling under stress in the workplace now – so many demands, so many targets, not enough resources to do the job as well as everyone would like it done... the list is endless. Community Diagnostic Centres are taking a lot of our time at the moment, and that's on top of all the 'normal' work. I've seen a quick glimpse of the draft national data collection for Cardio-Respiratory services and by the time you read this, you may have seen the full report. Two things struck me straight away – that we're all effectively in the same boat, and that we are clearly managing to find different ways to try and get back on an even keel. There has got to be some benefit to sharing experiences and working together. Hopefully, this data will be used to drive investment in our services, although not necessarily financially. The other thing that jumped out at me was the relatively low banding of people clearly leading large complex departments compared to areas of healthcare science that perhaps have had an establishment of senior scientists for a longer time. To that end, we will be starting to pull together some resources for members to use in order to benchmark their grades and perhaps consider re-evaluation of their banding. Keep an eye on the website for more information.


It was lovely to see so many colleagues participating in activities to promote Healthcare Science Week – really flying the flag for cardiac science and demonstrating what a fantastic career we have. It is really apparent that we love doing what we do. Hopefully, you'll get some inspiration for Healthcare Science Week 2024 in this Journal. It's also great that the Equivalence Sessions are still going strong – the peer support group that meets monthly with the aim of mentoring people through the AHCS equivalence process. The number of Clinical Scientists in Cardiology is steadily increasing which is fantastic to see.

During all of this – don't forget to take time and figure out healthy ways for you and your colleagues to cope with stress. Take breaks, take care of your body, take time to unwind, and talk to others (not about work!). Connect with friends and family, take up a new hobby, but most of all – go easy on yourself. You can only do what you can; so accept that you can't do things perfectly no matter how hard you try. And most of all – keep up your sense of humour! It's the only thing that will see us through!

Joanne Ashton
President, SCST

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SCST celebrating 100 years of the British Cardiovascular Society

In February, the centenary celebration of the British Cardiovascular Society was marked by a reception at St James' Palace, London. Following the drinks reception, guests were greeted by Her Royal Highness, The Princess Royal.

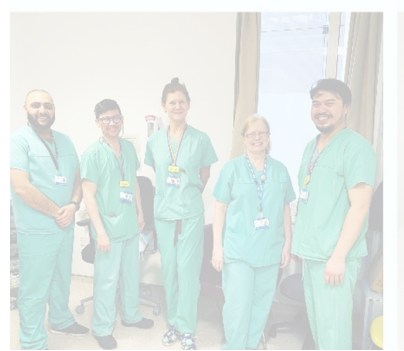
Su Baxter (Honorary Secretary) and Nolan Stain (Vice President) had the privilege of meeting HRH on behalf of SCST leading to this lovely photograph above (printed with permission).

Shirley Fletcher Apprenticeship Award

The Chief Scientific Officer's Shirley Fletcher Apprenticeship Award is awarded to healthcare science staff who demonstrate exceptional dedication to the profession and learning within the workplace.

The outgoing SCST chair of education, Tracy Cook, who is the Education and Training Lead in Diagnostic Cardiology at Sheffield Teaching Hospitals, was one of three alongside Tracey Murray (Lead Respiratory Physiologist) and Sarah Kelly (Service Manager of the Gastrointestinal Physiology Department). The award was given for the rollout of an innovative training programme.

The SCST would like to formally congratulate Tracy for this fantastic achievement.

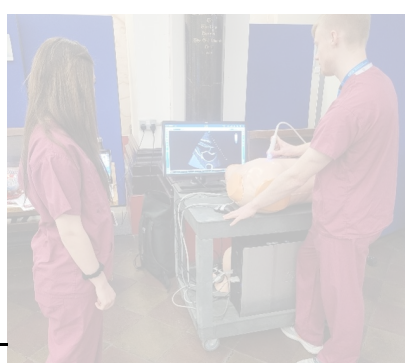
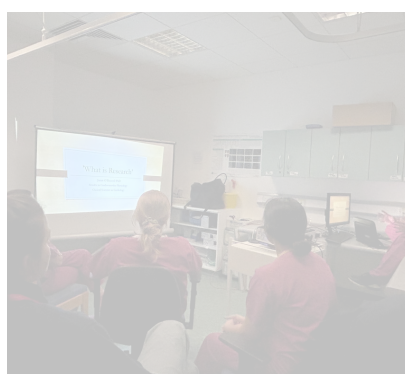


Healthcare Science Week

Healthcare Science Week is an opportunity to publicise and share the important work of a (sometimes overlooked) healthcare profession workforce with the wider healthcare community, patients and the public.

It not only can be an opportunity to encourage patients to engage with the staff they meet when they come into the hospital but also raises awareness of the profession and potential career pathways for others.

This year Healthcare Science Week was held between the 13th to 19th of March and the SCST would like to share some examples of what Trusts around the country got up to.



St George's Hospital

Hannah Crane, Clinical Scientist

March 13th-17th was Healthcare Science (HCS) week where all branches of HCS are celebrated. There are over 56,000 Healthcare Scientists nationally across 40 specialisms. We collectively underpin the delivery of over a billion diagnostic and scientific investigations and treatment interventions a year, encompassing 80% of total NHS diagnostics. Despite this, we make up just 5% of the workforce!

Each day throughout HCS Week, Cardiac Investigations at St George's Hospital had Twitter takeovers (@STGCardiac), with 'A Day in the Life of' showcasing some of the different specialisms in Cardiac Science, and a 'Trainee Takeover' featuring members of each of the 4 different training programmes reflecting on their experiences so far.

Some of our senior cardiac scientists put together various talks throughout the week, including a pacemaker-themed HCS Quiz and Thursday afternoon saw the beginning of the Cardiac Investigations Research Series with an 'Introduction to Research talk'.

Throughout the week, various strands within HCS took turns to advertise their specialism in the Grosvenor Wing. The Cardiac Science stand had pacemakers, heart ultrasound images, stents and balloons for staff and patients to look at and ask questions to gain a deeper understanding of Cardiac Science.

Of course, the whole week culminated in a Friday evening social after work for some well-earned downtime!



ABOVE
Introduction to Research at St George's Hospital

RIGHT
HCS Week Stall at St George's Hospital

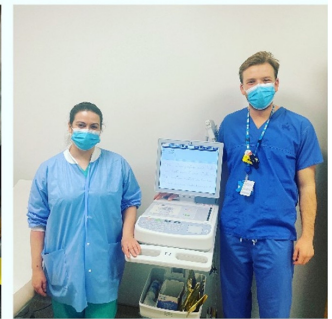
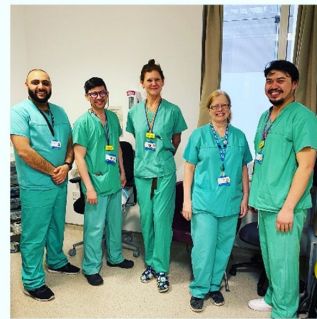
BELOW
HCS Week Stall at St George's Hospital with the team



Bart's Health



Dr Nolan Stain (Clinical Scientist)
James Malcolmson (Clinical Scientist)



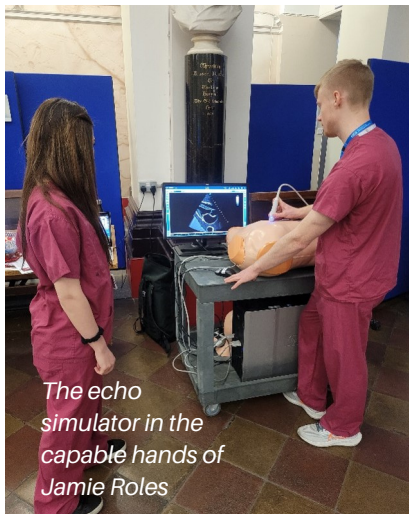
Barts Health has five hospitals covering most of the East London footprint employing a large number of Healthcare Scientists (HCS) with over 150 of them working in cardiac physiology. To celebrate Healthcare Science Week 2023, we hosted an intra-disciplinary HCS open day. This collaboration, led by our Lead Healthcare Scientist, drew specialisms from across the breadth of HCS to come together and showcase the amazing work they do, vital to the vast majority of care pathways (their work underpinning 80% of all diagnoses). There was representation from various disciplines including respiratory and sleep science, cardiac science, pathology, biomedical science, neurophysiology, radiation safety, and MRI physics.

The event was held at the Royal London Hospital's entrance foyer, so many patients, staff and visitors stopped to chat about our work as they passed through the area. It was great to be visited by several senior executives and managers throughout the day to hear more about us and give support for the work we do - including our Group Chief Medical Officer.

Our cardiac physiology stand showcased a breadth of diagnostic tests and therapies in cardiology, including hand-held heart ultrasound machines, and pacemaker and ICD programmers. Lots of people stopped to chat with members of our team and see some of the current technology used to monitor and look after cardiac patients.

HCS week coincided with neurodiversity weeks we used the opportunity to intersect these two important events. Some neuro-diverse HCSs wrote blogs and participated in a range of activities.

We used our social media accounts to highlight the day with wide-ranging support and re-tweeting. We also took the opportunity to highlight our amazing cardiographers and associate practitioners who are an absolutely critical part of the cardiac physiology team.



The echo simulator in the capable hands of Jamie Roles



HCS Week Cardiac Science Stall at GSTT with Sam Bean



Demonstrating the Seldinger technique

Guy's & St Thomas' Hospital

Lucy Bowen (Clinical Scientist)

Sophie James (Trainee Clinical Scientist)

On the Wednesday of healthcare science week the cardiac science team, headed up by Laura Carlisle (Clinical Scientist) and Sam Bean (Clinical Scientist) and the STP trainees took to the Central Hall at St Thomas' Hospital to showcase the work of cardiac science among the other healthcare science specialisms. Alongside the stall with leaflets, a video on echocardiography at GSTT and a selection of pacemakers through the ages, there was an echo simulator and even a cath lab simulation. Patients, the public and staff alike tested their cardiologist-in-the-making Seldinger and IVUS techniques.

Sophie James (Second Year Trainee Clinical Scientist) also did a digital takeover of the London Healthcare Science Trainee Network as a 'Day in the life of an STP'.

Starting her morning in the echocardiography department studying various pathology and "trying to nail" her apical views, Sophie spent the afternoon at the HCS Roadshow stall before spending the evening on call in the cardiac catheter labs. Sophie's day shows us just how varied a career in cardiac science can be!



Thank you to everyone who took part in Healthcare Science Week 2023!

Your celebrations demonstrate the incredible impact that healthcare science has made over the last 75 years of the NHS, and the difference we continue to make every day to patients and staff.

#HCSWeek2023



The interactive displays had a great reception from attendees and were even picked up by the Chief Scientific Officer, Professor Dame Sue Hill, in her Twitter post showcasing the efforts of healthcare science week!

Finally, at the end of a long week, a team outing to the pub was well deserved!



Bradford Royal Infirmary Hospital

Joanne Ashton (Clinical Scientist)



Staff at Bradford Royal Infirmary celebrated Healthcare Science Week 2023 in a few different ways. Activities were curtailed a little as part of the week coincided with a national strike, putting everyone under a little more pressure than normal. However you can't keep a good team down - so three staff paid a visit to a local school and spent two hours talking about what it was like to work in Healthcare Science, and why it was a brilliant career to aspire to. Unfortunately, no photographs are available from the school, but amazing feedback and huge thanks were received.

We invited the executive team from Trust HQ to come and shadow cardiac scientists for an hour. Despite the immense pressures of that week, two of them came to cardiology. The Deputy CEO, Saj Azeb paid a visit to the Cath Lab and spent an hour with Madiya Yasin observing a PCI and the amazing multi-disciplinary team that cardiac scientists are an essential part of there. He also managed to grill one of our students with the hands-on training required to complete the degree.

The CEO, Mel Pickup managed to squeeze in time to spend an hour in the pacing clinic and then managed to send out a Tweet of herself together with Nimra Uddin and Savannah Thompson. The invitation to shadow worked really well and is something that we will expand on in future years.



Prof Mel Pickup

@Mel_Pickup

Grateful to Nirma and Savannah who hosted me on a visit to Cardio Respiratory clinic as part of Health Science Week & to the patients who allowed me to observe them having their pacemaker checks & chat to them about their experiences of being in our care. Lovely to meet you.

Healthcare Science Week

We also booked out stands in the main concourse of the hospital. We chose the two hours over the lunch period to maximise footfall yet minimise the impact on the clinical services. There were separate stands for Echocardiography, Invasive cardiology, CRM and respiratory.

Sam Walsh, an STP trainee at BRI, said: *"It made me proud to be able to educate staff, students and patients on what we actually do, and for others to be interested in what we had to say".*

Deeon Pryce, who is an Associate Practitioner, said: *"After speaking to individuals who have used the services we provide, listening to their positive experiences and feedback on their patient journey made me feel incredibly proud to be a part of a team providing a high-quality service and being recognised for the positive impact our roles have on the service users".*

Rebecca Ferguson, an echocardiographer agreed: *"I felt so proud to be a cardiac scientist when the practice development nurse from ICU recognised who we were and then went to gather the ICU students nurses and juniors to come and speak to us to learn more about our role because our career 'is very important and they are experts'. Even one person recognising how important we were and then telling others is always a proud moment!"*

A debrief recognised the things that had worked well:

- Echo training simulator worked particularly well, lots of staff wanted to have a go and wanted details for further training sessions
- Information leaflets on the conditions and diseases were well-received by people
- Informative posters to draw in interest
- Getting access to a place where there is a lot of footfall from both the public and staff
- News spreading in the global email and promotion on social media by the trust helped gain interest

The daftest questions we were asked were:

- *"Is smoking bad for your heart?"* ...really? in this day and age?
- *"Does orange juice clear out your arteries?"*What???
- *"So, what placement did you do after nursing to do this job?"* Aaaargh!!! but it did give us the chance to explain the difference between career and degree!

All-in-all, Healthcare Science Week 2023 was a great success. Excellent PR for the department; raising the profile of both cardiac science and respiratory science. Amazing recognition from the senior Trust management team, and a little bit of a different day just to add to the fun of working in Cardiology!



SCST Congenital Heart Disease Echo Accreditation



An article for Healthcare Science Week

Catherine Townsend

My congenital heart disease (CHD) journey started approximately 10 years ago while I was employed as a Cardiac Physiologist and Healthcare Scientist at my local level 3 Adult CHD (ACHD) centre. Here, there was a monthly outreach clinic run by ACHD Cardiologists from our local specialist ACHD network at Oxford. As my career has grown and developed, I developed a keen interest in Congenital echocardiography and wanted to develop my expertise in this area. I now work at a Level 2 Specialist ACHD centre, as a Healthcare Scientist with a particular interest in Congenital Echocardiography.

Congenital heart disease (CHD) is a rapidly growing field, and thanks to improved surgical outcomes, there are now more adults than children living with Congenital Heart Disease (Marelli et al., 2014; Baumgartner et al., 2021). There is a broad spectrum of diseases, ranging from simple mild pulmonary stenosis, and small ASDs or VSDs to extremely complex diseases - and in the complex category, no two patients are quite alike!

Most patients with CHD require life-long follow-up to assess for long-term sequelae. Female patients often require more frequent follow-ups during pregnancy. Thus, Adult Congenital Heart Disease in particular is a rapidly expanding field. Congenital Heart Disease in particular is a rapidly expanding field.

Even during my earlier days working in echocardiography, ACHD echo clinics were always my favourite clinics, although I was also keenly aware of my limitations and limited understanding of the range of conditions encountered. With my 'once-a-month' exposure it was also very difficult to remember all the difficult terminology (sequential segmental analysis,

palliations and surgical procedures), especially without ever having had any formal teaching on the subject.

Now at a specialist centre, I, together with two colleagues who also have a special interest in ACHD have been extremely fortunate to have been mentored in our ACHD echo journeys by Dr Jo Lim, one of the ACHD Cardiologists at Oxford. Jo currently runs monthly teaching sessions (these are free to attend and registered to receive BSE re-accreditation points, small plug, link below!!)

As a small group of Healthcare Scientists with a particular interest in ACHD echo, we wanted to pursue congenital echo accreditation and needed to decide which of the European Congenital accreditation pathways to pursue (BSE Congenital Accreditation or EACVI Congenital certification). There are similarities and differences between these pathways. Both require candidates to complete a written examination and a logbook with case studies. Both can include both paediatric CHD and ACHD. However, the 'feel' for them, and the way they are assessed is a little different. In my view, the BSE accreditation feels somewhat more tailored to ACHD echo, whereas EACVI certification, though including both paediatric and adult CHD, seems to have rather more of a paediatric (unoperated) 'flavour'. Eventually, we decided to go with the EACVI certification as this is what Dr Lim had done herself.

I passed the (very challenging) written exam last year and am now well on the way to completing my logbook and DOPS. Undergoing this process has taught me a great deal (though I am very much still learning, developing and refining my ACHD skillset)

As a Healthcare Scientist, I very much appreciate the opportunity to extend my echocardiography skillset to become specialised in the field of congenital echo. As there is now a small group of Healthcare Scientists at Oxford with a particular interest in Congenital echo, the ACHD Cardiologists have started to build dedicated Fontan clinics, which are an exciting new challenge, and one that I enjoy immensely. I love how my confidence in tackling complex congenital echocardiography is growing, such that I am now developing the knowledge and skills to obtain specialist views and make specialist assessments, with a genuine feeling that I am starting to know what I am doing! One of the things I love about complex congenital echo is that each patient's anatomy is unique - for the ACHD population, their long-term follow-up and sequelae are also very much determined by their surgical history. This, in turn, is dependent on the patient's age and what surgical treatments were available at the time, as well as individual centres/surgeons' preferences. Indeed, when it comes to complex congenital echo there truly are no two hearts alike, and each patient is like a history lesson!

I have the opportunity to sometimes join paediatric congenital lists and scan some of these patients, and the paediatric cardio-oncology lists help a great deal here in terms of paediatric patient and family interaction, and learning how to quickly acquire the necessary views on moving targets! I do enjoy both paediatric and adult congenital echo - they each have their unique challenges and I enjoy the variety of approaches required to engage with patients of all ages, many of whom also have additional needs.

With the rapid expansion of ACHD echo services, the need for specially trained Healthcare Scientists has never been greater. Although complex patients are often seen in specialist centres, it is vitally important that Healthcare Scientists performing echocardiography at least have a good working knowledge of the basics.

It is encouraging to see the expansion of teaching and training at national conferences, webinars and the like (another plug for Dr Lim's teaching sessions). Even centres without dedicated ACHD services can have the occasional 'surprise' congenital patient present to them, who may be new to the UK or lost to follow-up - such patients are either the most interesting or the most terrifying, depending on the level of training of whoever is performing the echo! For this reason, it is vital that anyone performing echocardiography does engage with the learning and development opportunities in this area, to increase their confidence in dealing with these patients who can present unpredictably.

So - this Healthcare Science week, while I am reflecting on my own specialised journey, I also reflect on just how varied Healthcare Science is, and how diverse our workforce is, even within Cardiology. Some Healthcare Scientists prefer a varied role rotating through a variety of disciplines. Others, such as myself, prefer a more specialised role. We all make a very valuable contribution to our teams, and therefore to our patient's care, and we should celebrate our diversity and unique contributions.

Oxford Representation at the British Cardiovascular Society Conference

A number of cardiac scientists attended the British Cardiovascular Society conference held in Manchester from 5-7 June 2023, where many engaging talks were held across the three days.

On the third day, there were talks held by the Cardiac Physiology Clinical Scientists Group (CPCS).

Chaired by Heidi Tumman (Cardiac Clinical Scientist, Physiology Lead for Structural and Coronary Intervention), the team from Oxford generated good discussion as they presented the second CPCS session with the journey of a pregnant patient presenting with dizziness and palpitations.

Dr Julian Ormerod (Consultant Cardiologist, Specialist in Inherited Cardiac Conditions and Devices) gave the first talk (how the patient presented), followed by Prashanth Gunasekar (highly specialist Cardiac Physiologist - echo) who discussed her imaging, and showed other examples of ARVC (our patients' diagnosis).

The third part of the session was presented by Lucy Hickman (Senior Cardiac Physiologist, specific device interest), who covered all things EGM - ILR, S-ICD screening, and TV-ICD implant settings.



ABOVE

The team from Oxford who took the second CPCS session through the journey of a pregnant patient presenting with dizziness and palpitations.

From left to right: Dr Julian Ormerod (Consultant Cardiologist - presenter), Prashanth Gunasekar (Highly Specialised Cardiac Physiologist - presenter), Heidi Tumman (Cardiac Clinical Scientist - chair), Lucy Hickman (Senior Cardiac Physiologist - presenter).

NHS Payment Scheme 2023-25

Lucy Bowen, Clinical Scientist, Guys & St Thomas' NHS Trust

Mark Squirrel, Principal Clinical Scientist, Guys & St Thomas' NHS Trust

On April 1st 2023 NHS England released the 2023-2025 NHS Payment Scheme, replacing the National Tariff (NHS England, 2023). The scheme negotiates pay between providers and commissioners of secondary healthcare. The prices workbook can be found in Annex A of the 2023 to 2025 NHS Payment Scheme.

The workbook has several codes with unit pricing for elective and non-elective work. Cardiology codes can be found under E codes and respiratory codes can be found under D codes, which presents a challenge for departments running mixed cardiorespiratory diagnostic testing such as cardiopulmonary exercise testing (CPETS). SCST would like to highlight some of the relevant cost codes and pricing for cardiac departments below as there are different costs associated with elective, non-elective and ACHD patient populations.

ECG monitoring and stress testing as an elective outpatient is priced at £131 (EY51Z) with ACHD ECG monitoring and stress testing at £190 (EC22Z). Non-elective work is £449, and £795, respectively. Compared to the £131 per exercise test (ETT), CPETS are coded under respiratory codes as £296 (DZ31Z). At some centres CPETS have been historically coded as ETT's, opening the potential for significant loss of income and we would encourage departments to clarify their current diagnostic coding for exercise testing.

Pacemaker (PPM) and Implantable Cardiac Defibrillators (ICD) interrogation is priced at £109 for elective work (EY11Z) and £407 for non-elective work (EY11Z). Interrogation includes follow-up sessions in clinic and via remote monitoring. For echocardiograms, there are different pricing units for different complexities of the study. A direct access simple echocardiogram is priced at £85 for 19 years and over (RD51A) whereas an outpatient procedure for a complex echocardiogram is priced at £264 (EY50Z). If that complex echocardiogram is performed on a non-elective admission that price rises to £1,143 (EY50Z). ACHD echocardiograms are priced separately with an elective scan being priced at £375 (EC21Z) and a non-elective scan being priced at £1,383 (EC21Z).

The SCST would like to open discussion as to what defines an echocardiogram as "simple" or "complex"? There is currently no differentiation from NHS England and the distinction between simple and complex status has significant implications for departmental payment. Ideas discussed so far have included a screening echo as "simple" versus a full transthoracic study as "complex". Another member suggested that a "complex" echocardiogram includes any study with more than mild pathology. We believe it is important to have a uniform agreement on defining "simple" and "complex" to ensure we are being reimbursed appropriately and are actively welcoming suggestions from our members.

Also listed in the workbook are 'High-cost devices and listed procedures'. These include: 3D mapping and ablation catheters used in complex cardiac ablation procedures; ICD's; ICD with cardiac resynchronisation therapy capability; mitral and tricuspid edge-to-edge repair devices; and transcatheter and percutaneous valve repair and replacement devices. Departments will be specifically reimbursed for these high-cost devices and procedures and therefore it will be important to accurately document the number performed each month. The final important aspect of the workbook that SCST would like to highlight to SCST members is the Market Forces Factor (MFF) which provides an estimated value for each Trust taking into consideration geographically associated cost differences incurred to correct the unit pricing.

The SCST would like to signpost cardiac physiology departments to the workbook which can be found on the NHS England website (<https://www.england.nhs.uk/publication/2023-25-nhs-payment-scheme/>) and would encourage department leads to familiarise themselves as there are important repercussions to payment and departmental financing. If you would like to contribute to the discussion, we invite members to share their views on our communication channels or by writing to the journal.

References

NHS England (2023) NHS Payment Scheme. Available at: <https://www.england.nhs.uk/pay-syst/nhs-payment-scheme/> (Accessed: 3 May 2023).

Insights from Apollo

The effects of spaceflight and lunar landings on the heart

*Christopher Cox, Senior Lecturer in Healthcare Sciences, Faculty of Health Sciences and Wellbeing
University of Sunderland, UK*

In the summer of 2019, events were held across the world celebrating the 50th anniversary of the first lunar landing and now in 2023, NASA is preparing to return to the moon with the launch of the powerful Artemis rocket.

On July 16th 1969 the powerful Saturn V, the largest rocket ever built, launched from Cape Kennedy Florida propelling the three astronauts Michael Collins, Edwin 'Buzz' Aldrin and Neil Armstrong, first into Earth orbit and then onto a trajectory that would take them onwards towards the Moon. Once in lunar orbit, the command module (CM) Columbia, piloted by Michael Collins detached from the landing module (LM) Eagle that carried the LM pilot Buzz Aldrin and mission commander Neil Armstrong towards the surface. Even as Eagle descended towards the Moon's surface a last-minute problem with the landing site triggered concerns that the mission might not make landfall. The world waited through the silence until they heard those immortal words "Houston, Tranquility base here. The Eagle has landed." The LM touched down on the moon's surface on the 20th of July 1969.

Astronauts Armstrong and Aldrin would spend 21 hours 36 minutes on the Moon's surface including approximately 2 ½ hours of extravehicular activity (EVA) conducting a range of scientific experiments. Less widely known, and information not published until much later were symptoms experienced by Neil Armstrong in the later stages of the EVA. In the last 20 minutes of EVA Neil Armstrong twice reported symptoms of severe dyspnea that were accompanied by sinus tachycardia with a heart rate up to 160bpm (Rowe, 2016). Armstrong's heart rate would remain

elevated through most of the return journey to Earth, returning to 61 bpm approximately 30 minutes before splashdown in the Pacific (Rowe, 2016). Publishing this finding in the International Journal of Cardiology, William Rowe postulates that these symptoms could be a sign of some form of stress cardiomyopathy resulting from a combination of reduced levels of magnesium ions and high levels of catecholamines experienced during microgravity that increase the risk of astronauts experiencing oxidative stress (Rowe, 2014).

The risk of oxidative stress during spaceflight is well-documented and multifactorial in origin. Oxidative stress can be defined as an imbalance in the production of free reactive species against antioxidant defences. Whilst in the short term it can promote normal physiological processes, in the long term it can lead to tissue damage (Pignatelli et al, 2018). Magnesium deficiency, which Rowe cites as a leading concern amongst the Apollo astronauts, has a direct impact on reducing the body's antioxidant defence. Magnesium increases the activity of glutathione peroxidase (GPx) enzymes that catalyse the breakdown of toxic hydrogen peroxide into water or alcohol at various locations within the body (Brigelius-Flohè and Maiorino, 2013). Magnesium also has an antagonistic relationship with calcium and the reduction in magnesium ions can lead to an increase in intracellular calcium-promoting catecholamine release (Kostov and Halacheva, 2018). The effects of oxidative stress stemming from magnesium deficiency in the body have been shown to lead to increased oxidation of lipoproteins within the subendothelial layers of coronary arteries reducing LDL clearance,

increased catecholamines and stress response, activation of the renin-angiotensin-aldosterone system, endothelial dysfunction and initiation of an inflammatory response (Zheltova et al, 2016).

Reduced magnesium in astronauts is thought to originate from impaired absorption and loss of magnesium from skeletal muscle and bone as a result of reduced movement, and exposure to microgravity (Rowe, 2015). Increased serum and urinary magnesium have been found in astronauts who have prolonged exposure to spaceflight such as prolonged stays aboard the International Space Station although proving a direct link between these measurements and reduced cellular magnesium is difficult (Smith and Zwart, 2015).

Environmental factors on the lunar surface would likely lead to astronaut dehydration during the landing itself. Both astronauts were performing a high degree of physical exertion during the EVA in heavy spacesuits, with a limited water supply and radically shifting lunar. Temperature variations at the lunar equator have been shown to range from 105K (-169°C) at night to 387K (113°C) at noon with radical shifts in temperature between areas exposed to direct sunshine and shaded regions (Malla and Brown, 2014). Increases in astronauts' resting and exertional core body temperature have been demonstrated in both short-term and long-term space flights with recorded maximal temperature increasing with progressively increasing workloads (Stahn et al, 2017). Reduced gravity even without the contribution of a confined extravehicular space suit reduces the transfer of heat from the skin to the surrounding air through convection and decreases the evaporation of sweat from the surface of the skin. Progressive dehydration has been demonstrated to reduce stroke volume through reduced venous return, consequently reducing cardiac output, arterial blood pressure and blood flow to organs (Watanabe et al, 2020). Reduction in stroke volume can be counterbalanced by a reflex increase in heart rate. However, evidence collected from endurance athletes has shown that this balance can be significantly impacted when both dehydration and hyperthermia are present and can lead to a reduction in cardiac output (González-Alonso et al, 1997).

Neil Armstrong was not the only Apollo astronaut to suffer adverse symptoms whilst on the Lunar surface.

As part of the Apollo 15 mission astronaut James Irwin experienced similar symptoms to Neil Armstrong with an episode of severe dyspnoea and tachycardia during re-entry (Rowe, 2016). Irwin's heart rate increased suddenly to 167 bpm and this persisted throughout re-entry. His heart rate was recorded at 85 bpm during a stress test performed on the day of return (Rowe, 2016). Whilst there were similarities in the symptoms experienced by both Armstrong and Irwin, there were additional symptoms experienced by Irwin and another member of the Apollo 15 crew. Irwin also experienced an episode of ventricular bigeminy and transient loss of consciousness upon returning to the command module from the lunar surface. During their extended extravehicular activity, both Irwin and fellow astronaut David Scott also experienced severe pain and oedema at their fingertips (Rowe, 1998). There were differences in the mission profile of Apollo 15 compared with 11. James Irwin and David Scott would remain on the lunar surface for a more prolonged period than the Apollo 11 crew and participated in three separate EVAs compared with the one performed by Armstrong and Aldrin. This adds a contributing factor of exposure to potentially toxic dust from the lunar surface as the astronauts returned to the landing module. A malfunction of the Apollo 15 water distribution system would have also led to severe thirst among the crew likely exacerbating dehydration (Rowe, 2016).

It is difficult to draw definitive conclusions about the safety of lunar landings or the potential risks given the small number of human beings that have walked on the moon and the varied nature of the missions they participated in. Conditions experienced by the Apollo astronauts were extreme, technology was limited and there was huge uncertainty about how the human body would respond to the physiological demands of spaceflight and lunar landings. As knowledge of myocardial behaviour has developed the data collected by these early moonwalkers can shape our understanding of the risks associated with travel to other planets. In the 21st century, ongoing missions to the International Space Station (ISS) can continue to build a picture of how the human body and the heart respond to long-term exposure to space and how human beings can adapt to prolonged periods of weightlessness. However, as humanity sets its eyes back on the moon and more distantly towards other planets like Mars it may be that insights gained from the Apollo programme can help light the way.

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Ask the Expert: Dave Richley



Tell us a bit about yourself and how you came into the world of cardiac physiology

I left Newcastle University in 1978 with a degree in zoology, not having given a moment's thought in the preceding three years to what I might do after graduation. I decided to apply for jobs of a scientific or technical nature and the first interview I got was for the post of physiological measurement technician (as we were then known) in cardiology at Freeman Hospital in Newcastle upon Tyne. I got the job, so cancelled an interview I had been granted for a post as a school lab technician. If this interview had come up first I might have ended up cleaning test tubes instead of doing echoes and pacing clinics.

What about ECGs do you find most interesting?

Where do I start? Maybe it's the sheer range of conditions that ECGs can help with – not just in cardiology but also with endocrine disorders, electrolyte imbalances, drug effects, acute cerebrovascular conditions, the consequences of respiratory disease and so on. Perhaps it's the fascinating, often under-appreciated subtleties that can be seen in acute coronary syndrome. But probably the most difficult and therefore the most interesting ECGs to interpret are complex bradyarrhythmias – these can be a real mental challenge. What's particularly rewarding about ECGs is that 120 years after the first recording was made our knowledge continues to advance. I think that many people in the 1970s thought that all the mysteries of electrocardiography had been solved, but because of recent insight gained through advances in genetics, molecular biology and electrophysiology, and because of investigative techniques such as MRI, we can now make correlations with ECG patterns that were simply not possible a few decades ago.

What do you consider the most important steps in ECG analysis in order to reach the correct diagnosis?

First, you need the story. Age, sex, clinical presentation, medical and family history where appropriate, and relevant medications help to provide the context that simplifies ECG interpretation and makes it more meaningful. Without any clinical context, it is possible to provide a purely descriptive interpretation but it's very difficult to draw useful conclusions from the findings.

Those who are not confident or experienced should adopt a thorough, systematic approach to interpretation that may be time-consuming but should ensure that nothing of importance is missed. There is no single 'correct' approach, but it may be helpful to determine the heart rate, then the rhythm, followed by the QRS axis and the standard intervals, before evaluating QRS morphology, ST segments, T waves and any other deflections that may be present. Experienced ECG interpreters tend to absorb and process the important information very quickly, without using the step-by-step method, but research has shown that even the so-called experts revert to the beginner's approach when confronted by an ECG that is complex and puzzling.

What are the most common mistakes or pitfalls made in ECG interpretation?

One of the most common mistakes is to glance at an ECG and come to an instant evaluation. This tends to happen when people have got some experience of interpretation but are not experts. The more experienced are often aware that important but subtle details may only be apparent on close scrutiny and there are often alternative explanations for a particular pattern: the more you know, the more you are aware of how much you don't know.

But the area where most mistakes are made is probably that of arrhythmias. Much of ECG interpretation relies on pattern recognition – think of the bundle branch blocks or the ST elevation in acute MI – but this often doesn't work for arrhythmias because you may encounter something that you have not seen before. Sometimes arrhythmias have to be worked out by combining observation, knowledge, speculation and deduction. Unfortunately, some people don't know how to elucidate complex arrhythmias, so they jump to a conclusion that appears to be based on one particular feature they have identified. For example, it's very common to find complete heart block diagnosed purely on the basis of apparent AV dissociation, even though there may not actually be any heart block.

Also, I think it's important to understand that the ECG, like all other tests, has limitations. There will always be false positives and false negatives: a QTC of 480 ms does not mean that there is long QT syndrome, and normal QRS amplitudes do not rule out left ventricular hypertrophy.

I think that one of the problems is that cardiac physiologists (and doctors, come to that) learn about ECGs during their basic training but may never undergo any further formal ECG education again. Yes, they'll learn loads about imaging and implantable device management – and rightly so – but ECG knowledge may remain at a basic level and even atrophy through disuse. Let's face it – the most technically dazzling 4D echo with strain imaging and speckle tracking, as well as impressive modalities such as spiral CT and MRI with late gadolinium enhancement, can't begin to compete with the humble ECG when it comes to diagnosing early repolarisation syndrome (ERS). And if you don't know what ERS is, that may be because you learnt about ECGs years ago and haven't kept up to date with recent developments!

If you could give one piece of advice to someone starting out in cardiac science what would it be?

Immerse yourself in the subject. Read as much as you can, ask when there's something you want to know, and seek clarification when there's something you don't understand. Push yourself to advance your knowledge and be more proficient. The more you put into it, the more you'll get out of it. Also - be kind.



Jeff Davison: An SCST Profile

Words by Lucy Bowen, Clinical Scientist Guy's & St Thomas' Hospital

The cardiac physiology department at Guy's & St Thomas' Trust is home to many a trainee embarking on various stages of their career in cardiac science, from apprentice to higher specialist scientist trainee. Most, if not all, trainees will have passed through the hands of Jeffery Davison at some point in his role as Head of Training and Development. As Jeff steps back from his current role and sets sights on sunnier climes I wanted to reflect on a (sometimes surprising) career that has spanned over four decades.

Jeff started his career in October 1977 on the other side of the river from Tommie's at Ealing Hospital working as an Operating Department Assistant and then in 1981 working in theatre/ITU monitoring. Time at Ealing Hospital was sandwiched with a brief stint in the land of cardiology at Charing Cross between 1980 and 1981 as a cardiac technician.

Jeff then took his interest in cardiology to the esteemed streets of Harley Street Clinic as a cardiac technician performing predominantly

paediatric catheters. From there he moved to Wellington Hospital as a senior technician, picking up further skills in echocardiography, before becoming Chief Cardiac Technician at the London Chest Hospital.

Shortly after starting at the London Chest Hospital, Jeff decided to try something completely different and took a job at British Caledonian as a cabin crew for long-haul flights allowing him to travel the World. During this role, they would be afforded long rest periods between trips between 6 and 20 days, which allowed him to carry on his role at the London Chest in the interim. During this time Jeff learnt to fly and obtained his commercial pilot's licence. However, he didn't fly multi-engine aircraft and therefore never flew commercially. In June 1987, Jeff performed his last cross-check, stowed his final tray table and returned to the world of cardiology, becoming the youngest senior chief medical technical officer in London at the Middlesex Hospital.

The turn of the '90s brought rave music, the Spice Girls, and a new career path for Jeff. He became a Clinical Engineer at Intermedics in Brussels covering Europe, The Middle East and Africa. Intermedics was set up by Medtronic Salesman Herbert Beutel, working with new lithium batteries in pacemakers. Here Jeff worked on the first generation of ICDs including testing capacitor reforms. Jeff then transferred to Tokyo where he covered Asia Pacific.

In 1992 Jeff decided to leave the glittering high rises of Tokyo to travel eight hours back in time to Cardiff where he became General Manager (Cardiology) at the Glan Hafan NHS Trust where he would stay for the next two years. Not one to sit still for long, Jeff then took on a role in International Product Management with a worldwide appointment for another two years, before being drawn back to the big smoke to become Chief Cardiac Clinical Scientific Officer at Harefield Hospital between 1997 and 1999. I remember celebrating the turn of the millennium with fireworks on my village green in Kent aged 7, unaware that a few miles down the road Jeff had just taken on a new role as Chief Clinical Scientific Officer in Cardiac Rhythm Management at Maidstone Hospital. In 2002, Jeff went up North (nearly), to Birmingham where he became Principal Cardiac Physiologist at the University Hospital Birmingham where he stayed for a year before returning to an old haunt The Wellington Hospital as Senior Chief Cardiac Physiologist. Jeff then stepped things up again to become Cardiac Physiology Service Manager at the Royal Brompton in Cardiac Rhythm Management where he worked between January 2004 and March 2008.

In April 2008, Jeff made the move to Guy's & St Thomas' Hospital in London where he would settle into his role as Head of Training and Development for the next fifteen years. Training under the guidance of Jefferey Davison has

become a rite of passage for all trainees that graduate through Tommie's. After such an extensive career, you can only imagine the disappointment when in 2017 Jeff was delivered two very green, if enthusiastic, first-year STP's by the name of myself and Sam Bean who had little-to-no knowledge of cardiac physiology. I still remember performing my first 12 lead ECG on Sam in our first week with Titi (one of the senior cardiographers) and only being able to recognise the signal in Lead I. It was a long road ahead. Fast forward five and a half years, a memorable trip to Krakow, countless exams, and a few pep talks later, Sam and I are still working at Tommie's and I hope we have done him proud. Sam has followed in Jeff's footsteps with Laura Carlisle (also STP) taking on the acting up band 8 role in Training and Development.

Jeff imparted his love for travel onto us early on. Within our first month, we both had BA executive accounts (points mean prizes) and we always had an excellent pick of accommodation in Newcastle for university. Jeff encouraged us to use our elective as an opportunity to see the World and the seven weeks I spent in Nepal in the third year of my STP were some of the best weeks of my life. Jeff has been instrumental in the development of my career, encouraging me to follow the path of echocardiography when I was dead set on going into CRM, a decision which has ultimately paid off and will always be grateful for.

Jeff continues to offer ongoing advice in the present, even when he has, unfortunately, been on site less in recent years due to his health. I think I can speak on behalf of all of the trainees at Tommie's that Jeff has left a lasting impression on their careers. Always with a contact up his sleeve and a smile on his face, his breadth of experience and ability to see the bigger picture is irreplaceable.

Successful SCST exam candidates

Congratulations to all successful candidates who undertook the SCST Certificate in Electrocardiology, Foundation in ECG Interpretation and Diploma in ECG interpretation in November 2022.

The successful candidates are as follows:

SCST Certificate in Electrocardiology

Highest score:
Ewelina Baran (97%)

Jessica Eve Matthews
Ashleigh Megan Beck
Andrew William Webster
Ashleigh Murray Mcwhirter
Hannah Boardman
Ellen Fiona Schadenberg

Joshua Pickles
Lucy Grace Russell
Harriet Hewson
Dean Lobb
Amy May Potter
Ashley Blackford
Amy Elizabeth Kneale
Liam Cowling
Vicki Weeks

Andrew Graham
Isabel Zariah Walker-Crick
Sarah Helen Bonthron
Dilan Patel
Klaudia Murzyn
Danielle Underwood
Holly Mayfield
Beth Weir

SCST Foundation in ECG Interpretation

Highest score:
Lacey Jade Owen (95%)

Sean Michael Nicholas Pallot
Daisy Grace Wilkie
Ella Jade Brennand

Anna Elizabeth Jane Battersby
Gary Peter Simpson
Lindsay Dyan O'Mahoney
Joseph Burt
Alex Panamarenko
Ruth Scott

Lyndsay Walton
Laura Jess
William Davies
Samantha Broughton
Helen Clare May

SCST Diploma in ECG Interpretation

Highest score:
Christopher Alexander Noel Allen
(91%)

Bethany Northeast Jean
Meredith Melissa Jones
Aideen Doherty
Louise Curran
Laura O'Byrne
Benito Gonzales
Benjamin Paul Joseph Barratt

Kerry Wilkinson
Rachel Holland
Ciara Blagbrough
Ahmed Ali Abdalla
Hannah Jane Drinkwater
Samuel Houghton
Naomi Semilore
Stuart Anthony Morgan
Jonathan James Matlin
Katie Jane Gillies
Cathy Johnston

Richard Garvey Walker
Adam Growcott
Eve Holland
John Phillip Quartermain
Luke James Bresnen
David Michael O'Sullivan
Michelle Leigh Collins
Pia Annie Marie Smith
Onyinyechi Orié

SCST courses in 2023

The SCST runs a number of well-respected courses. The details and dates of the courses for 2023 are included below.

ECG courses

Foundation Course

The Foundation Course in Essential ECG Interpretation is a 2-day course that explains how to identify and interpret abnormal ECG patterns commonly encountered in emergency and acute medical settings. It is suitable for any healthcare professionals who want or need to be able to recognise clinically important ECG abnormalities.

The 2-day course will start with basic ECG theory and terminology and go on to define the normal ECG. Teaching will proceed by clinical category, such as tachyarrhythmias, bradyarrhythmias, chest pain syndromes, drug and electrolyte effects, sudden cardiac death/syncope syndromes. Learning will progress by integrating ECG features and clinical presentations in a structured approach to differential diagnosis.

Teaching will finish with discussions of a range of clinical scenarios illustrating many of the abnormal ECG patterns covered.

The complete teaching package will comprise:

- Pre-course reading on ECG theory
- 2 days' teaching in a face-to-face classroom environment
- Copy of all teaching slides
- Workbook of classroom exercises
- Lunch and refreshments are provided over the 2-day course
- Class size is limited to allow individualised support and feedback

Course cost: £395 including lunch and refreshments

Visit the SCST website to obtain the link to the respective Eventbrite pages or scan the relevant QR code to sign up.



SCST Foundation Course in
Essential ECG Interpretation
4th & 5th September 2023
Birmingham



NEW!
SCST Foundation Course in
Essential ECG Interpretation
11th & 12th September 2023
Belfast

Diploma Course

The Diploma preparation course is the professionally recognised course for all those who are reporting on both 12-lead and ambulatory ECGs. It is designed as a preparation course for the Diploma in ECG Interpretation examination but is also suitable for healthcare professionals seeking to advance their ECG interpretation knowledge. Examination for this award is in the form of a 3-hour written paper, which can be taken twice a year in March and October. The course covers the entire syllabus which can be accessed by clicking on the button below. This is a very popular course and delegates are advised to book early to secure a place.

The 3-day course will start with basic ECG theory and terminology and go on to define the normal ECG. Teaching will proceed by clinical category, such as tachyarrhythmias, bradyarrhythmias, chest pain syndromes, drug and electrolyte effects, morphological abnormalities, basic pacing and sudden cardiac death/syncope syndromes. Learning will progress by integrating ECG features and clinical presentations in a structured approach to differential diagnosis.

The complete teaching package will comprise:

- Pre-course reading on ECG theory
- 3 days' interactive tuition in a virtual classroom environment
- Experienced and knowledgeable tutors
- Course manual/revision guide
- Access to online social media support for 1 month after the course

Course cost:

£495 for SCST members

£545 for non-members



SCST Diploma in ECG
Interpretation

11th to 13th September 2023

Virtual

Visit the SCST website to obtain the link to the Eventbrite page or scan the QR code below to sign up. For course booking enquiries, please email: courses@scst.org.uk

The new SCST Cath Lab course

The SCST is pleased to be able to present our brand new cath lab course and training programme – the Interventional Catheter Laboratory Foundation Programme (ICFP).

The ICFP is an exciting new programme, designed after listening to the needs of our members, those who are currently working in physiology, but are looking to progress their career into the cath lab. The programme will give all those who sign-up the knowledge, skills, and most importantly, the experience to begin to excel in the cath lab. To ensure this the programme is formed of two parts:

1. **Course:** A comprehensive course covering everything you need to know to succeed, from haemodynamics and core physiology, to radiography and access techniques. You'll be on the way to the most knowledgeable person in the room
2. **Examination:** An exam, to unequivocally prove your comprehensive knowledge, supplemented with a logbook, ensuring you get into the cath lab to get exposure you need to begin to grow your skills

Online Course coming Autumn 2023 following our pilot! Further information to follow.

SCST Equivalence Sessions: upcoming dates

The SCST Equivalence sessions are panelled by three members of the council that have been through the STP equivalence process themselves with guest speakers from the AHCS to other Clinical Scientists. They occur monthly on a Wednesday evening for one and a half hours, on a six-month rotation. The remaining sessions will concentrate on one of the five domains per month, with a chance for questions and discussion with the panel and other attendees.

Visit the SCST website to sign up.

Heather Herbert
SCST Council - Treasurer

June 21st: Professional Practice
July 19th: Scientific Practice
September 20th: Clinical Practice
October 18th: Research & Development
November 15th: Clinical Leadership

SCST 2023 NUM Awards

Ahead of the SCST NUM this autumn we will be building on previous years' success and celebrating the workforce's outstanding contribution over the last 18 months. SCST invites you to nominate colleagues that you think should be recognised within our profession.

Rising Star Award

A staff member or colleague who has recently qualified or is undertaking an Apprenticeship, PTP or STP qualification and shows great insight and innovation in the role. The actions of this colleague will likely offer better diagnostic service within the workforce and/or their approach to their job will allow for better patient care.

Patient Care Award of Excellence

A staff member or colleague who proactively offers exceptional patient care on a daily. Going above and beyond in a pursuit that offers excellent patient care.

Innovators Prize for Transformation

A staff member or colleague who has proactively created transformational change in a service or department. This change has led to either financial savings, time savings or resulted in a better diagnostic provision allowing better patient flow.

Unsung Hero Award

A staff member or colleague who has made a real difference to their team department or patients. A colleague who is a proactive team member and completes their role in the betterment of their department without requesting acknowledgement or dispensation for what they do on a daily basis.

The Dave Richley Award for Outstanding Education

A staff member, colleague(s) or team who have proactively pushed education forward in their trust or the wider department team. Raising standards and the profile of the Cardiac workforce on the whole.

There are also four closed awards that you or a member of your team may be eligible for. The receiver of these will be decided by the SCST council -

Diploma achiever of the year
Certificate achiever of the year
Foundation achiever of the year
Lifetime achievement award

If you wish to nominate a member of your team or yourself for one of these prestigious awards you can access the application form via the SCST webpage or complete the Google Form via the QR code below. Nominations will close on 15/09/2023 at midnight, so be sure to get your nominations in on time.



SCST membership

The SCST has a number of different memberships available which can be found below. For more information please contact the SCST Membership Coordinator, Valérie Honoré, who can be reached at: membership@scst.org.uk and 020 7380 1934.

Joint with BCS [UPDATED!] - £110/year

BCS have recently voted through new rules at their AGM meaning

- Joint SCST-BCS members are eligible to stand for BCS committee and have BCS voting rights
- Joint SCST-BCS members are not able to chair a committee or stand for executive positions at BCS
- Please contact the SCST/BSA membership co-ordinator to apply

Assistant/Associate Member - £45/year

- Cardiographer
- Assistant Healthcare Science Practitioner (Cardiology)
- Associate Healthcare Science Practitioner (Cardiology)

Ordinary Member - £50/year

- Cardiac Physiologist
- Clinical Scientist (Cardiology)
- Healthcare Science Practitioner (Cardiac Physiology)
- Academic within Healthcare Science (Cardiology)

Affiliate (Paid) - £40/year

- Any individual whose job title or academic role is not listed in the other membership member criteria e.g. (list not exhaustive):
 - STP student
 - Paramedic, manufacturing industry, nurse
 - Student cardiographer
 - International

Affiliate (Unpaid) - £0/year

- Currently enrolled on Practitioner Training Programme (Cardiology/Respiratory)
- Proof of enrolment may be required

Fellow - £50/year

- Awarded by SCST (on application or through nomination) in recognition of achievement and contribution to the profession.
- It is for those who demonstrate a commitment to advancing standards, strategic leadership and best practice.



SCST