



Imperial ENGINEER

MIRACLE MILE

ANNUAL DINNERS

BOTTLE MATCH 2022

DOLOMITES EXPEDITION

RSMA 100 CLUB BURSARIES

WHAT BIOLOGY TEACHES ENGINEERING

For members of City & Guilds College Association
and The Royal School of Mines Association

ISSUE 36 *SPRING 2022*

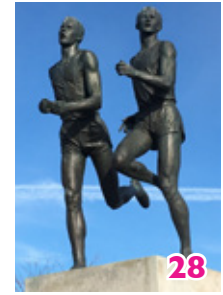
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Front cover image
CGCU Welcome dinner
at The Guildhall
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© Hayley Wong

Back cover image
Marmolada early morning
(see page 17)
© Tristan Dell

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Welcome to the Spring 2022 edition of Imperial Engineer magazine.

This will be my last update as your President. Most of my two-year tenure was overseeing CGCA activity during lockdown. Despite these challenging circumstances, we have made great progress in transforming the Association.

Membership is rising and stands at 3,500 throughout the world. Most new joiners are students and younger graduates. Those who attended the recent Annual Dinner at Ironmongers Hall and the Decade Reunion event at the Polish Club would have been impressed with the energy and enthusiasm of our diverse membership. Over the years, CGCA has built a good relationship with the Faculty of Engineering. As you know, the Faculty has performed remarkably well in what has been difficult circumstances. We are proud of its achievements, academic success and student engagement in such challenging times.

Our primary focus remains the welfare of our members and students. Alongside the College, we are committed to helping those students facing adversity, particularly those impacted by the war in Ukraine. As we emerge from the pandemic, the Trustees of the Old Centralians Trust are working with the Faculty to alleviate student hardship, and providing support.

I leave our 125-year old Association in a good place. We now have some important foundations in place, and it will be for my successor(s) to deliver on the rest of the programme we have started.

It has been a pleasure and privilege to be President of CGCA.

Thank you.



**Atula
Abeysekera**

PRESIDENTS REPORT



**Tim
Cotton**

2022 could finally be the year of renewal for all of us and whilst it has been a particularly hard year for students who have not been able to enjoy normal college life with all of the usual lectures, field trips, social and sporting events and interactions, we have definitely turned a corner in coping with the pandemic. So, thinking positively, here are a number of upcoming events for your calendars:

There is going to be a summer *Bottle Match Sporting Weekend* 10-11 June 2022, in London. This is to allow the 2021 Bottle Matches to be played and hopefully we will see better success on home turf. February 25th and 26th 2022 saw RSM lose the Bottle Match (10pts to 17) but regain the Sharpley Cup in Men's Hockey. Men's Badminton was the only other win that weekend with the other 6 games in hockey, badminton, football, tennis, squash and netball all going to CSM.

Planning is under way for the 2022 *Annual General Meeting* and the *Summer BBQ for Final Year Students!* These will both be occurring on Thursday June 30th, the day before the last day of term, at the Union Bar in Beit Quad. In addition, a date has been booked at the Rembrandt Hotel, South Kensington for the *137th Annual Dinner* for Friday November 25th 2022.

Following the recent successes of the annual RSMU/RSMA careers event, on March 16 2022 the committee once again supported the students' careers evening. It was organised by the current RSMU Hon Sec Tom Burns and was an interesting and engaging event.

The committee continues to maintain a very active relationship with the RSMU and key societies within the RSM such as Geology, MatSoc and GeoPhysicsSoc. All of them are Represented on the RSMA Committee meetings and the RSMA provides financial support where needed. These Clubs and Societies are the life-blood of the RSM and it is very pleasing to report that these organisations managed to maintain a very active schedule of virtual events throughout the year. As mentioned earlier, all organisations enjoy, and want more, interaction with the wider alumni group. This year the Committee is looking at increasing the exposure and promotion of the RSMA within the RSM student body. This includes financial sponsorship of the RSM Union General Awards, attendance at RSMU events and ensuring that RSMA promotional items outlining the role of the RSMA are prominently displayed at each event.

In the 2021 Autumn term, the RSMA Trust awarded five £1000 bursaries to final year students. All of this year's winners, as well as those from past years, are a shining example of students who have demonstrated true RSM spirit and uphold the values of the RSM by giving comradeship, help and advice. This is now the fourth year running that the Bursaries have been awarded and 16 students have benefitted from the tremendous generosity of RSMA members. This year, the selection committee had 9 worthy applicants from across the RSM. This is a significant example of how you are directly supporting students at the RSM. Remember ALL the funds for this Bursary have been raised by YOU through your kind generosity at events and specifically by those members who have supported the 100 Club. This is an amazing achievement and is a concrete example of former students of the RSM who want to give back to the current student body. Lastly, the 100 Club, this is slowly growing and I would encourage you, if you are able, to sign up and support the RSMA via the 100 Club or by a one-off donation. The Committee has recently setup different ways to allow members to support the 100 Club, for example offering a monthly direct debit to spread the cost. Read on page 8 a piece from the five new RSMA Final Year Bursars and how you can sign up and keep helping the RSM students.

I hope you find this issue informative and I look forward to seeing some of you in the RSM and /or at an RSMA event in the near future. Lastly, many thanks for your support, it is truly appreciated. The RSMA is always looking to attract more Committee members so if you can spare a few hours every couple of months please do get in touch. Remember you can all still use the email address rsm@imperial.ac.uk to contact the RSMA at any time. Please send us your news and we will look to share it with the wider RSM Community.

DIARY

As a result of the still ongoing worldwide COVID-19 pandemic, events in many locations have been cancelled or converted to virtual events. Local restrictions are varied, therefore, before considering attending any event, please contact the organisers to check whether the event is still taking place.

RSMA Toronto, Canada

Informal RSM meeting

Last Friday of every month, noon.
Jason George Pub, 100 Front Street East, Toronto
Contact: rsma.1851@gmail.com

RSMA Perth, Australia

Monthly Sundowner

First Friday of every month.
The Celtic Club, 48 Ord St, West Perth, WA, 6005
Contact:
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Imperial Alumni, Houston, US

Alumni social

Third Thursday of every month, 6pm
Capital Grille, 840 West Main Houston Pkwy N, Houston, TX 77024
Contact: Matt Bell – matt@in2oilandgas.com

Imperial Engineering Alumni, Johannesburg, South Africa

Quarterly Johannesburg Lunch
(17th Nov, 16th Feb, 18th May)
Baron & Quail, Woodmead, Johannesburg, South Africa
Contact: Richard Gundersen – Gundersen@yabo.co.za

CGCA

AGM & Presidents' Evening

Monday, 6th Jun 2022, 17:30 for 18:00
Venue TBC, Imperial College, South Kensington

RSMA

AGM & Summer BBQ for Final Year Students

Friday, 30th Jun 2022
Union Bar, Beit Quad

Engineering Alumni

Traditional Reunion Luncheon

For engineers who graduated in a year ending in a '2' or a '7' – C&G and RSM graduates all welcome.
Saturday, 19th Nov 2022, 12:30 for 13:00
Polish Club, 55 Prince's Gate, Exhibition Road, South Kensington
Booking form enclosed with this issue

RSMA

136th Annual Dinner

Friday, 25th Nov 2022
Rembrandt Hotel, South Kensington SW7 2RS

An up-to-date calendar of events of interest to CGCA and RSMA members is always available on the CGCA and RSMA websites. Imperial College maintains a calendar of college events at bit.ly/IE-WhatsOn and the Friends of Imperial College regularly organise events of interest to alumni (see bit.ly/IE-FOI)

Please note that while many of these events are open to all and often free, they usually require registration in advance. Please follow the links in the entry to get more information including if and how to register and whether there is any cost.

For more information follow links, or see page 2 for contact details

Update from OC Trust Chair

After a slow 2021, the Trust is seeing an increased number of foreign travel requests from postgraduate students who have been invited to present the output of their research at international conferences. This is very gratifying to see, and affords the students concerned a taste of mixing in circles at the top of their chosen discipline, usually in some rather nice places (Hawaii, Japan, Switzerland etc.). The Trust offers financial support which typically takes the student some way towards covering their expenses without making life too easy for them – £400 is awarded for a European event or £600 for places further afield.

We have also recently awarded funds to an intrepid pair of skiers who will be tackling the northern extremities of Scandinavia, and also two enterprising cyclists who will be taking a year to pedal from Paris to Singapore in aid of a French children's hospital. One of the charity's board members will be assisting the latter with advice on videography along the way (from their sitting room rather than an accompanying support vehicle!).

Postgraduate travel and expeditionary exploits are two of the ways in which past alumni donations and bequests are broadening the horizons of some of today's

students. Awards for entrepreneurial behaviour at College and student union commitment are two others. These, plus support of students in hardship, are all ways in which our collective forebears' money is put to good use by the Trust.

If you'd like to consider making your own contribution, please visit the CGCA website, hover over 'OC Trust' and pick 'Help the Trust' to find out more. Latest reports of funded student exploits can be found under the adjacent option 'Activity Reports'.

Thank you!

OC Trust Reception for Senior Staff

The Old Centralians' Trust relies on the input and coordination of staff at Imperial throughout the year. Staff nominate students for the Trust's Student Activity Awards, which reward extra-curricular activity and going 'above and beyond' for fellow students. When there are cases of hardship, these are also handled first and foremost by College staff members, with the Trust then very much being a complement to other forms of support.

We were therefore delighted, for the first time since 2019, to hold our annual reception for senior staff at the Polish Club on Tuesday 22nd March. Invitees included department heads, senior tutors, Student Wellbeing Advisers and members

of Dr Lorraine Craig's team who do so much to advance student welfare across the Faculty of Engineering. We were also able to welcome Professor Ian Walmsley FRS, Provost of Imperial, and ICU President, Lloyd James.

Members of the Trust Board, who had held a Committee meeting earlier in the afternoon, were accompanied by seven students who have all benefited from Trust awards. Allowing staff to hear directly from students how the Trust had helped them was a powerful way to communicate our value. Tristan Dell and James Foote had received support for their mountaineering trip to the Dolomites in September 2021 (see page 17 in this magazine);

Christy Chan and Chloe Lau had both received Student Activity Awards; Hayley Wong, Leah Redmond and Kia Popat are all CGCU Exec members benefiting from John Elliott Bursaries, which help support them with the extra costs of their commitments as Union officers.

Useful and convivial conversations were had by all, and yours truly gave a short address about the challenges faced through the pandemic and the potential hardship cases yet to come, due to the war in Ukraine.

As ever, the Trust welcomes support in the form of donations or even bequests from CGCA members. Please consult the 'OC Trust' section of the CGCA website for more information about how to do so.

Peter Chase
OC Trust Chair

CGCA AGM 2022

The City & Guilds College Association Annual General Meeting, AGM, will take place on Monday, 6th June, starting at 17:30. For the first time in the last 3 years, it will have a 'physical' part in a venue on or near the South Kensington campus. A ZOOM session will also be available for those members unable to be in London.

This year will see Professor Atula Abeysekera step down after two years as President, and Professor Anil Bharath take over. The 2021 accounts will be presented for approval, and there will be an election for Association officers for the 2022 – 23 academic year. If you wish to be a candidate for a role on the Committee, please contact me.

In addition, we hope to nominate a new Senior Vice President and present a revision to the Articles of Association on CGCA Limited, including a new Committee structure and a new Director role.

Following the AGM, Anil will make a presentation to introduce himself to the Association.



Incoming CGCA President
Professor Anil Bharath

2022 also sees the reinstatement of the President's Evening, the social evening that traditionally follows the AGM but has not been held since the start of the pandemic. On this occasion, however it will be Presidents' and not President's as, in his two years at the helm, Atula has not had the opportunity to host an evening. Details of tickets and how to book a place will be released shortly.

For confirmation of the arrangements, and papers for the meeting, please see our website or social media closer to the date.

Nigel Cresswell
CGCA, Hon Sec



Outgoing CGCA President
Professor Atula Abeysekera
with Boanerges at Guildhall

CGCU WELCOME DINNER AT THE GUILDHALL

On the 30th October 2021, a first was created for the City & Guilds College Union

For the first time in the CGCU's 123 years history, its biggest student event of the year – the CGCU Annual Engineering Welcome Dinner – was held in the Guildhall. This Grade I listed building has major historical significance to the union, both having their roots traced back to the City Corporation. It was only suitable that the return of the CGCU's flagship event, post-COVID restrictions, take place there.

Not only was the site extraordinary, the catering was done by none other than Mosimann's, the Royal Warrant Holder that catered for the weddings of William & Kate, Harry & Meghan, the Queen's Golden Jubilee Luncheon, the Olympics, and many more impressive events.

The largest CGCU dinners in previous years hosted 230 guests. However, this year it was decided that it was important to celebrate the return to in-person events with as wide an audience as possible; thus the event capacity was doubled to 500 guests. Owing to the wow factors of the event, 500 tickets were sold out within mere seconds, with the early bird batch selling in less than half a second.

After more than two months of preparations, 500 guests dressed in black tie suits and dresses poured into the quad of the historic site. Unfortunately, they were not allowed to enter through the main door as that is reserved for the Queen herself. Going through security at the east entrance, they were greeted to the magnificent Guildhall Art Gallery and Roman Amphitheatre on their way to the cloakroom. Guests then made their way down to the Crypts for a drinks reception. Its lower-hanging, stone arch ceiling made for an unusual backdrop to the conversations. After around an hour and a half of mingling, the main entrance to the Great Hall was finally opened,

revealing a darkened, cathedral-like hall with pillars of light flooding up to the 27m high ceiling. It was at this point that many guests commented on its similarity to the Hogwarts great hall. CGCU's century-old mascots, Spanner and Bolt, greeted the guests at the entrance as they entered.

Four tables sat atop the raised stage at the very front of the hall, where the honoured guests' seats were allocated. Soon after, 50 waiters snaked their ways through the innumerable round tables, delivering the first out of the three courses of the night along with Mosimann's own wine. This was accompanied by trendy performances by the band, Candy's Room.

The main course was ended with speeches from the CGCA President Atula Abeysekera, the Chair of the



Spanner and Bolt greeted guests as they entered the Great Hall

Old Centralian's Trust, Peter Chase, and finally, the CGCU President, Hayley Wong.

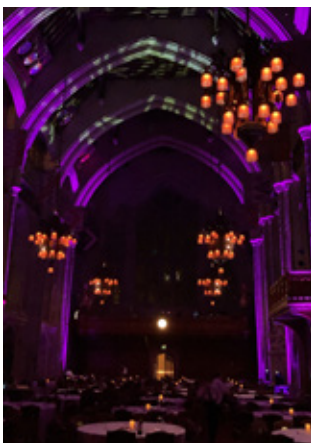
Several incredible performances by the Techtonics – an acapella group that has previously won the World Championship – marked the conclusion of the lavish part of the evening in a shower of applause.

Finally, with the assistance of Bo and Clem – the CGCU and RSMU's vintage car mascots, the guests headed to a nearby bar to continue the unforgettable night.

As the biggest event the CGCU has ever held, there was no better way to return from the pandemic with a bang.



CGCU Committee & Bo Committee. [L to R] Will Carter - Secretary, Chloe Lau - Communication Chair, Selina Lee - Clubs & Societies Chair, Asia Gosieniecka - Activities Chair, Isabella Breslin - Bolt Bearer, Leah Redmond - Alumni Officer, Aya Rahmayanti - Events Officer, James White - Education Chair, Hayley Wong - President, Tiffany Lim - Spanner Bearer, Kia Popat - Vice President, (front) Reia Xu - Media & Marketing Officer, (back) Jeffrey Chong - Clubs & Societies Officer, Andrew Beggs - Bo' Driver, Allan Lee - Treasurer, Joao Costa - Guildsheet Editor, Ben Stevens - Derrick Rider, Naveen Joseph - Sports Officer, Aurno Maitra - Wellbeing Chair



CGCA ANNUAL DINNER BACK ON TRACK

After missing out in 2021 because of Covid-19 restrictions, members and their guests gathered together on the evening of 25 February 2022, at Ironmongers' Hall, for the 108th annual dinner of the Association. Dinner Organiser Colin J Kerr tells us how it went, illustrated with photos by Yifeng Zhang.

Perhaps in response to the limit on social activities during the pandemic lockdown, there was an excellent turnout. A total of 146 had registered, but we did lose a few to illness on the night, making a total of 142 attendees, the biggest turnout since the centenary dinner, held at the Mansion House in 2013. There was a particularly strong turnout from students and younger members, though some of the regular senior attendees were not able to be present for health reasons, feeling that they would prefer to give the pandemic a little longer to abate before returning to the hurly burly of social life.

Boanerges was present, eventually, but the journey to the Hall was not without incident; Bo' just about made it. It was a bit touch and go whether Bo' would actually start at all, but Andrew Beggs and his team drove all but the last half mile before a cylinder collapsed. The two passengers, our principal speaker and his wife, completed the journey to the Hall in a team member's car.

Bo' had to be towed the last half mile. The collapsed cylinder needed to be fixed after the dinner before Bo' could be driven back to South Kensington. Despite all the chaos and confusion, the guests, Sir Jim McDonald and his wife Lady Eileen, really enjoyed the journey and there were smiles all round between the passengers and the driving team.



Sir Jim McDonald, Principal and Vice Chancellor of Strathclyde University and President of the Royal Academy of Engineering, spoke about the future of Engineering, making particular reference to energy and the need to transform from fossil fuels to alternatives. He referred to the recent COP 26 in Glasgow, which he had attended, stressing the role of Engineers, as professionals used to dealing with problems, in bringing about change. The current climate crisis underlines the urgent need for them to inform debate and provide solutions which, in addition to technical advances, must incorporate sustainability, responsibility and social justice.

He believed that the outcomes of COP 26 gave some grounds for optimism. For example, there had been some progress on forests, methane and coal, and CEOs from many major companies had been present, perhaps indicating the beginning of enlightened self-interest. The switch to electrical power was, he believed, both necessary and possible. Some new tools were showing good progress, including the subsea grid off Scotland, wind energy fabrication, remote monitoring, AI, etc, but the challenge remained enormous and it remained vitally important to go beyond mere words. In this respect, he stressed the role of young Engineers in bringing about change, urging them not to compromise the future, to get active, to challenge authority from a strong position of knowing what they are talking about, and above all, to keep holding politicians to account.



Professor Nigel Brandon, Dean of the Faculty of Engineering



Past and current CGCU exec with Spanner and Bolt



CGCA President Atula Abeysekera welcomed guests



What (or who) surprised Past CGCA President Roger Venables?



[Above] Colin Kerr also looking surprised. What had Atula said? [Right] Colin was congratulated on organising a superb dinner.



**Past CGCU Presidents,
Tim Munday (2014-15),
Claudia Caravello (2017-18),
Andrew Hill (2018-19)**



**CGCU President Hayley Wong, with Spanner bearer
Tiffany Lim and Bolt bearer Isabella Breslin, led the Boomalaka**



**OC Trust Chair Peter Chase
shares a drink with Will Dubin**



The staff at Ironmongers' Hall looked after us very well, providing an excellent menu and a superb venue. Our wine cellar proved up to the task, with claret and port accompanying the food, with the Wine Society providing sparkling wine and a very good pinot blanc from Alsace. Feedback from members and their guests proved very positive and everyone seems to be looking forward to next year's event already.



**Colin Kerr and John Sharp
resort to Rock-Paper-Scissors
for the use of a comfy chair?**

In the absence of the 2021 dinner, we invited student prize winners from last year, making the student awards section quite an event. We also invited the current and immediate past winner of the FCGI Centenary Award, since they also missed out on their presentation, which normally takes place at the annual FCGI lunch, which had also been disrupted by Covid in recent times. The prize winners are listed below.

Holbein Memorial Award, for the student deemed the "Sportsperson of the Year" in the widest sense of the word, during the past academic year:

2019-20: Mr William Draper-Barr, Department of Mechanical Engineering

2020-21: Ms Christy Chan, Department of Electrical and Electronic Engineering

Peter Moore Memorial Award, for the current Boanerges Driver

2020-21: Mr Peter Torok, Department of Mechanical Engineering

2021-22: Mr Andrew Beggs, Department of Computing

John and Frances Jones Prize, for the postgraduate student (taught or research) who has made the best all round contribution to College life in the past academic year.

2020-21: Ms Milia Hasbani, Dept of Bioengineering

2019-20: Ms Julia Sun, Dept of Bioengineering, who won the prize in 2019-20, received a special commendation though she was unable to be present, due to being at UCLA in California, studying for a medical degree.

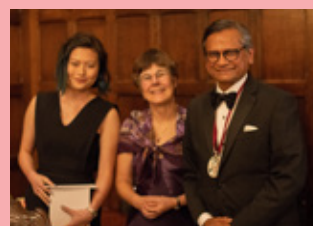
The FCGI Centenary Award, established by the Fellows of the City and Guilds of London Institute to commemorate the centenary of Imperial College, awarded to the student who has made the best all-round contribution to the activities of the CGCU during the past year.

2020: Ms Leah Redmond, Department of Bioengineering

2021: Mr Will Dubin, Department of Civil and Environmental Engineering



William Draper-Barr



Christy Chan



Peter Torok



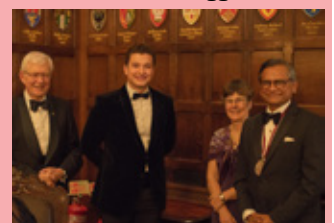
Milia Hasbani



Andrew Beggs



Leah Redmond



Will Dubin

RSMA Trust 100 Club

Final Year Bursary enters its 4th Year

The Club continues to be a success and thanks to the generosity of the 100 Club members, over £36,000 has been raised to date, which has allowed 5 bursaries each of £1000 to be awarded in 2021. Just as importantly, the 100 Club fund also allows the RSMA Trust more scope to award students who may be disadvantaged, either financially or in other ways and this is done in conjunction with the respective departmental undergraduate directors.

With the world slowly moving to living with Covid, the hardship category will likely take a new dimension and more students, due to family circumstances or other, are feeling the strain. With the build up of the fund, we are now in a position to look at increasing the scope of

hardship awards to better support this category. In conjunction with the RSMA Trust and college staff we will still look to assisting with sponsorship for college-approved field trips and activities. Remember, the 100 Club does not sponsor RSMU sporting or social activities – those sponsorships

are solely in the domain of the RSMA.

Below are 5 messages, one from each of the 2021 winners. These are a wonderful testimony to the Club's objectives and we ask that you please consider supporting your college, the Royal School of Mines. This is a great opportunity to give back to

the Royal School of Mines, of which we all have many fond memories, and to positively support today's generation of students. Let us not leave the support to the hard-core few. So if you can commit, in any way, it would be very much appreciated by the students, staff and the RSMA.

Jessica Dring Morris



Hi! I'm Jessica, a final year MEng Material Science and Engineering student. From RSM Netball Captain in my 2nd year, to Vice President of the RSM in my 3rd and now as the

Materials Society President, the RSM has always been a core part of my university life! Being awarded the RSMA bursary prize this year has been a great honour. It has not only financially supported me, but the recognition for my contributions to the RSM community has meant a great deal to me. The award has given me the freedom to enjoy my final year, as well as giving me more time to focus on the Materials Society and on my MEng project.

This year, as Materials Society President, I have focused on increasing diversity and inclusion as well as strengthening our ties with industry partners. Having successfully signed two new sponsors, as well as introducing events for Chinese New Year's and Diwali, the society is as strong as ever. This term we

have invited speakers from various industries to speak at our popular lunch time lecture series and have plans to visit Diamond Light Source and TWI in the second half of this term. Without the support of the RSMA bursary, I wouldn't have been able to dedicate as much time as I currently do to the Materials Society, mainly from a financial perspective. The award has provided me with enough support to cut down my working hours and focus more time on the RSM and Materials Society.

Academically, this year my focus has been on my MEng project titled: *The Characterisation of London Underground Pollution*. The aim of the project has been to identify the key elements present in Underground Pollution, as well as assessing their toxicity and

composition to create a model which could be used to predict the toxicity on all lines. I have loved being part of a research group and in particularly seeing how the work I am doing is helping the group in their wider research into air quality in London. I hope to use the skills and experiences I have gained from this project to head into the technology industry, with a particular focus on research and data modelling.

Looking back at my four years at Imperial, I am very grateful for all the opportunities the RSM has given me, and in particular for all the great people it has allowed me to meet. With this in mind, I want to say a huge thank you to the RSMA for their support in my final year – I hope to remain involved in the RSMA for many years to come!

George Morgan



First and foremost, I'd like to thank the Royal School of Mines Association for this extremely generous bursary prize, the 2021 Royal School of Mines Association Final Year Student Bursary Prize. I was delighted to hear the news that I had been granted this award, and I am extremely grateful. The prize is a great opportunity for students of

the RSM!

Being a student at Imperial promises to be an extremely active experience. A lot is expected of students, and we are always being given opportunities to learn and expand our subject knowledge. Adding the wealth of extra-curricular activities that are available at Imperial, students can experience a whole new university experience. Firstly, pure enjoyment and satisfaction that we can study at one of the world's best universities in our chosen area of study. But also be able to thoroughly enjoy ourselves outside of the lecture theatre, all in the best city in the world. Moreover, students within the RSM are continuously proactive within their course in addition to partaking in numerous extra-curricular activities. This combination is an opportunity that should not be turned down, and is one that this great bursary prize encourages and makes more comfortable!

During my time at Imperial and the RSM, I have had a fantastic experience partaking in extra-curricular activities. I think this was initiated in my first year, playing rugby for the university rugby team and winning my first Bottle Match. The game finished 15-5 to the RSM and was a fantastic experience that encapsulated the community of the RSM. My second and third year involved taking up the roles of Year Academic Representative of my course and Vice President of my course society, MatSoc. The former was an extremely rewarding role, requiring me to feedback information to and from students and teaching staff, and the latter gave me the opportunity to host the annual careers fair, in addition to running the 20-week lunchtime lecture programme – which ran online that year for the first time, given the circumstances. Finally, my final and fourth year at Imperial has been the busiest of all! Engaging with my course and my final year

MEng project, alongside applying to postgraduate opportunities, I have continued to enjoy these plentiful opportunities. Being the Vice President (Education) of the RSM requires me to ensure students of both departments (Earth Science and Engineering and Materials) are enjoying their academic experience, a role that intertwines quite nicely with being the Departmental Academic Representative for my department. These two roles have mainly involved ensuring the transition to this new 'hybrid' way of studying is smooth and beneficial for learning. Playing rugby has provided an intense season for the 1st XV, winning the league, and being promoted into the next division has been an extremely rewarding finish to my time playing at Imperial, in addition to my role as Honorary Secretary. As I write this, I look forward to travelling down to Cornwall to play in my third Bottle Match!

Teigan Collins



I am currently a 4th Year Geologist, having just completed my MSci project, titled '*Sedimentary Characterisation of Turbid Reefs*

using a Novel Artificial Intelligence based Approach' in collaboration with the Natural History Museum. I have thoroughly enjoyed my time in the RSM, having been heavily involved in all aspects of its activities and events, in both attendance and organisation.

Socially, I am a very involved member of the RSM, for example sports clubs such as Tennis, Netball and Hockey, representing the RSM at Bottle Match, as well as an avid attendee of the many dinners and events the RSMU has to offer. I have also been grateful to hold many volunteer leadership positions over the past few years. In my second year, I was elected Geology Society fieldtrip officer and since then have further held positions as Honorary Secretary of the RSMU, Industrial

Liaison Officer of the Geology Society of which this year I am lucky enough to hold the role of President, alongside remaining on the RSMU executive committee as Ordinary Member. I have also been involved in the representation network within the department, allowing me to really involve myself in both the student and staff bodies within the department.

I am very proud to have been involved in the Geology Society committee for three years. So far, this academic year we have run a successful two-night trip to the Mendip Hills, introducing 45, largely first and second year, students to the society and have exciting plans for our annual Symposium, '*Planetary Process: Earth and Beyond*' well under way.

I was greatly appreciative for receipt of the RSMA 100 Club Bursary, as it allowed me to attend Reef Conservation UK, in Edinburgh November 2021 to present preliminary findings from my MSci Thesis, helping cover the cost of both travel and accommodation which I would not have been able to cover otherwise. Not only this, it was a great recognition of my contribution to the RSMU. The RSMU and its community has been an integral part of my degree and the bursary will allow me to continue to be a part of this throughout my final year of studies, whilst encouraging me to remain a part of the RSMA for many years to come. I remain very grateful to the RSMA for their generosity and support, thank you.

James Wood



I'm James, a final-year MSci Geology Student and recipient of a RSMA 100 Club Bursary Prize for this academic year. Over the four years of my degree, the RSM has felt like home and the people of the

RSMU have felt like family. Although nearly two years of my degree have been hampered by lockdowns, isolations, and remote teaching, the RSM Community of students, staff and alumni have made the entire experience so positive. As such, I have tried, wherever I can, to help give back to the RSM and spend time continuing the many wonderful traditions we have and improving the experience of other students.

During my time in the RSM, I have been involved in many aspects of student leadership, from societies to student representation. Most recently, I have been the Academic Departmental Representative for ESE for the past two years, acting as the students' voice in meetings with staff in the department to ensure that decisions made affecting our degrees (of which there were a

lot over the pandemic, as I'm sure you can imagine!) were made with proper consultation with students and that equally the point of view of the staff was communicated effectively to students to ensure equitable solutions were arrived at. This has been a challenging but rewarding experience that has hopefully made a meaningful impact to the education of ESE students.

I have also been involved in the incredible student societies of the RSMU with a position on the Committee of IC Geology Society for the past three years and membership of RSM Hockey since the start of my time at Imperial. I've also tried to add to the societies of the RSMU by founding RSM Tennis as a brand-new official ICU sports club, following a few informal sessions we ran the previous year prior to the Bottle Match. While

the club is still in its infancy due to pandemic-related setbacks, it is now on its way to being an established part of the RSMU to provide yet more activities to our students.

Receiving the 100 Club Bursary Prize has helped a huge amount this year. Not only has it provided financial assistance to purchase better technology for remote learning (laptop/monitor etc.), but it has also given me a great sense of fulfilment to know that the work I've put in to try and make students' time here more successful and enjoyable has been recognised. The RSMA have been a brilliant supporting force to me through opportunities, advice and socialisation and I hope to keep in touch with those of you I have met and meet those of you that I haven't in the future.

Jasmine Hedra Crocker



I am delighted to be a recipient of a RSMA 100 Club Bursary Prize and am very grateful to the Committee for recognising my dedication to our RSM community. This comes after being an active member of the RSMU since I arrived at Imperial in 2018 and sitting on the committee for 3 years. In the past 2

years my responsibilities within the RSMU have increased dramatically following 2 successful campaigns for presidency in 2020 and 2021. Alongside student representation, I have truly enjoyed playing for RSM Tennis and Netball at Bottle Match plus contributing to the organisation of two RSM-CSM varsities in 2022. The RSM has now formed such a massive part of my life, which is incredibly rewarding but time-consuming all the same. The £1000 bursary prize has enabled me to continue dedicating as much time and energy to my involvement in the RSMU and less on an alternate source of income to fund a student lifestyle in London. Therefore, I have been able to continue acting on my goals as RSMU President in my final year by advocating for our students at a variety of levels in college plus supporting our other 20+ committee members, 3 departmental societies and 5 highly active sports clubs. I am sure I

wouldn't have been able to dedicate as much time to these tasks and contributing to the re-emergence of the union from a Covid-19 lull without the funds from the RSMA.

Unfortunately, the UK isn't well known for its volcanic peaks and calderas. Therefore, international fieldtrips are necessary for an aspiring volcanologist like myself to experience studying features up close. I will also use the bursary to subsidise and reduce the financial burden of two upcoming opportunities. The first will be attendance at the International Association of Volcanology and Chemistry of Earth's Interior (IAVCEI) 3-day workshop in El Hierro, marking just over 35 years since a significant submarine eruption in the Canary Islands. Travel and accommodation costs for this fieldtrip will be greatly reduced and I will be able to network with geologists from all over Europe. The second opportunity will be to finally

ascend to the summit of Mount Etna, in Italy. Although my Masters thesis on '*2021 Paroxysmal Events of Etna: Pre-eruptive Magmatic Conditions and Timescales*' is complete, I have a firm desire to visit the volcano. I wished to collect my own samples from Etna prior to my research in the Natural History Museum, however Covid-19 affected my ability to do this.

Words cannot describe how grateful I am to the RSMU community for making my university experience how it has been. But the RSMU would not be where it is without our alumni. The RSMA are such a valuable group of like-minded people who clearly wish the RSMU the very best and offer both financial help and wisdom generously. On behalf of the RSMU and on a personal note following receipt of the bursary, I must express massive thanks to the RSMA and 100 Club.



Tim Cotton (RSMA President), with bursary recipients Jasmine Hedra Crocker, James Wood, Teigan Collins, George Morgan, Jessica Dring Morris, and Heads of Department Prof Peter Haynes (Materials) and Prof Tina van De Flierdt (ESE)

RSMA Annual Dinner November 2021

After a year's hiatus due to the Covid 19 pandemic, the Association was able to hold the 136th annual dinner on Friday 26th November 2021 at the Rembrandt Hotel in Knightsbridge. It was a great success!

This year saw the Committee joined by 132 members and guests, of whom 62 were current RSMU students. This was an extraordinary turn out, in part as a result of the RSMA and the RSMU looking to invite as many students as possible because many had missed their own Fresher's Dinner and Spring Awards Dinner due to pandemic restrictions and field work. As is always the case, the members of the RSMA were extremely generous and sponsored three quarters of the students attending. After a welcome drink or two, all the guests sat down for a traditional festive dinner of a smoked salmon and prawn cocktail, turkey (with all the trimmings) and a white chocolate dessert. Entertainment was provided by James (Jim) Rutherford – Non Executive Chairman Centamin plc who gave a thoughtful and provocative speech on the need of ESG (Environmental, Social and Governance) to be an integral part of any company's DNA in order to be successful.

The Association was pleased to be able to present in person the

two RSMA awards announced at the June AGM. The Peter Harding Memorial Award was presented to Fiona Cassidy for her tireless support of the RSM, RSMA and RSMA Trust. Fiona was on hand to receive her award and also give out the RSMA Trust Essay Prize to Disha Bandyopadhyay. Her essay, entitled *The Invisible Matter: Nanomaterials*, was also published in the last issue of Imperial ENGINEER (IE35, pp24-26). The Prof Rees Rawlings Award was not awarded in 2021.

To close out the awards, the third winner of the 100 Club Draw was conducted and this went to Paul Atherley who was in attendance and very graciously re-donated the prize back to the Fund. The support of the 100 Club members cannot be overstated as they have allowed the Association to be able to award five £1000 bursaries to penultimate year students to assist them in completing their final years at RSM. See the article on page 8 of this magazine describing these five bursars.

Samuel Casement, a new RSMA

Committee member, gave a toast to the guests and added words of encouragement to those students in the room to get involved with RSMA and to help others following behind them.

Finally, it was left to Jasmine Hedra Crocker, the RSMU President, to close out the evening with a few words and the Mines Song.

Afterwards guests and students stayed and mingled in the room before heading to the bar. As one member put it "I would just like to say what a brilliant dinner it was. The best RSMA dinner I have attended for a very long time. The food was great as was the service. The speech excellent and the Company was, as always, exquisite."



Photo courtesy of Chris Webborn

Chaps, young and not so young, celebrate



Photo courtesy of Hywel Thomas

Conversations continued long into the night around the seasonal table decorations

Bottle Match 2022

RSM Women's Hockey 2022 (RSM 0 – 2 CSM)

After an early start and a long journey down to Cornwall, the RSM women's hockey team took to the pitch on late Friday afternoon. Although for three quarters of the team this was their first bottle match, the team was determined to improve on the 21-0 loss from last time.

And what an improvement there was! From the first whistle it was a very tight game, both sides having goal-scoring opportunities and multiple attacking and defending short corners with neither team relenting. Some spectacular saves from Danielle kept the score level until just before half time where we conceded the first goal.

Entering the second half 1-0 down, the girls came out fighting. We had many opportunities to score from short corner after short corner, but unfortunately were unable to convert any of these into a goal. Another unlucky counterattack from CSM put us down 2-0 by the full-time whistle.

Although this was a disappointing loss in a very competitive and tight game that could have gone either way, the improvement from two years ago is incredible, I want to thank every player for the effort they put in on the day and also throughout our season this year!

Nadia Mason
**RSM Hockey President
& Women's Captain**

RSM Men's Hockey 2022 (RSM 1 – 0 CSM)

And as the Friday floodlights flicked on the boys took to the field buoyed by the high quality of the ladies' match just minutes before. Seeking revenge, the opening ten minutes saw a furious CSM press and hound the RSM defensive line with only a few well-placed aerials and passes making their way out of the RSM half. Despite the difficulties, CSM

never came close, most attacks being snuffed out or saved by Lekan as usual. As the CSM forwards began to tire, discipline within the Cornish ranks began to fail with some very tasty challenges earning some green cards. Arguably, the chance of the game arrived for RSM but it was spooned wide. Nevertheless, half time eventually came, allowing a breath after what was a breathless first half.

The second half was a different story. Holes in the CSM defence began to creep open and the game became much more open. A flurry of short corners for both teams saw some brilliant saves. Before long however, CSM decided that a green card wasn't quite enough and a yellow card for their centre back swung the advantage back to RSM. Predictably, Matthew Roper pressed home the advantage by smashing a half volley into the roof of the net, quieting the deafening home support. With around 10 minutes left to go, back to 11 each, a green card for RSM and a passage of poor play saw CSM gain the ascendancy. Despite a million short corners, clearly the arrival of the RSM coaches and the away support dwindling along with any CSM finishing ability saw the goal remain firmly shut for a clean sheet. The Sharpley returns home after a mature and composed performance. It's all about the hockey!!

Harry Whittaker
**RSM Hockey
Men's Captain**

RSM Netball 2022 (RSM 5 – 82 CSM)

This year's match was yet another battle between our Royal Miners and the Exeter/Falmouth players representing CSM. The match was set to be a challenge from the get-go, but our girls played amazingly.

It was evident by the bustle in the CSM crowd that their aim for the match was to get their score to



RSM 2022 Netball team

Photo courtesy Jasmine Crocker RSMU

triple digits. This did not phase our solid defence line whose sole aim was to keep it below triple digits – completed successfully might we add. In addition, RSM more than doubled the points scored compared to last Bottle. With epic support from our viewers (especially the football team) morale was high the entire match. It was clear we had more fun than the winning team – but that is the RSM for you.

Although CSM did remain victorious, yet again, the numbers clearly show improvement and reflect the hard work that our girls have put in consistently this year.

Anya Champagne
RSM Netball President

RSM Football 2022 (RSM 1 – 2 CSM)

After a year without the Bottle Match, RSM were more motivated than ever to go down to Cambourne and bring it home, however it was not meant to be this year as CSM retained the cup after an enthralling 2-1 nail-biter. The second day of Bottle Weekend started off with a massively entertaining Netball match, firing up the boys significantly to put in a big performance. The stage was set in Truro School, on what I can only imagine was the finest artificial pitch in all of Cornwall. The atmosphere was palpable as the RSM Ultras brought

the noise, minus those who clearly got a bit too carried away at the prior event.

In true RSM fashion, we went one down within a matter of seconds as CSM played a simple ball down the wing followed by a tap in from the low-driven cross. The boys rallied behind this and used it as a wakeup call to get us back in the game. Minutes later our towering centre-half Chris Tidd won RSM a free-kick on the edge of our area with Brennan stepping up to take it.

The wind behind him, Brennan thumps it up the pitch and it bounces once before Roy Juxon, the number 9, hits it on the half volley and sends it on its way to the top bins. The fans erupt and applaud the best goal they will ever see in their life, RSM back in it at 1-1.

Clearly this goal had rattled the CSM team as they started lunging into rash challenges and by the 30th minute mark their captain had received two yellow cards. With the rest of the game and an extra man, we knew what we needed to do as we controlled the possession and pace of the game. Second half kicked off and it took a while for both teams to grow into the game with some sloppy errors and all-round lackadaisical football. It was clear CSM were set up to sit back and defend, putting all the onus on us to attack. Countless midfield darting runs from Daroon and



RSM 2022 Women's Hockey team

Photo courtesy Jasmine Crocker RSMU



RSM 2022 Football team

Photo courtesy Jasmine Crocker RSMU

Fred were causing them issues but with our star striker on the bench with a pulled hamstring and half a bottle of vodka in him (for medicinal purposes), we were lacking the final clinical finish. With Brennan and Nettleton bombing it down the flanks being fed by Pablo and Hector we were knocking on their door for the entire second half.

CSM realised all they had was route-one, long ball football as they kept trying to get in behind. Eventually a perfectly placed ball got through our line, and it was a sprint race between our keeper and their striker, which unfortunately the striker won as he took it round the keeper and tapped in, much against the run of play. With little time left on the clock, RSM chucked everything at them and even the Captain Idris Brahmah's injection of energy and pace wasn't enough with all their team behind the ball.

Well played to CSM who fought hard, especially with a man down, but RSM can be very proud as we have never come closer to an away win in the history of the rivalry. The boys in black and white will come back stronger as we always do and reclaim that cup next year!!

William Nettleton
RSM Football President

RSM Squash 2022 (RSM 0 – 3 CSM)

An intense three sessions of training (and rule learning) were set to pay off for the RSM following our early coach ride down to Cornwall. As the only returning player besides captain Alex, Chami set foot on court hungry for revenge after 2020's defeat. Whilst the points began to rack up quickly in CSM's favour, RSM's maiden point was met with a cheering roar from our spectators. Despite this, CSM gave Chami the run around, leading to a second successive defeat. Relative squash newbies Annie and Khaled were next up. RSM's score ticked up with each successive game as Annie and Khaled got the hang of our tricky opponents, but sadly both matches ended with points just shy of winning a game. Up last, Alex faced an onslaught from CSM's top seed. Whilst disappointed with his defeat, Alex was just relieved to be leaving with both eyes. Our 3-0 defeat is not representative of how much closer the games were this year and doesn't reflect the improvement the team has made since 2020. Both RSM and CSM should be proud of their performances, and we look forward to an even more competitive set of matches when we welcome CSM to London next time!

Alex Jones
RSM Squash Captain

RSM Badminton 2022 (Men's: RSM 5 – 3 CSM) (Mixed: RSM 0 – 9 CSM)

RSM Badminton ambitiously put out a mixed and men's team for the first time ever. This was due to the abundance of talent within the RSM this year. A fantastic team filled with fantastic players heading down to Falmouth, venturing earth, wind and fire to reach the CSM grounds. But, never before seen scenes occurred when a large crowd appeared to watch a badminton match. Outnumbered 40-2 the RSM spectators pulled off a stunning victory by being the better supporters.

Men's match: with the RSM doubles team ruling supreme in the first games it was all up to the singles players to clinch the edge. As the final points were played, Abhi stood against the Cornwall County player 12-14 down in the 3rd game. But with the whole team behind him he had a miraculous comeback, covering more court than Kante he glided across the concrete floor faster than a cheetah on speed. Such effort earned a crucial victory, with the adrenaline so high that the men's captain had to leave the court to "calm down". The men's doubles then followed up by a rinse and repeat of the double win and bish bash bosh the men's badminton was ours.

Mixed: after the heroic effort from the previous games the team stood up again. Some unbelievable badminton was played with the RSM being always represented to the highest level. However, phenomenally all the matches needed 15-13 with the RSM losing all of them. But of course, to show the RSM spirit, no complaint was made, which juxtaposed the CSM whom had previously complained that they couldn't count to 15 and wanted to play to 21 (or something). Regardless the team played exceptionally well and did us all very proud.

Overall, possibly the best badminton bottle of all time. If you disagree, please email wrong@opinion.ac.uk.

Adam Clift
RSM Badminton President

RSM Tennis 2022 (RSM 0 – 12 CSM)

After a 6 AM start and 5-hour coach journey into the depths of Cornwall, the RSM tennis team arrived in a gloomy Falmouth, eager to put right the loss of the previous year. Backed by the vivacious support of the RSM hockey and racket sports massive, the match began with the doubles teams taking to the courts. There were some great performances, spearheaded by Aviva

and James Wood narrowly missing out on an opening victory, and close losses in the prevailing doubles matches including some strategic substituting between Zaynah and Rosie wasn't enough to bring a win in the doubles. Patrick, Teigan and James Hamer took to the singles matches next and were encouraged by the RSM allegiance in the stands but were unable to hold off the experienced CSM tennis veterans with losses 6-3 6-3, 6-3 6-3 and 6-2 6-2. Our designated hockey players, Matt and Zaynah, fought intense battles prior to leaving for hockey, with 4-6 7-5 4-6 and 6-4 6-3 losses respectively – questions have to be asked whether they were leaving some fuel in the tank. In the second round of matches, and the departure of crowds to watch the hockey, James Wood and Aviva stepped up to tackle their singles matches, with James Wood walking away with player of the day following harsh 6-4, 6-4 and 6-4, 6-3 losses respectively. Patrick and Lianne played well against much more experienced opponents, losing 6-3, 6-3 and 6-4, 6-4 respectively. Despite some great performances from the RSM team and a clear improvement on last year's results, CSM were too strong this time in their home fixture. We will be looking forward to welcoming CSM to London next year to break their winning streak.

James Hamer
RSM Tennis President

RSM Rugby 2022 (RSM 10 – 17 CSM)

The stage was set, and hopes were high as RSM brought forward one of the strongest rugby squads Imperial has ever seen, just off the back of winning the league. The RSM boys were ready to put in a huge performance against the CSM, especially as the conditions were better than the usual Cornish mud and sludge.

RSM were immediately faced by the physicality and size of the CSM forwards, however this was no match with big hits from Sean Nakai and Matt Speechley. With a scrambled back line and players

out of position, it took some time for the RSM to get switched on, unfortunately conceding a try early in the first half, 7-0.

A few mistakes following this gave rise to Adam Brzosko receiving the first and only yellow card of the game. Being a man down in the forward pack allowed the CSM to score another try by a driving maul, 14-0. However, even with being a man down, repetitive structured play and aggression from the RSM forwards gave way to a driving maul try off a lineout. With our best kicker in the club missing, Vice-Captain George Morgan stepped up to the plate to try convert, missed, 14-5.

The RSM knew what to do for the second half and really raised the standard. With some fresh legs, the RSM dominated in multiple areas of the pitch. Hard lines from Man-of-the-match Spencer Ingall and Dylan Bilski scared their defence, but some mistakes in game gave way to an opposition penalty kick for posts, 17-5.

This did not dishearten the RSM squad, with big runs and good phases allowing the rest of the game to be played in the CSM half. With the clock ticking down, Sean Nakai managed to squeeze in another RSM try, and in good spirits, the RSM Captain, prop, Animesh Misra, lined up for the conversion. As expected, the kick went wide, ending the game on 17-10.

Unfortunately, the RSM could not bring the Bottle home this year, meaning the CSM continues to be unbeaten at home for the past 10 years. Not to worry however, I expect the CSM to take good care of the Bottle until they lose it at Harlington next year. A thanks goes to all the supporters and volunteers who made the Bottle Match weekend a success once again, and a special thanks to our Rugby Sponsors, IMR Resources and Minexia, without whom this match would not have been possible.

Animesh Misra
RSM Rugby Captain



RSM 2022 Rugby team

Photo courtesy Animesh Misra RSMU

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Nigel Brandon re-appointed Dean and elected to the NAE in the US



Professor Nigel Brandon speaking at the recent CGCA Annual Dinner

Professor Nigel Brandon OBE FREng FRS has accepted his re-appointment as Dean of the Faculty of Engineering for a further five years, until 31 July 2027.

During his time leading the Faculty of Engineering, Professor Brandon has spearheaded the Faculty's academic strategy priorities. These include: transitioning to a sustainable zero-pollution economy; engineering resilient and secure infrastructure; AI and machine learning for engineering applications; and affordable technologies for an ageing society – together with a continued focus on innovation in engineering teaching, research and translation. His tenure has also seen Imperial taking a leading role in the national Faraday Institution, which is performing pioneering research on batteries.

He is Chair of Sustainable Development in Energy at Imperial,

and a pioneer of electrochemical devices like fuel cells, flow batteries and electrolyzers for low-carbon energy applications. His academic excellence was recognised with an OBE for services to UK-China science and he is a Fellow of both the Royal Academy of Engineering and the Royal Society.

He was recently elected International Member of the National Academy of Engineering in the USA, recognised for his contributions to the science and engineering of solid oxide fuel cells and their technological development and commercialisation. He will be formally inducted during the NAE's annual meeting on 2 October 2022 in Washington, DC. Academy membership honours those who have made outstanding contributions to engineering research, practice, or education, including, pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or driving innovative approaches to engineering education.

Professor Brandon holds an engineering degree and PhD from Imperial, to which he returned as an academic, in 1998 following a 14-year research career with BP and Rolls-Royce. He is a founder of Ceres Power, a UK company developing fuel cell and electrolyser technology based around a unique metal-supported solid oxide cell technology, and a founder of RFC Power, a UK company developing a novel liquid-gas flow battery to store renewable power.

Photo courtesy of Yifeng Zhang

Imperial academics awarded three of five new RAEng Research Chairs

The Royal Academy of Engineering Research Chairs aim to strengthen the links between industry and academia by supporting exceptional academics in UK universities to undertake use-inspired research that meets the needs of the industrial partners. Awardees are expected to establish or enhance a world leading engineering research group; deliver 'use-inspired' research that meets the needs of their industrial partners; and become a self-sustaining research group by the end of the award, by securing substantial external grant income. Of the five new chairs recently announced, three were awarded to Imperial academics.



Professor Ruth Misener, Department of Computing, awarded the BASF / RAEng Research Chair in Data-driven Optimisation.

Professor Misener aims to transform the intersection between AI and the chemicals industry to help improve sustainability and energy efficiency. Developing data-driven, optimal decision-making under uncertainty is key to achieving a sustainable society. When coupled with societal values and sociological research, these numerical tools can contribute towards wider sustainability objectives, blending traditional, mechanistic model-based optimisation with data-driven optimisation. The long-term vision is to repurpose machine learning methods for the chemicals industry.



Professor Daniele Dini FREng, Department of Mechanical Engineering, awarded the Shell Global Solutions / RAEng Research Chair in Complex Engineering Interfaces.

Climate Change is the single biggest threat to present and future generations and meeting our ambitious targets for net zero greenhouse gas emission will require technology mobilisation on an unprecedented scale. Understanding complex engineering interfaces in products and systems in operating environments, is key to successfully delivering innovation in the energy sector. In collaboration with Shell, Professor Dini will address the challenges of predicting the behaviour of these critical interfaces and develop new design strategies. Applications will include lubrication and cooling of interfaces in electric vehicles and nanoscale materials and surface design for optimised energy harvesting/storage devices.



Professor Michael Templeton, Department of Civil and Environmental Engineering, awarded the Oxfam and Water For People / RAEng Research Chair in Global Sanitation Technology.

Using robust approaches to designing, testing, and implementing novel onsite sanitation technologies and processes, Professor Templeton aims to address engineering challenges associated with achieving the UN Sustainable Development Goal of universal access to safely managed sanitation. Examples will include more affordable, easier-to-assemble septic tank designs and modular methods to treat faecal sludge in rapidly urbanising cities and emergency settings. His approach combines laboratory experiments, fieldwork, mathematical modelling, and collaboration with in-country practitioners and end users, to co-develop engineering solutions that will improve the lives of the poorest members of society in developing countries.

Chair of the RAEng's Research Committee Professor Karen Holford said: "The partnerships that support innovative engineering like this are vital to our future health and prosperity and the Academy values them very highly."

Photos courtesy of Imperial College London

EEE Professor awarded Blondel Medal and IEEE Fellowship

For his contributions to multi-antenna communication systems and wireless power transmission systems, Bruno Clerckx has received the Blondel Medal, which is awarded each year in France by the French Association of



Electrical Engineering, Electronics, Information Technology and Communication (SEE). The Medal honours one university or industrial scientist per year for exceptional work in the field of science and electrical and electronic industries. It was awarded to Professor Clerckx on 13 December 2021.

Bruno Clerckx is Professor of Wireless Communications and Signal Processing in the

Department of Electrical and Electronic Engineering. He is Head of the Wireless Communications and Signal Processing Lab, and Deputy Head of the Communications and Signal Processing Group at Imperial. His work focuses on developing mathematical models and signal processing algorithms, to understand how to make the best use of radio waves in various wireless systems such as communications, power transmission, and sensing.

He has also been elevated to Fellow of the Institute of Electrical and Electronics Engineers (IEEE). Fellowship is awarded to members for extraordinary accomplishments in progressing electrics and electronics.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

New Year Honours

Professor Robin Grimes, BCH Steele Chair in Energy Materials in the Department of Materials, has been made a Knight Bachelor for services to UK Resilience and International Science Relationships.

Professor Robin Grimes' research focuses on the application and development of computer simulation techniques to predict structural and dynamic properties of ceramics and metals for energy applications – particularly nuclear.

Since 1984 he has authored over 300 peer-reviewed publications. He has served as Chief Scientific Adviser (Nuclear) for the Ministry of Defence and Chief Scientific Advisor to the Foreign and Commonwealth Office.

Professor Grimes continues to play an active part in building engagement with scientists across the world, including Japan, Argentina and India. He was elected Foreign Secretary of the Royal Society, in 2021.

Professor Robin Grimes said: "I am grateful to my excellent colleagues and to the environment



Photo courtesy of Imperial College London

at Imperial which has enabled me carry out this important work within Government. I am honoured to receive this recognition."

Also honoured was Former Strategic Adviser to Imperial's Centre for Nuclear Engineering, **Dr Norman Waterman**, who received an MBE.

Department of Electrical and Electronic Engineering alumna **Dr Cathy McClay**, who is also a former Lecturer in the department, received an OBE for services to the energy sector and the promotion of decarbonisation. See page 26 for more details.

£3M EPSRC grant for research into Quantum computing

A grant, worth a total of £3 million, has been announced by the Engineering and Physical Sciences Research Council (EPSRC) following calls for cutting-edge research at the interface between quantum computing and other ICT areas.

Researchers with expertise in quantum computing and communication technologies at Imperial and University College London (UCL) have been awarded this fund, for collaborating and advancing hybrid quantum computing and quantum internet.

The funding will support joint research at Imperial and UCL, with plans to engage the UK and international researchers in the fields. The team will also inform and interact with other researchers of the quantum community through networking activities.

The project will also strengthen collaboration between academic research and industry partners in the Quantum field.

Achieving reliable quantum computation faces unique challenges – not least the fragility of quantum systems due to their interactions with their environment and the fact that the state of the system during

a computation cannot be measured to confirm its correctness. The very feature that makes quantum computation powerful, the exponential size of the space of states in the number of qubits, makes it hard to emulate and hence assess behaviour.

The cross-disciplinary community of researchers in quantum computing and computer science, will collaborate to address the global challenge of delivering quantum computing that is robust, reliable, and trustworthy. With the substantial recent progress internationally in building ever larger quantum computers, verifying that they do indeed perform the tasks they were designed for has become a central unsolved problem in the field.

This initiative will bring quantum computation research into close contact with the scientific tools, methods and (especially) mindsets of the ICT research community – across a broad spread of the key classical computing stacks. Together, they will define the beginnings of a general framework and advance specific solutions for reliable and robust quantum computation, at key

Imperial team wins University Challenge



Photo courtesy of Imperial College London

Imperial's team are this year's winners of the University Challenge TV quiz programme. After four wins – in 1996, 2001, 2020 and now 2022 – Imperial ranks with Magdalen College, Oxford and the University of Manchester as the jointly most successful teams in the quiz tournament's history.

In the final, which aired in early April, Imperial's student team defeated the University of Reading by ten points. To reach this year's finals, the team beat Emmanuel College, Cambridge in the semi-finals and overcame other teams including University of Exeter, St John's College, Cambridge and King's College, London.

In preparation for University Challenge, the team spent months revising their specialist subjects and practising quizzes as a close-knit group. MSc Science Communication student Fatima Sheriff specialised in literature, while Gilbert Jackson, who is studying a MSci in Chemistry, focused on music and art. Captain Michael Mays, a PhD student in Computational Fluid Dynamics in

the Department of Aeronautics, specialised in history and philosophy and Max Zeng, a Biochemistry undergraduate, impressed audiences with his geography knowledge. The team was supported by reserve, Felix Swift Roberts.

Commending the team, Imperial's Provost, Professor Ian Walmsley, said: "We are incredibly proud of our Imperial team and congratulate them on this historic victory."

"Collaboration, creative thinking and deep knowledge are all part of our commitment to excellence at Imperial, and the team has all of these qualities in abundance."

After winning this year's show, the team hope that they can inspire future Imperial teams who take part in University Challenge. "I really hope that we can foster the same level of commitment and enthusiasm for quizzing," Fatima said.

"The real gift is the team camaraderie, the bonding over stupid facts at silly hours and the in-jokes we have. The months of training together are the most fun I've ever had."

layers across the principal quantum computing stacks needed to achieve reliable quantum computing systems.

This funding recognises Imperial as a global partner in the international Quantum community.

The College's beacon for Quantum research, Imperial Centre for Quantum Engineering, Science and Technology (QuEST), is a multi-disciplinary centre for researchers at Imperial. Its research is initially targeting three important themes for the future: Materials for Quantum Technologies, Quantum Internet and Applications for Quantum Computing.

Professor Ian Walmsley FRS said: "This award recognises the breadth of expertise that Imperial can bring to developing quantum computing as a future technology."

This highly multidisciplinary group will help drive forward new applications for and new approaches to quantum computing, developing the networking concept as an essential and viable platform for the next generation of computing infrastructure."

In the first year of the work, researchers will need to co-create a research programme to develop distributed and hybrid quantum computing that supports practical applications.

A series of scoping workshops will be convened to propose and discuss technical directions and to facilitate the formation of project investigator teams. Projects selected for funding will commence from April 2023.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Imperial engineers design and build e-scooters with local youth club

Last year, the Public Engagement team and researchers from across the College worked with North Paddington Youth Club to explore Imperial's research and build electric scooters.

The project follows a year-long partnership between Imperial and the youth group that has previously seen its members customise sneakers taking inspiration from Imperial's research.

Imperial's Public Engagement Producer, Emma Slater, is working with the club. "The e-scooter project totally came from the young people. They really enjoyed working on the sneakers so we said, 'Ok, what shall we do next?' and they wanted to do something on electric scooters and engineering, so here we are!"

North Paddington Youth Club's members are aged 16-21. The club offers under-represented and under-served young people opportunities to engage in activities in a safe and welcoming environment. Projects like this are a key part of Imperial's aim to collaborate with local young people who may face lack of opportunities, or multiple barriers, when engaging with science.

Ronnie Renney, the Youth Club Manager, said, "Imperial couldn't have picked better researchers – they were so welcoming, and they gelled with the young people really well. Our members are always asking if the project will be repeated, as some of them didn't manage to do it the first-time round!"

The co-designed e-scooter project aimed to bring together Imperial researchers and local young people to design, build and customise scooters, so they can grow their confidence and

practical understanding of science. The project received funding from UKRI's Making Connections grant scheme, in partnership with the UK Science Festival Network (UKSFN) and caught the attention of local e-scooter brand, Mycle, who generously supplied brand new scooters to the youth club.

Researchers from across the Department of Mechanical Engineering and Imperial's Advanced Hackspace have been guiding the young people through the design and build process. It has been an opportunity for the researchers to gain new perspectives on their work and experience engaging with local young people as well as make connections with other researchers and departments which may lead to future collaboration.

The group followed a design engineering journey. They started by understanding how e-scooters work, then designing and building and customising their own version of a Mycle scooter. To round off the project, researchers supported the group with a CV/interview workshop which would support the group to understand the skills they had developed in the project and how these might be relevant to their own career aspirations.

Dr Marc Masen, Reader in Tribology and Mechanical Engineering Design, who took part in the project, said, "I loved the experience. It was great being able to talk about my work with young people who were all so different and enthused. It was a learning experience for me as well, figuring out what worked and didn't work, which is excellent for my own development."



Photo courtesy of Imperial College London

Imperial-X initiative

Imperial-X (I-X) is among the first-ever successful applicants to The Alan Turing Institute's Network Development Awards.

Launched in March 2022, I-X harnesses the College's excellence in AI, machine learning, and data sciences to address challenges in health, space, environment, economy, virtual reality, internet of things, and communications.

The Award, worth over £18K, establishes links with the Turing and will help I-X to foster equality and diversity in its work.

I-X Co-Director Professor Peter Pietzuch, of the Department of Computing, said: "This Award is an excellent vehicle to create an initial link between I-X and the Alan Turing Institute, which in turn will help shape the evolution of I-X over the next few years."

I-X's research programme aims to deliver ambitious scientific 'moonshots' in the next 5-10 years. It brings together multi-disciplinary academic teams from across Imperial with companies and non-profit labs to identify and fix problems through the 'University of the future'.

I-X will be housed over two floors at the Translation & Innovation Hub (I-HUB) on Imperial's White City Campus. It will function as a 'mixed campus' that brings together around 500 researchers from the Faculties of Engineering, Natural Sciences, and Medicine, and Imperial College Business School. These academics will collaborate to transcend individual disciplines and tackle our greatest challenges.

Imperial Provost Professor Ian Walmsley said: "I-X brings together Imperial's strengths in data, AI, computing and maths to drive the smart society of the future. We will embed our research, education, and innovation mission in a multidisciplinary, entrepreneurial environment that engages external partners to help deliver new ideas, new technologies and deeper impact more effectively and rapidly."

To do this, I-X is recruiting new faculty members to join 30 new research initiatives to drive the digital revolution. The projects cover areas such as improving healthcare with big data and AI; preparing for a future of human-AI cooperation; robotics and automation; and building ML systems that understand the real world, like self-driving vehicles.

I-X seeks to work closely with industrial partners and the new



roles are also being made available as joint-industrial appointments.

Chair of I-X, Professor Eric Yeatman, from the Department of Electrical and Electronic Engineering, said: "The ultimate vision for I-X is to deliver 'transformational' research, teaching and innovation, to build a better future by bringing together universities, business, government and the next generation of students and young people who will be most impacted by these technologies."

"With I-X, we will create a testbed for different ways of running a university and the digital sector presents a fantastic opportunity to do this."

The scope of this programme includes 'core fields' like AI, ML, statistics, and data science. These will underpin 'applied fields' such as health, space, environment and economy, virtual and augmented reality, internet of things, and networking and communications. There will also be 'foundational aspects' that inform the manner in which technologies are developed including security, privacy, resilience and ethics.

Co-Director of I-X, Professor Nick Jones from the Department of Mathematics, said: "I-X represents a huge strategic commitment for the College, harnessing our excellence in interdisciplinary, collaborative research to position us as leaders of the digital revolution. We are building an exciting new model of co-discovery and co-creation in the digital space."

I-X aims to engage not just industry and academics but the public at large and local communities in London through the development of apprenticeships in data science. It will also engage students through new flexible Masters programmes, new courses for industry, and new industry integrated PhDs.

To find out more about Imperial-X visit:

<https://ix.imperial.ac.uk/>

Dolomites expedition 2021

In September 2021, having navigated all the extra hurdles resulting from the pandemic, two Imperial College PhD students, Tristan Dell (Department of Bioengineering) and James Foote (Department of Materials), undertook an expedition: mountaineering and climbing in the Dolomites. They were supported by both the RSMA and the OC Trust. This article is based on their expedition report.*

* The full report can be read online at: <https://www.cgca.org.uk/activityreports>

The Dolomites are a mountain group lying in the eastern section of the Italian Alps. Surrounded on all sides by valleys, the striking and characteristically steep peaks of the Dolomites loom over the surrounding area with their huge faces and summits which often breach 3,000m in altitude. The Dolomites take their name from the geologist Dieudonné Dolomieu who conducted the first scientific study of the area and its associated geology. The rock is formed of light-coloured limestone, this rock has led to the unique geography of the area and its famous jagged mountain peaks.

During our time in the Dolomites, their more recent history became very apparent. During the First World War, they were the site of prolonged conflict along the Italo-Austrian frontier. This was reflected in the local geography of several of the locations in which we climbed. At Sass de Stria the approach to the crag involved traversing trenches and passing complex networks of caves and galleries which were used by troops on both sides. The intricate scars of the War pockmark the mountains, with some of the man-made cave-networks exceeding 500m in length. One happy outcome of all this was the establishment of many of the Via Ferrata which are still in use today, providing excellent access to otherwise technical peaks.

The breadth of crags throughout the region offers some of the most striking yet easily

Itinerary

Day 1: Travel to Cortina d'Ampezzo from London

Day 2-3: Based at the rifugio Cinque Torri.
Minimal climbing possible due to bad weather

Day 4-5: Based at Paolina Hütte. Travelled to the Western side of the Dolomites, then did the via ferrata Roda di Vael (VF1B) and Massare (VF2B) on the Rosengarten

Day 6: Hiked to rifugio Vajolet

Day 7: Hiked to rifugio Antermoia via the via ferrata Lorenzi-Molignon (VF4C)

Day 8: Returned to Karersee via the via ferrata Antermoia (VF2B) and the Sandtner Pass (VF2A)

Day 9: Climbed at Passo Fedaia

Day 10: Climbed at Citta dei Sassi

Day 11: Guide arrived. First multi-pitch climb on Myriam (V+) at Cinque Torri

Day 12: Ascent on the Marmolada (3,342 m) via West Ridge (VF4C) and descent via Normal Route (PD)

Day 13: Trad multi-pitch up the South Arête (IV+) at Sass de Stria

Day 14: Climbing at Sass de Stria

Day 15-16: Travelled back to London via Venice



Descent from the Marmolada

accessible climbs in the world. Given the easy accessibility and wide range of grades offered throughout the region, it was a very appropriate area to push our technical abilities, both on rock and on more technical mixed terrain. It was also fantastic to sample some truly exceptional multi-pitch routes on limestone which really did live up to its reputation. The key crags climbed during the expedition were Cinque Torri, Passo Fedaia, Citta dei Sassi and Sass de Stria. We also spent several days in the Rosengarten group and on the Marmolada.



The glacier traversed on the descent of the Marmolada

Photos courtesy of Tristan Dell and James Foote

FEATURES

Expedition Overview

We split our time in the Dolomites between the Eastern region, centred around Cortina d'Ampezzo and the Western side, centred around the small town of Canazei. After two days of bad weather, and a chance encounter with the Italian military carrying out exercises at the entirety of Cinque Torri, we spent several days in the Rosengarten group getting acquainted with some of the via ferratas in the area. This was used as technical preparation for the later ascent on the Marmolada, with varied and remote terrain on some of the passes and ridges giving fantastic exposure and a solid introduction to using the via ferratas. While here, we experienced the first snowfall of the season and were the first to summit the Catinaccio d'Antermoia (3,002 m) after the fresh snowfall. We also summited the Roda di Vael (2806 m) and completed a traverse of the ridgeway between Molignon di Fuori (2,779 m) and Molignon di Dentro (2,852 m) using the via ferrata Lorenzi-Molignon (VF4C).

After a fully packed four days in the mountains, we focussed our efforts on sport climbing on the absolutely fantastic rock for which the Dolomites is so well known. We spent two days climbing single pitch routes at Citta dei Sassi, and at the Passo Fedaia on the Marmolada, before climbing with our guide, Fabio Agnese, our first multi-pitch: Myriam (V+) at Cinque Torri.

Given a fantastic weather window at the end of that week, we decided on an ascent of the West Ridge of the Marmolada to Punta Penia (3,343 m) the next day. Despite fresh snowfall earlier in the week, the crevasses on the glacier were clearly visible and we navigated three glaciers under the leadership of our guide, Fabio. We completed the ascent in a single day, returning to Sass de Stria for a final day of multi-pitch climbing before Fabio left the team. Tristan led 8 pitches of trad multipitch for the first time on the South Arête (IV+), demonstrating the value of working closely with a guide in really expanding our repertoire of skills when it comes to climbing.

After a final day of multi-pitch climbing without a guide at Sass de Stria, the expedition came to a close, with Tristan and James travelling back to London via Venice. The expedition was deemed successful in meeting its aims: preparing the team for more ambitious technical climbing and mountaineering expeditions in the future. Both Tristan and James gained vital glacier mountaineering experience as well as significantly pushing their technical climbing

ability and developing confidence in complex multi-pitch climbing routes (both on ascent and descent).

Learning Outcomes

Logistical Considerations

Cost and Financial Planning

Overall costs were higher than expected. Largely driven by uncertainty around relaxation of travel restrictions, it was difficult to make advance bookings which drove up costs. Items such as car hire were more expensive than predicted due to the need to wait until 2 weeks prior to travel before it was confirmed that it would be feasible to travel to Italy. Furthermore, testing costs came to nearly £150.

We decided to work with a guide who was based in France such that it would be feasible to work with him if we needed to default back to our contingency plan of mountaineering in the Écrins region of the Western Alps. He was willing to travel to Italy however only for a minimum of 3 days (rather than the 2 we had budgeted for), which drove a marked increase in cost.

As James was new to multi-pitch climbing, we decided to do a day of multi-pitch training with Head on Out (a Bristol-based climbing organisation) in preparation for the expedition. This also increased costs associated with guides / training.

The cost of accommodation and food in rifugios was also higher than anticipated. BMC Reciprocal Rights rates were only accepted in properties belonging to the Club Alpino Italiano (CAI). The majority of huts were privately owned, so we endeavoured to cut costs by staying only in CAI rifugios where possible. We endeavoured to counteract the higher spend on accommodation by being frugal with food costs.

In summary, both team members spent significantly more of their own money than anticipated in order to cover these increases in cost. This will be a valuable learning experience when budgeting future expeditions, especially in more developed areas where it can be difficult to reduce costs. In future, more diligent financial planning would enable the team to have a more realistic picture of costs prior to departure, ensuring that budgets can be set more

appropriately. We were fortunate in that the expedition team was small and the knock-on effects manageable, however with a larger scale expedition taking place over a longer time period, it is clear that better financial planning would be key.

Hypothermia

It's well known that the weather can turn quickly in the mountains, so we were careful to check local forecasts before heading out each day. This is especially pertinent when climbing in the Dolomites in late Summer as lightning-strike can be a significant risk factor in the afternoons in the event of a thunderstorm.

Throughout September we witnessed first-hand how quickly the temperatures can drop. At the beginning of the expedition, we had several days of temperatures well above 20°C. Towards the end of the month, temperatures were dropping toward zero. Unfortunately, when climbing at Passo Fedaia at 2,500m, we were caught out by this. As the sun went behind the mountain, temperatures dropped notably and the wind picked up. Unfortunately, James was on belay and unable to reach his warmer layers, which led to him becoming cold over a sustained period. This led (surprisingly rapidly) to symptoms of mild hypothermia. Thanks to our first aid training and an easy walk out of the crag, we were able to recognise this quickly, administer first aid and monitor James to make sure that further action wasn't necessary. This was an important first-hand example of how quickly a seemingly innocuous change in the weather can lead to serious consequences when in a remote area at altitude.

In future, it's abundantly clear that reading the weather patterns and the terrain around you are crucial skills which could have prevented this. Furthermore, better communication at the belay stance would have communicated the severity of the situation and would have led to safer outcomes (and a longer day climbing).

Checking Military Movements / Crag Availability

During the first day of the expedition, plans were made to climb at Cinque Torri, however, the expedition team was not aware of the military training regime underway at the crag. This meant that no climbing was allowed in the area and led to a day with no climbing and a long approach to the crag. This was a good lesson to learn early on so that crag availability could be checked prior to climbing in future.

Travel During a Pandemic

Travel during the Covid-19 pandemic was a significant consideration in planning this expedition. Not only did it lead to added expense in terms of testing prior to departure and return to the UK. It also led to last-minute planning and booking as the expedition team were uncertain the expedition would go ahead until a matter of weeks prior to the expedition.

To attempt to mitigate disruption, the team prepared a detailed contingency plan centred around a comparable expedition to be carried out in the Écrins region of the French Alps. After careful monitoring of travel regulations (both inbound and outbound) to over 10 alternative destinations, France was identified as a sensible contingency. A detailed proposal was prepared to include glaciated mountaineering routes and extensive multi-pitch climbing and we negotiated with our guide that he would work with us in either location. This speaks to the value of selecting a contingency location which was geographically close to the Dolomites, as it allowed us to plan an extremely comparable expedition with minimal disruption, similar budget and comparable analysis of risks.

Of course, due to the rapidly evolving situation, it was necessary to consider the requirements of our funding bodies and liaise closely with these. Gladly, we were able to go ahead with our initial plan, meaning that additional complexity here was largely avoided.

Climbing and Mountaineering

The Value of Training Prior to Departure

Training during the pandemic was a little different to what would usually be possible. Fortunately, it was possible to travel within the UK in the months leading up to the expedition, so the team was able to get some excellent time in climbing outdoors in North Wales, the Gower and the South Coast. Alongside this, regular indoor sessions and a consistent programme of cardio ensured we had the fitness for consecutive long days in the mountains on challenging terrain.

Dealing with Exposure

The exposure was more difficult to prepare for, prior to departure, as few climbs in the UK offer exposure comparable to the Dolomites. The initial via ferrata allowed preparation for the exposure on the later multi-pitch climbs in a safer environment. This preparation was hugely valuable, especially for Tristan, as he struggled with some of the more exposed and unprotected ridges. Getting accustomed to the exposure early on meant that we were able to make the most of our time with the guide, climbing confidently on the longer multi-pitch routes.

The Value of a Good Guide

Our guide, Fabio, was invaluable in helping us to push the technical limits of our climbing and mountaineering in a safe environment. Fabio allowed us to learn and tackle James' first multi-pitch routes and both of our first ever trad routes. Alongside this, Fabio taught the expedition team how to safely traverse glaciers, an activity that would have been impossible without a guide. Fabio was fantastic to have on the expedition on a personal level and a great contact to have for future expeditions.

Trad Fundamentals

Working with Fabio proved a fantastic opportunity to learn trad climbing. A lot of the multi-pitch climbing in the Dolomites is trad, ranging from excellent routes for learning the fundamentals of gear placement to true big-wall test pieces and classic faces such as the Cima Nord and the South Face of the Marmolada.

Working with Fabio, we learned how to place all key pieces of trad gear and also covered the guiding principles for selecting the right piece of protection. This culminated in Tristan leading 8 pitches of trad on the South Arête at Sass de Stria. Though low in grade, this was an excellent opportunity to put into practice a lot of the skills we had learned.

Multi-Pitch Lead Techniques

Leading a multi-pitch route can be daunting. The exposure is challenging, and reading the route is vastly more important (and more difficult) than when climbing single pitch. This is equally applicable in ascent as it is when descending safely. As such, efficiency and proper planning are crucial.

Once at the belay stance, setting up a safe belay from above was a key skill we were able to practice whilst on expedition. Interestingly, the Italian convention is to use a 'plaquette' (a planar belay device) rather than the more widely used guide-

plates such as the Petzl Reverso which we were accustomed to. With input from Fabio, we learned how to belay in this way and Tristan led the entire route independently.

Multi-Pitch Rope Admin

A key takeaway from multi-pitch trad climbing was the use of two half-ropes. This was new to both team members and meant that rope admin became notably more complex (and important). After a couple of stances where the ropes really slowed us down, we were able to refocus on how to build a multi-pitch belay stance for three climbers so that we could transition efficiently between pitches with minimal rope admin.

Non-Standard Descents

Simul-climbing and scrambling can be common. This was the key takeaway from the descending the multi-pitch routes we climbed with Fabio. Despite the presence of good abseiling anchors, there were large sections of unprotected traverse or easier downclimbing that were required on some of the descents, especially on Cinque Torri. Under Fabio's guidance, we did this safely by simul-climbing these sections. This was the first time that either team member had simul-climbed so we were directly under Fabio's leadership.

This was a valuable lesson when considering future routes to climb as the descents were at times more technical or challenging than the climb itself. This would be a vital factor when planning longer days out on big walls or larger multi-pitch crags with no clear walk-off.

Glacier Fundamentals

Working with Fabio, we spent an afternoon off the mountain going over key techniques important for glacier work. This included how to rope a group of climbers for glacier traverse, including the key knots, spacing considerations and rope etiquette.

We also covered the theory of self-arrest using an ice axe, and crevasse rescue. Once on the glacier, we were able to touch on the finer points of navigating around crevasses, different snow and ice conditions, and techniques to find a suitable path both for descent and ascent.

Unfortunately, sparse snow cover and rather more crevassing than anticipated meant it was not possible to safely practice self-arrest when on the glacier. However,



Tristan and James taking in the views on the hike down from Cinque Torri

this is something we would look to do in future through further training. Overall, the expedition was a fantastic introduction to glaciated mountaineering, with the team traversing three glaciers across a single day on the Marmolada.

Concluding Remarks

The expedition allowed James and Tristan to further their climbing and technical skills whilst gaining their first experience of trad climbing and glaciated ascents. The objective of the expedition was to equip both team members to take on more ambitious expeditions in future. In this respect, both team members agree that the expedition was a success.

The financial support of our funders made it possible to work with a guide, allowing the undertaking of more ambitious climbs in a safe environment and offering us an experienced teacher to show us the correct protocols for the glacier traverses. This was transformative in ensuring that we learned a huge amount while in the Dolomites. Alongside the technical aspects, the expedition allowed the team to gain valuable experience in the planning of expeditions, with Tristan leading an (albeit small) expedition for the first time.

Both James and Tristan thoroughly enjoyed the expedition and would like to wholeheartedly thank funders for all the support they offered, without which the expedition would not have been possible. The experience gained has prepared the team well to pursue further, more challenging expeditions with confidence, something which we are sure to put to good use in future.



Climbing Myriam (V+) at Cinque Torri



Torri Vajolet in Rosengarten



Ascending the Marmolada via the via Ferrata on the West Ridge

Acknowledgements

The expedition would not have been possible without the generous and kind support of the following organisations. We are hugely grateful for their support in what were undoubtedly uncertain and rapidly evolving circumstances prior to travel.

Imperial College Exploration Board
Old Centralians' Trust
The Royal School of Mines Association
Imperial College Mountaineering Club



Our guide Fabio coiling ropes at Sass de Stria



James and Tristan in high spirits at the summit of Roda di Vael

The Team

Tristan Dell

Expedition Leader, aged 26.

3rd Year PhD Student, Department of Bioengineering.

Tristan was familiar with the Dolomites, having skied there on several occasions, including on the Marmolada. He has a long-standing fascination with the distinctive peaks of the region. As a native German speaker, he was key to communicating effectively, with German being the dominantly spoken language in Süd-Tirol.

His climbing experience includes Getu Valley & Yangshuo, China; Clécy, Normandy; UK. He also has prior experience mountaineering at very high altitude on a multi-day hike up to >4000m in the Indian Himalayas and multiple shorter 1-day/2-day hikes in the Alps, Highlands, North Wales and the Peak District. He is also a competent skier; and fieldwork/outdoor first aid certified (2019 and 2021)



Tristan and James take a rest under a roof on Myriam

James Foote

Logistical Lead/Treasurer, aged 26.

3rd Year PhD student, Department of Materials.

James climbs multiple times a week, getting outdoors to do so in the UK and further afield whenever he gets the chance. Winter mountaineering is a key skillset James wishes to develop, making the Dolomites a fantastic destination to develop his skills, and build upon the belay-partnership between himself and Tristan in a challenging new setting.

His climbing experience includes Normandy, France; The Gower, Wales; and deep-water soloing in Portland, UK. He also has experience of multiple multi day hikes during 6 months living in New Zealand including mountain ascents of a number of peaks of 2000m+ altitude; organising long multiweek trips during expeditions in South America including hikes to peaks >5000m. He is also a competent skier and PADI qualified Advanced Scuba Diver; and outdoor first aid certified (2021).

What does biology have to teach us about engineering?

An intriguing question, posed (and answered) by Professor Anil A Bharath from the Department of Bioengineering, who will be taking over as CGCA President at the AGM in June.

Introduction

The evolutionary processes of biology have shaped us, and the world we inhabit. Perhaps unsurprisingly, we have learned much about ourselves through studying the fundamental processes of life. But what can biology teach us about engineering?

This question is one that occupies many academics around the world, including here at Imperial College, where several research groups take bio-inspired approaches to engineering. The span of remit of bio-inspired engineering is immense: it ranges from materials through to computation, and even to the control of miniature airborne drones. In this brief piece, I will touch on some intriguing topics where we can identify the direct or indirect influence of biological structure, function or strategy on engineering.

Materials Engineering

There are some materials that can be created to have dramatically different properties depending on how they are formed, or shaped. Spider silk is a well-known example, but we'll start with seashells! Our daily experience of many ceramic materials is that they are fragile. But crustaceans have evolved to have highly mineralised tissue formed from platelets of ceramics with a thin layer of glue-like material; these structures display plastic deformation, which provides them with some resilience to applied stresses. At Imperial's Centre for Structural Ceramics, Dr Florian Bouville (Materials) and colleagues identify key design parameters, taking inspiration from the microstructure of seashells, with a major goal of reducing the brittleness of traditional industrial ceramics. The team can produce tough ceramics of up to 8cm diameter, limited pretty much only by the equipment used for firing. There are applications for these structures both in industrial processes and consumer products. For example, ceramic cell phone cases are better for certain wireless technologies than aluminium, since they do not block electromagnetic signals.

But the complex microstructures of biology provide not only tensile properties, as found in highly mineralised tissue (95%-98% ceramic), but also materials with adhesive properties, found in climbing insects, such as ants and grasshoppers, or in small vertebrates such as tree frogs and geckos. Dr David Labonte (Bioengineering) and colleagues investigate the mechanisms which enable these animals to run with sticky feet – it turns out that some ants can carry more than 100x their own body weight while walking on a ceiling!

As often in biology, animals of extraordinary diversity in terms of shape and size may nevertheless use remarkably similar mechanisms, governed by physical laws. The



Perhaps one of the best-known examples of inspiration for engineering, the *Geum urbanum* has similar hook-like structures to those of the burs that are thought to have inspired the hook and loop fastener (colloquially known as 'Velcro').

Picture courtesy of Prof Richard Wheeler, University of Oxford; used under Creative Commons License (v3.0).

main control mechanism for adhesions that support climbing appears to be based on a direction-dependence of adhesive structures: they adhere strongly when pulled in one direction, but readily detach when pushed in another. This property thus provides a fast mechanical activation and release mechanism which arises from the microscopic morphology of particular adhesives. The first successful attempts by research groups all over the world have already been undertaken to design bio-inspired adhesives based on this simple functional insight.

Fundamental research and engineering questions certainly do remain in the area of bio-inspired materials engineering: the question of how to translate repeated composite patterns from nature into a manufacturing process is one; scaling up of manufacturing is often another [1].

Robotics

A tremendously active topic of research and development takes the form of bio-inspired robotics, an area which seeks to capture some form of behaviour or functionality that is difficult to reproduce with traditional approaches to engineering. These behaviours, or functionality, may be very specific – such as particular sensing capabilities [2] – or as all-encompassing as properties of energy efficiency across a wide range of tasks that are adapted to a particular domain.

One such domain is in fluids: the ability of a robot to move through water (swimming!)

is one obvious area in which nature wins over current robot technology from the perspective of energy-efficiency. Despite the quite convincing-looking fish-like motion of recent aquatic robots, the energy efficiency of real fish in motion significantly exceeds that of their mechanical counterparts.

Studies in real fish [3] suggest that dynamically adaptable stiffness induced by muscular contractions may play a role in this. Physical models of tuna-like fins [4] have been engineered to test regimes for dynamically stiffening the tail structure during swimming and have shown the potential for significant energy savings, particularly for trajectories along which large speed variations are expected.

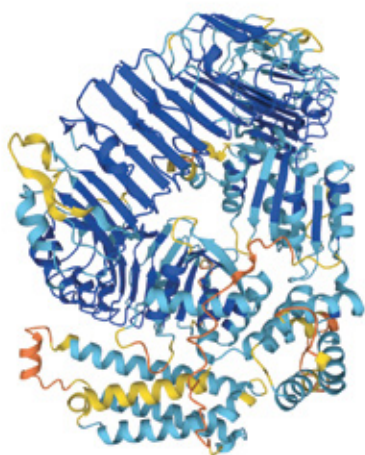
Professor Holger Krapp (Bioengineering) and colleagues have studied the computational and control systems of insects during flight. The team has expertise in showing how relatively low-complexity vision systems are coupled directly to flight control surfaces in flies. These form closed-loop control systems that, together with other sensors, cover a wide dynamic range of motion characteristics; by engineering these into analogue, rather than digital circuitry, these systems can be made very energy efficient compared to their digital counterparts. Similar control systems are being engineered directly into unmanned ariel vehicles in collaboration with Professor Mirko Kováč (Aeronautics).

Computation

The current boom in artificial intelligence owes a lot to modern machine learning, driven both by computational power and availability of data. But a key idea that has driven the currently rising tide is the humble artificial neuron. Although a single artificial neuron is a poor imitation of its spiking biological counterpart, large collections of these artificial units have been found to be very good at solving well-posed problems of image recognition. Whilst one should be cautious about over-stating the capabilities of the current generation of artificial neural networks, it is quite clear that these algorithmic structures, and their training processes, have significantly broadened the tools available to engineers who are engaged in building intelligent systems, including self-driving cars and systems capable of interpreting written documents (natural language processing).

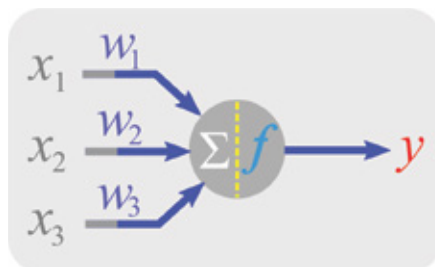
Just emerging over the horizon, we see that research by companies such as Alphabet's DeepMind is leading to new solutions to computational problems previously thought to be almost intractable, such as predicting protein folding [5]. These exciting developments also exploit networks of artificial neurons, customised to the nature of the protein folding problem and the desired predictions.

More recently, one of the challenges of systems built with artificial neurons has been to support continual learning, and specifically to avoid the problem of 'catastrophic forgetting', whereby previous capabilities are lost as learning progresses to address new tasks. Here, again, studies of biological neurons yield insights into the dynamic nature of synaptic connections. By devising descriptions of biological processes of learning [6], Professor Claudia Clopath (Bioengineering) and collaborators have suggested ways that even



Probable 3D folding of disease resistance protein Atlg58602, as predicted by DeepMind's AlphaFold AI system. AlphaFold suggests the shapes of complex protein structures using an artificial neural network and supporting bioinformatics (effectively, a computational model). The regions of this prediction are colour-coded according to model confidence.

Rendering courtesy of UniProt protein data bank.



(Left panel) A basic artificial neuron can be implemented in analogue, digital hardware, or software. A simple unit such as this one, does not spike like its biological counterpart; instead, the weighted summation of inputs, mapped through an activation function, f (Right panel), can be thought of as representing the rate of firing of a biological neuron. The weights and bias term define the input-output mapping.

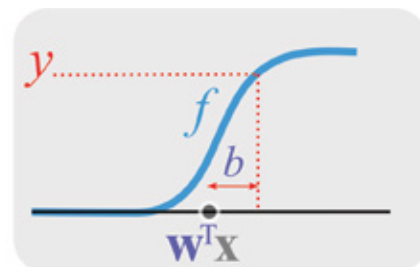


Figure courtesy of the author.

artificial neurons can be endowed with the vital property of plasticity, enabling them to learn continuously, and therefore to adapt to changes that take place over relatively short time-scales. The hope is that we will be able to engineer intelligent systems that can more successfully cope with alterations in their operating environments without having to retrain them, a costly and expensive exercise.

Conclusion

One final area, of relevance to us all, and where bio-inspired engineering is also creating a mark, is in technologies for healthcare. For example, Professor Ferdinando Rodriguez y Baena (Mechanical Engineering) and his team have developed actively steered needles [7] that have been inspired by the mechanisms and control methods of insects' ovipositors; these steerable needles are capable of following paths through tissue with sub-millimetre accuracy, potentially reducing damage to surrounding tissues when deployed in minimally invasive surgical procedures.

Can we propose a recipe for the process of transferring successful strategies and techniques of nature to the engineering domain? Despite the emergence of suggested methodologies to achieve this translation process [8], it is rather difficult to pin down one specific methodology that guarantees a successful approach to taking ideas from biology to solve an engineering problem. Instead, we should look to ideas that arise from the pursuit of basic or fundamental science.

Indeed, we find that successful examples of bio-inspired engineering and innovation [9] frequently take the form of a journey, possibly over many teams of scientists, mathematicians and engineers, that traverses almost all areas of science and technology, from fundamental biology through physics and mathematical modelling, all the way to engineering and process design.

Acknowledgements

The author wishes to thank Dr Florian Bouville for vivid explanations of ceramic material structures; Dr Naomi Nakayama (Bioengineering) for insightful comments and feedback; Konstantinos Ntagiantas (Bioengineering) for his patient explanation of ideas otherwise beyond reach; Dr David Labonte and Professor Claudia Clopath also supplied comments on early drafts.

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Anil Anthony Bharath is Professor of Biologically-Inspired Computation & Inference in the Department of Bioengineering at Imperial. He has worked on convolution-based architectures for visual processing since the mid 1990s. Anil has published in the fields of pattern recognition, machine learning and signal processing, and has extensive experience in computer vision. His current research is focussed on the use of deep networks for inference. Currently Vice-President of CGCA, he will be taking over as President in June 2022.

Sea-level change in Hong Kong's Victoria Harbour

The recently published UN Intergovernmental Panel on Climate Change (IPCC) Working Group II Sixth Assessment Report, titled *Climate Change 2022: Impacts, Adaptation and Vulnerability*, sets out the latest scientific findings for global governments and policymakers to aid them in taking action on climate change. It is the starkest warning yet of the dangers of failing to limit the global average temperature rise to within 1.5°C. But the horrific events of Putin's unprovoked war against Ukraine have overshadowed the warnings from the IPCC in both public and governmental attention.

For the first time, the report includes a detailed overview of the adverse impacts of climate change on mental health, and an emphasis on how misinformation has delayed climate action on an individual and collective level. Decisions to protect the most vulnerable, based on accurate science, are being impeded by deliberate misrepresentation of that science to protect vested interests.

Here in the last of his articles offering a personal viewpoint of other factors that contribute to climate change, alongside anthropogenic activities, Wyss Yim considers historical tide gauge data from Hong Kong's Victoria Harbour.

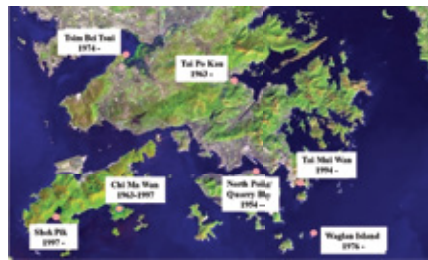
Long records of temperature rise available from cities are uncorrected for the urban heat island effect resulting from land-use changes and population growth. Consequently, for verifying global warming a continuously rising sea level is an important supporting indicator of warming.

In the present study, an investigation of sea-level change in Hong Kong's Victoria Harbour is made using the record of tide gauges from 1954-2021. Victoria Harbour is located on the coast of the South China Sea adjacent to the mouth of the Pearl River Estuary and Delta. Two pauses in sea-level rise of 33 years (1959-1991) and 23 years (1999-2021) duration separated by 9 years of accelerated sea-level rise (1991-1999) can be interpreted. Contributing factors include uncertainties introduced by the relocation of tide gauge station from North Point to Quarry Bay in 1986; a 60-year cyclic sea-level changes; ground instability; and variability of precipitation and atmospheric pressure. Sea level overall is rising discontinuously despite a continuously rising level of carbon dioxide. Another fifty years of observations assisted by land motion measurements of tide gauge stations provided by interferometric synthetic aperture radar (INSAR) are needed to confirm the cyclical changes.

The continuously rising levels of carbon dioxide is the main cause of global warming resulting in turn in sea-level rise according to the assessment reports of the Intergovernmental Panel on Climate Change (IPCC). However, the rate of sea-level rise which is based on carbon dioxide scenarios is uncertain and since the first assessment report in 1990 has been repeatedly revised downwards.

Six automatic tide gauges installed since 1950s at sites along the coast of Hong Kong are currently in operation. The oldest, North Point Station which came into operation in 1954, is located in Victoria Harbour on reclaimed land prone to ground settlement. Although settlement corrections have been made, they were partial at best because the benchmark used for surveying the elevation of tide gauge was erroneously also located on reclaimed land instead of on the bedrock needed to rule out settlement completely. In the early 1980s, because of possible construction disturbance by the Eastern Corridor and the East Harbour Crossing, North Point Station was relocated to Quarry Bay on newly reclaimed land about

500m east. Since 1986 uncertainties of ground settlement corrections were removed using a new benchmark, on bedrock, in surveying. Subsequently the combined record of the North Point Station (1954-1985) and the Quarry Bay Station (1986-2021) was adopted by the Hong Kong Observatory (HKO) and the IPCC as the annual mean sea-level record for Victoria Harbour and Hong Kong.



Tide gauge stations operated by HKO



North Point tide gauge 1954-1985 located on reclaimed land

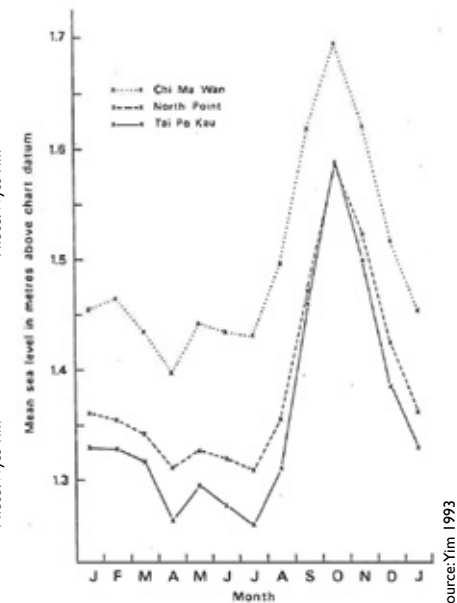


Quarry Bay tide gauge 1986-present located on reclaimed land

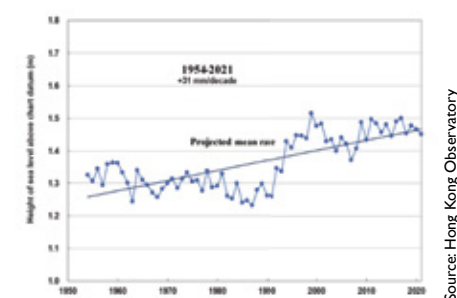
After ground settlement correction, a rate of future sea-level rise of 3.1cm/decade in the Harbour was projected by the Hong Kong Observatory. Under the *intermediate* and *very high* greenhouse gas emissions scenarios of the IPCC, the projected annual mean sea level in 2100 is likely to rise by 37-82cm and 57-108cm respectively relative to the average of 1995-2014 (1.45m above Hong Kong Chart Datum).

A comparative study of 1970-1984 monthly sea level at three tide gauge stations in Hong Kong (published in 1993 by the author) has revealed that major differences in sea-level elevation exist under the strong easterly monsoonal wind during winter and

spring. Out of the three stations, Chi Ma Wan Station abandoned in 1997 with maximum wind forcing has the highest mean monthly sea level followed by North Point Station with intermediate wind forcing and Tai Po Kau Station with minimum wind forcing. Monthly mean sea level at North Point Station is on average between 8-15cm lower than Chi Ma Wan Station while Tai Po Kau Station is on average between 2-5cm lower than North Point Station. Such a comparative study of sea-level variability is possible only when multiple stations are available like Hong Kong. North Point/Quarry Bay Station with the longest record and intermediate level of wind forcing make it the most suitable station for sea-level change study out of the three.



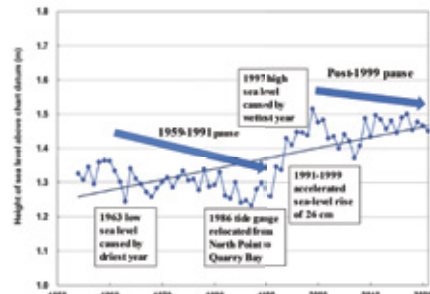
Comparison of 15-year monthly mean sea level during 1970-1984 at the North Point, Tai Po Kau and Chi Ma Wan Stations



Annual mean sea level in Victoria Harbour based on the combined records of the North Point/Quarry Bay Station

The changes in annual mean sea level found in the combined record of the North Point / Quarry Bay Station during 1954-2021 include:

1. Sea-level rise of 4cm from 1954-1959.
2. Pause in sea-level rise of 33 years duration from 1959-1991.
3. Accelerated sea-level rise of 9 years duration by up to 26cm from 1991-1999.
4. Pause in sea-level rise of 23 years duration from 1999-2021.



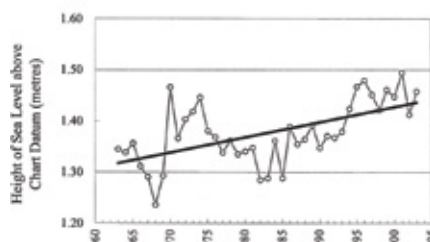
Changes in annual mean sea level found in the combined record of the North Point/ Quarry Bay Station

An improved understanding of the changes can be obtained by a comparison between the North Point / Quarry Bay Station record and the Tai Po Kau Station record. The three advantages of the Tai Po Kau record are:

1. Lowest monthly sea-level change in comparison to Chi Ma Wan Station and North Point / Quarry Bay Station as pointed out earlier.
2. The tide gauge is located on a pier with piled foundation less prone to ground settlement.
3. Unlike North Point / Quarry Bay Station a continuous record without interruption from the same location is available.

Differences found in a comparison between the North Point / Quarry Bay and Tai Po Kau records during 1963-2003 include:

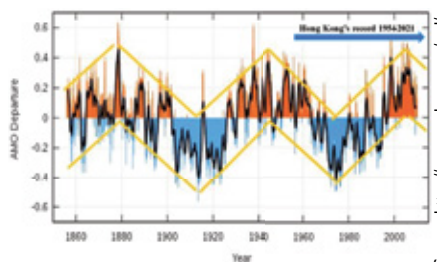
1. No agreement in the years with minimum and maximum annual mean sea level.
2. Absence of the two pauses of sea-level rise interpreted from the North Point / Quarry Bay Station record. In the Tai Po Kau Station record, only one pause of sea-level rise 25 years in duration is present from 1970-1994.
3. The wettest year on record in 1997 coincided better with an anomaly in annual mean sea level peak than in the North Point/Quarry Bay Station.
4. An accelerated rise in sea level of up to 13cm is observed during 1990-1996 in the Tai Po Kau Station record. The potential sea-level rise is 13cm lower than the potential sea-level rise of 26cm found in the North Point / Quarry Bay Station during 1991-1999.



Annual mean sea level at Tai Po Kau Station during 1963-2003

Because continuous sea-level rise is not supported by the record of tide gauges, other local and regional controlling factors including astronomy, tectonics, climate and man-made are examined. A summary table of these factors and their explanation is provided below.

The pauses in sea-level rise may be explained by astronomically-driven multidecadal cyclic changes. Out of these changes, the 60-year cycle originally identified and introduced into the Chinese Calendar around 2637 BCE, which appears in phase with the Atlantic Multidecadal Oscillation (AMO), is particularly easy to observe. Significant surface temperature maxima accompanied by accelerated sea-level rise occurred in 1880-1881, 1940-1941, and 2000-2001. These warmer periods coincided with times when orbital positions of Jupiter and Saturn were relatively close to the Sun and Earth.



AMO time series with a 12-month moving average (black) 1856-2013. The pattern of sea-level change found in the 1954-2021 record in Hong Kong's Victoria Harbour is in general agreement.

Type	Feature	Explanation
Astronomy	Cyclic change in sea level	Cycle length approximately 60 years tracking the Atlantic Multidecadal Oscillation
Tectonics	Crustal instability through loading and unloading	Tectonic movement, erosion and deposition including mass movement and sedimentation
Climate	Lowest uncorrected mean sea level of 1.28m above Chart Datum in 1963	Driest year since record began at Hong Kong Observatory's Headquarters Station; high local/regional pressure and low Pearl River discharge
	Highest uncorrected mean sea level of 1.51m above Chart Datum in 1999	Possible influence by the wettest year since record began at Hong Kong Observatory's Headquarters Station in 1997; low local/regional pressure and high Pearl River discharge
	Accelerated sea-level rise of up to 26cm 1991-1999	Partially explained by cyclic climate changes
Man-made	Low relative sea level 1985-1987	Uncertainty introduced by the relocation of the North Point Station to Quarry Bay including ground settlement
	Isostasy-related sea-level change	Human activities including coastal reclamation, construction loading, landfills, quarrying, mining and dredging
	Fossil fuel driven sea-level rise	Not addressed in the present study

Summary table of local and regional controlling factors for annual mean sea level in Hong Kong's Victoria Harbour



Professor Wyss Yim DSc PhD DIC FGS was at Imperial College in the Department of Geology from 1971-1974. After that he spent 35 years until retirement at the University of Hong Kong where he taught civil engineering, geosciences and environmental management students, and helped found the Department of Earth Sciences. He was awarded the DSc by the University of London in 1997. Wyss served as President of the Western Pacific Sub-commission on Quaternary Shorelines (1995-1999), President of the Shelf Carbon Group (1999-2003) and President of the Sub-commission on Continental Shelves (2003-2007), all bodies of the International Union for Quaternary Research.

Imperial Black Alumni Network

The College's Alumni Relations team are working with alumni to establish a network for Imperial graduates of Black heritage. The Network will initially aim to:

- Support the personal and professional development and lifelong learning of Black heritage alumni through peer-to-peer support, networking and events;
- Build on the unique shared experience of Imperial alumni and promote the exchange of inspirational ideas, know-how, resources, and insights;
- Leverage and celebrate the achievements of its community to inspire and support other Black heritage alumni and students to advance in their careers;
- Provide a source of support for relevant initiatives and programmes at the College.

They hope to officially launch in summer 2022 and are currently recruiting volunteer committee members. Committee members will collaborate with Imperial's Alumni Relations team to shape the network's strategy, events and activities.

"We want the network to be alumni-led," says Kellianne Bartley, Alumni Engagement Officer. An initial discussion, with over 80 alumni and

students in February, explored what the network could look like, how it could benefit members and create a supportive community. Kellianne adds: "A key part of the network will be creating a supportive community and fostering a greater sense of belonging through events and initiatives that bring alumni and students of Black heritage together."

Alumni who attended the initial discussion said that it was great to come together as a community to hear different and varied experiences and opportunities, and share feedback and perspectives.

This new Network will join other alumni groups, such as Imperial Women's Network and the Healthcare Network. These professional interest and affinity networks provide a forum for Imperial alumni and professionals working in, or with a particular interest in, a specific sector to share ideas, challenges and expertise, and address topics of interest in their sector, industry, or community.

Those interested in applying to be a committee member of the Imperial Black Alumni Network should apply by Monday 6 June. More information can be found on the Alumni volunteer pages, at <https://bit.ly/IE36-Volunteer>

Cathy McClay awarded OBE



Photos courtesy of Imperial College, London

We were thrilled to hear that alumna **Dr Cathy McClay** (Elec Eng 1988-92) had been recognised in the New Year Honours List with an OBE for services to the energy sector and the promotion of decarbonisation. Cathy specialises in modelling and analysis for trading, risk management and strategy, especially for the transition to zero carbon. She is Director of Trading and Optimisation at Sembcorp Energy UK.

Cathy was the first female President of CGCU in 1990-91, is a life member of CGCA and was active as a member of the CGCA Committee in the early 2000s. After obtaining her doctorate at Cambridge, she returned to Imperial as a lecturer, and then moved into industry in 1999. She was listed as one of the Top 50 Influential Women in Engineering in 2016. In 2018 she returned to Imperial as a Visiting Professor.

Imperial Alumni Awards 2022

Alumni Entrepreneur Award

Launched in 2021, the Alumni Entrepreneur Award recognises innovative and creative alumni entrepreneurs who can demonstrate commercial success, growth and impact. This year's winner is **Dr Tasos Kounoudes** (PhD Electrical & Electronic Engineering 2000), who founded SignalGeneriX, one of Cyprus's first R&D technology companies, after completing his studies at Imperial.

Thinking back to his company's early years, Tasos says: "High technology R&D was a completely new industry in Cyprus at the time, and now lots of people work in this field."

When asked for his advice for budding entrepreneurs, Tasos is quick to point out the importance of facing challenges head on: "We face challenges from our first day of education. We're taught, and learn through our professional career how to find solutions. I still face new challenges after running the company for so many years."

More details at
<https://bit.ly/IE36-Awards>



Emerging Alumni Leader Award

Six alumni have been recognised with the Emerging Alumni Leader Award, which celebrates graduates from the last 15 years who are inspiring role models, mentors or champions for equality and are making an impact on society.

The winners include two engineers: **Mervin Azeta** (MSc Sustainable Energy Futures 2015), who was motivated by a tragic loss to dedicate herself to making energy available to all; and **Tony Shen** (MEng Aeronautics 2007), a leader in Asian aerospace who is addressing sustainability and tackling gender imbalance in STEM.

Xin Deng wins young scientist award

Congratulations to alumna **Dr Xin Deng**, a former PhD student in the Department of Electrical and Electronic Engineering, who has won the Female Young Scientist Award from the Chinese Society of Image and Graphics (CSIG).

CSIG's 'Shi Qingyun' Female Scientist Award is presented to women who have made remarkable contributions to the development of image and graphics research.

Xin is an outstanding scholar who was the winner of the department's Eryl Cadwallader Davies Prize for best PhD thesis in 2021, and was awarded a bursary from the department to help her pursue her studies. Her work has led to



the introduction of many new deep neural network architectures that are more interpretable and simpler than existing ones, yet lead to state of the art results.



Imperial alumni selected for Fashion for Good's Global Innovation Programme

DyeRecycle, founded by Imperial Chemical Engineering PhD alumni **Aida Rafat** and **Anton Firth** is among eight start-ups selected to be part of a nine-month Global Innovation Programme run by Fashion for Good.

DyeRecycle's innovative thinking proposes a new way to colour clothing sustainably, using a circular chemical technology to decolour textile waste and reuse old dyes.

The team pitched their innovations to Fashion for Good whose mission is to bring together the entire fashion ecosystem through their Innovation Platform and as an advocate for change.

The selected innovators for the programme represent technologies across raw materials, processing and end-of-use innovations; three pivotal areas for significant impact and carbon reduction opportunities. The 2022 Innovation Programme provides bespoke support based on the development stage and ambitions of each innovator, matching innovators with relevant industry partners to drive piloting, implementation, and investing activities.

Commenting on their successful pitch Rafat and Firth said: "We are very excited to participate in the nine-month Fashion For Good (FFG) innovation program to accelerate our commercial and technical development."

"Having this access to the FFG ecosystem and partners will allow us to better understand customer needs and where to best fit our technology in the supply chain. The value of the program also extends beyond nine months, as we will continue to have access to FFG partners and support as a program alumni."

The fashion industry is a major polluter in need of an urgent makeover. Responsible for up to ten per cent of global emissions, it has been a disaster for people and the planet.

With a destructive and irreversible effect on the environment, it depletes the world of non-renewable resources, releases greenhouse gases into the atmosphere and drains vast amounts of water and energy.

It is estimated that the fashion industry is responsible for two to eight per cent of global CO₂ emissions – greater than all international flights, maritime and shipping combined.

DyeRecycle develops innovative circular solutions for dyeing using textile waste. Their proprietary technology combines the need to recycle both dye and fabrics.

The circular process uses a unique liquid that selectively extracts dyes from coloured waste fabrics. This decoloured fabric can be recycled more effectively, and the extracted dye is transferred to new fabrics, creating a new concept of "recycled dyes".

Their technology also has the capability to transform textile waste scraps into dyestuff powder – a fine-powdered pigment used in manufacturing and the visual arts.

DyeRecycle's mission is to dramatically reduce fashion industry's chemical and water footprint in a cost-effective way by giving old fibres and dyes a second chance. The process provides at least 85 per cent reduction in dyestuff and chemicals use compared to conventional dyeing process, along with 65 per cent reduction water footprint and 70 per cent less global warming potential.

Reflecting on the Global Innovation Programme, Rafat and Firth added: "Being mentored by industry experts will ensure that our technology development is in alignment with the value chain requirements, and therefore facilitate our integration to the supply chain. It is a great opportunity for us to build long-term partnerships with brands and manufacturers to work with in the future."



Dr Aida Rafat, co-founder of DyeRecycle

Alumnus awarded €2.5 million European funding for saltwater battery

AquaBattery, founded by Imperial alumnus **Jiajun Cen**, has recently been awarded €2.5 million in grant funding from the European Innovation Council's (EIC) Accelerator. The team is developing a low-cost and sustainable long-duration energy storage solution with the vision of enabling a global transition to net-zero renewable energy.

The company's patented innovation uses just saltwater as the storage medium for the energy, which the team says has many advantages. As a flow battery – a battery which stores energy in electrolyte liquids – AquaBattery's innovation can independently amend power (kW) and energy (kWh) capacity. Thus, increasing storage capacity is as simple as adding water reservoirs to their system or using larger tanks. The team's technology uses abundant, non-toxic materials, such as water and table salt, unlike conventional lithium-ion batteries. This ensures safety from fire and health risks, while also having a low carbon footprint. As a result, AquaBattery say their solution will be low-cost, highly scalable and sustainable.

Energy supply from renewable sources such as solar and wind is intermittent, and excess electricity is lost if the energy is not stored. With the rising share of renewables



in the power mix, long-duration energy storage technologies are critical to integrate green electricity into the grid and support the decarbonisation of the economy. AquaBattery's solution could provide virtually unlimited storage capacity from 8 hours up to days, weeks or even seasonally.

Recent world events such as the war in Ukraine and the coronavirus pandemic have highlighted the importance of energy security and supply chain resilience. The team say their technology could contribute to European strategic autonomy by enabling the uptake of renewables and commercialising a technology which does not depend on vulnerable supply chains.

Jiajun founded AquaBattery in 2014 while studying for a PhD in Chemical Engineering at the College. After graduation in 2019, Jiajun then spent several years in the department as a visiting researcher and now works full-time at the company's office in the Netherlands.

Bumblebee raises £750,000 from investors

Bumblebee Power, the developer of lightweight, high frequency wireless charging technologies for transport and mobility applications, has raised a £750,000 seed round from investors including the Imperial College Innovation Fund.

Bumblebee was founded by engineers **Dr David Yates**, and **Professor Paul Mitcheson** from Imperial's Department of Electrical and Electronic Engineering, with the aim of transforming wireless charging into a practical, efficient and safe technology suitable for multiple applications, including e-bikes, e-scooters, drones and electric vehicles. Its proprietary technology is licensed exclusively from Imperial. In addition to transport-related applications Bumblebee's technology could provide automatic power charging for mobile devices such as laptops, phones and peripherals.

Bumblebee Power has developed highly efficient wireless charging technology that, when compared with existing solutions, offers three times the size of air gap, three times the tolerance to misalignment and inter-operability between different vehicles from a common transmit



unit. Combined with its low weight (less than 20% of similar products) and significantly lower cost, Bumblebee believes its technology could create a step-change in a range of areas.

"Bumblebee provides the only wireless charging solution that delivers the lightweight, wide power range and freedom of position performance that users really want. Our offering will transform wireless charging from a nice-to-have to a must-have technology across multiple markets," said Dr David Yates, co-founder of Bumblebee Power and co-inventor of the underlying technology.

The funds raised in this seed round will support initial field trials for a wireless charging system for e-mobility vehicles, scale-up to 7kW power capability and product development for a number of potential customer requirements.

A mile that transcends time to bring people together

Our regular Canadian correspondent, Nigel Fitzpatrick, (Metallurgy 1962-65, 65-68) reports on memories of the 'Miracle Mile' in Vancouver, meeting Roger Bannister, and coping with Parkinson's disease.

Born in a coal town, I grew up in a steel town. The world was changing fast, and I was fortunate to spend 25 years with Alcan where its stable surface enabled the growth of beverage can recycling via a thermal process developed in Ontario, where oddly it had been illegal to sell beverage in aluminium cans. From thermal processing, a move to finding new energy conversion technologies brought us out to the Pacific coast of Canada.

My Parkinson's Journey

October 2009: Helping with IP at Azure Dynamics (spun out of BC Research Inc.), I volunteered as a 'Greencoat' at Vancouver International Airport (YVR).

April 2011: My arm kept unhelpfully rising when I ran for Azure in the Vancouver 'Sun Run'.

October 2012: I was diagnosed

with Parkinson's Disease (PD). Briefing more people than wanted to know, we carried on. Rubbing left fingers and thumb together quelled my right shaking side as long as I remembered to do it. Medication started in the following year and was adjusted in time for a smooth trip to the UK and India.

Apprised, YVR management suggested that 'Greencoats' could help travelers with PD if formally briefed by Parkinson BC with me as an example. Three talks were given. I learned how important it is to keep moving.

November 2019: A 10-year YVR pin at a dinner, helping passenger waiting to board flights back to December fires in Oz.

Mid-January 2020: We were wiping surfaces touched by boarding passes.

The YVR program went into

abeyance in March 2020. I returned my uniform, feeling it would be some time before a person in their late 70's could walk there safely. There was time to reflect.

Thinking back to an alumni event in 2016, where we played a CBC recording¹ of the Vancouver 'Miracle Mile' of 1954 and found the topic brought all together, refreshed a memory of mine of meeting Sir Roger Bannister courtesy of friends in Kingston now alumni of an expanded Imperial. Below is an article 'Setting an objective' drafted around the 50th anniversary in 2004 and finally edited for its publication here with the help of the friends mentioned.

Sadly, Bannister, an outstanding neurologist and athlete, died in 2018 with Parkinson's disease which he had treated many times

¹ The dramatic race can be seen on the CBC Archive website at <https://bit.ly/IE36-Miracle>

in his patients and had championed support for. Landy died in February 2022 after a long battle with Parkinson's disease.

Here in Vancouver, young people continue to be inspired. The 'Miracle Mile' continues to be remembered at the BC Sports Hall of Fame, where the curator, Jason Beck, has authored an excellent account² of how the competition between Bannister and Landy drew the attention of the global media to the value of egalitarian sports which was exemplified in Vancouver. I learned from Jason that statues of the two contestants by the track that still bring visitors are close to the point where John Landy looked back as Bannister overtook him.

Best of all, as I sat down to write this introduction, issue 51 of *Imperial* (the magazine for the Imperial community) arrived. On page 07, in the Imperial Innovates section, an article entitled *Smooth Operator* describes Lucy Jung's gallant quest for people with Parkinson's³.

Wow! *Imperial* is a still place to cheer for!

² Jason Beck "The Miracle Mile" Caitlin Press 2015

³ Find out more about Lucy and her startup Charco Neurotech at: <https://bit.ly/IE36-Lucy/>

SETTING AN OBJECTIVE

A quarter of a century ago in Kingston, Ontario, the wife of my future best man phoned and said, "I need someone to accompany me to dinner in an hour." To spare you the details, I complied.

My caller, Jan Hill, had been a charge nurse, at St. Mary's Hospital at a time when Sir Roger Bannister had trained as a Neurologist. Dinner was at the home of Donald and Patricia Forsdyke for St. Mary's alumni drawn together that day by the annual Brockington lecture at Queen's University, delivered by Sir Roger.

Seated opposite him and not being a medical person, I was tongue-tied until I remembered struggling to do underwater lengths at a public pool. Mentioning oxygen resulted in a delightful discourse from which words remembered include, "The important thing is to set an objective."

May 6th, 1954, Sir Roger's objective setting led to the first sub-4-minute mile in Oxford. June 21st, running in Finland, John Landy of Australia took the world record down to 3:58.0. The media were enthralled the two stars would meet at what became dubbed the 'Miracle Mile' at the Commonwealth Games in Vancouver where both came in under four minutes. Though Bannister won, the record was held by John Landy until 1957.

The event in Vancouver is commemorated by a statue of the two men, with Landy being overtaken while turning to see where Bannister was placed.

On August 7th, 2004, the 50th anniversary of the 'Miracle Mile', I set an objective to mark out a mile and run it before 8 am. Twice in a car I measured out 1.6 km, and then I estimated the extra .093 km to complete a mile. There were Block Watch signs on both streets used, and it is possible homeowners reported a suspicious, slow-moving car despite my early morning start!

The route included a mild hill as well as two dog walkers who were not to be hurried. The result was not dramatic. Allowing myself to adjust for age, I multiplied my time by 0.805 for a feel of what my pace that day would have been at Roger Bannister's age in 1954. I calculated that this plodder would have been just beginning his 3rd lap when Rich Ferguson of Toronto, who was behind John Landy and Roger Bannister, finished his 4th.

Although the 1500 metre race at the Olympics remains the premier event to watch, the mile is still run, and by 2004 the record was 3:43.13 by Hicham El Guerrouj of Morocco. Canadians routinely get under four minutes today, and the person who sold me my 2004 road running shoes at Forerunners <http://www.forerunners.ca/> had recently done the mile in 4:05.

As a sexagenarian already then, it was late for me to think of racing. My own objective was just keep running safely! For 2022, walking replaces running.

Written by Nigel Fitzpatrick, ex RSM, with help from Jan, Patricia and Donald ex St. Mary's and Joan Fitzpatrick ex Westfield College. Originally written in 2004 – edited in January 2022.



Photo courtesy Joan Fitzpatrick



Photo courtesy Joan Fitzpatrick



Photo courtesy Joan Fitzpatrick



Photo courtesy Rodrigo Silva de Paula

Now, walking replaces running for Nigel, including walking in snowshoes. He credits Allie Saks who has the Vancouver concession from Rock Steady Boxing for keeping him on his feet at <https://bit.ly/IE36-RockSteady>

Book Review

MARTYR OR MURDERER? THE STORY OF MADAN LAL DHINGRA

Bill McAuley, the previous editor of Imperial ENGINEER, reviews a new book, *Exhumation: The Life and Death of Madan Lal Dhingra* by Leena Dhingra, published in 2021 by HopeRoad Publishing and available from major on-line booksellers.

Sixty years of age and weathering have softened the Portland stone on the southern tier of the Queen's Tower. Few students working or sunning themselves on the eponymous Queen's Lawn will realise that this was originally the centrepiece of the Imperial Institute. Perhaps none know that, on the evening of Thursday 1 July 1909, a young Indian nationalist shot and killed Sir William Curzon Wylie, a senior member of the British Indian Government, as he was leaving a function at the Imperial Institute. His story has been told by his great niece, Leena Dhingra in a new book which mixes biography with personal memoir.

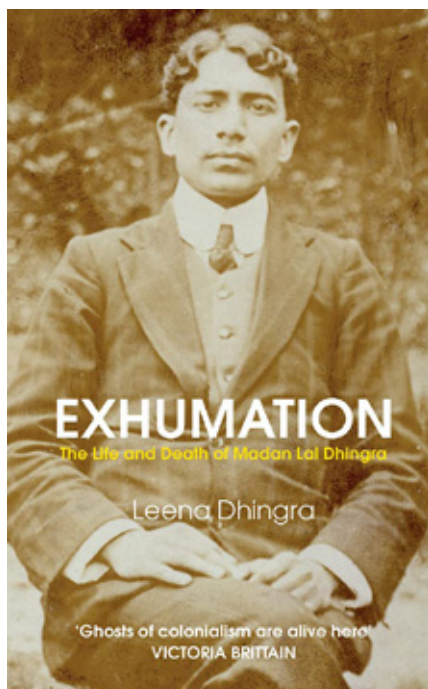
First, a little more on the Queen's Tower. The Imperial Institute was built in 1893, to house private collections donated from throughout the Empire, and other functions. These were gradually taken over by Government in most areas but the educational and cultural functions were transferred to the renamed Commonwealth Institute. A new building to house its activities was constructed on Kensington High Street and completed in 1962. Following the decision to demolish the original building, the intention was to level the site completely, but thanks to a spirited campaign led by Poet Laureate John Betjeman (and modestly supported by this writer in his then capacity as *Phoenix* editor) the tower was saved and the additional construction added to support it.



The Imperial Institute from around 1905

Madan Lal was born into a prosperous family in Amritsar in 1883. His father, Dr. Ditta Mal Dhingra, was a surgeon and had eight children. Seven were boys and all studied abroad. From Leena's account, it seems that the younger generation were content to continue in the family's privileged position as upper class professionals and interlocutors with the British Raj. Not so with Madan Lal. As a youth he had signed on as a lascar and spent some time on merchant vessels trading between India and the Far East.

He was persuaded to resume his studies and attended the Government College University in Lahore from 1900. There, he became involved in activities involving independence movements which led to his expulsion in



1904. After considerable family friction, he finally agreed to join one of his brothers in London, and in 1906 he departed to enroll in Mechanical Engineering at UCL.

Far from being softened by the Imperial capital, he became increasingly radicalised by several Indian nationalist groups, resulting in his being disowned by his father. By 1909, he had developed a plan to target and assassinate a senior figure in the Indian Government and on that fateful July evening he succeeded. In his subsequent trial, he made no attempt to deny his actions. He was found guilty and was hanged at Pentonville in August. The reaction at the time was generally outrage, including from Mohandas Gandhi who was likewise committed to the goal of Indian autonomy but equally committed to non-violent action. Madan Lal was buried without ceremony, but his remains were returned in 1976 at the request of the Indian government. He is a hero to the Hindu establishment but not apparently, to most members of his family.

So much for Madan Lal, and this is where Leena's magic begins. Born in 1942, she was a five-year old in Paris in 1947 (where her father had taken a temporary appointment with UNESCO) when Partition transformed the family into instant exiles. The Radcliffe Line had fallen like a sword on the Punjab, sundering the province and leaving Leena's family in Lahore, now in Pakistan, cut off from India, their country. Now in effect stateless, Leena interweaves her own story – part chronicle, part memoir, part lament – into Madan Lal's story.

A brief summary of events leading to Independence and Partition will be useful. Following the events of the First World War,

where citizens of every religious persuasion from every part of British India volunteered in their millions in defence of King and Country, national consciousness continued to emerge in all parts of the Empire. No more so than in the subcontinent, but here the centuries-old tension between Islam and the other faiths, particularly the majority faith, Hinduism, was a major complicating factor. By the thirties, most in the Raj and in Britain had accepted independence as the goal, but here, more than anywhere else, the Devil was in the detail. The eruption of war for the second time in 1939 froze deliberations but, after victory over Japan in August 1945, events moved into fast forward. The new Attlee government was anxious to shed its responsibilities for the Raj as soon as possible and in selecting Lord Mountbatten for the role, Attlee picked a man in even more of a hurry. He rapidly concluded that granting independence as a single polity was impossible and that creation of a separate Muslim state the only answer. This presented a major challenge not only in Punjab, but also the even more populous state of Bengal. There, an earlier attempt by the Curzon administration in 1905 had failed and been reversed in 1911. Ironically, it was this earlier attempt that had enraged and further radicalised Madan Lal.

Cyril Radcliffe, a distinguished lawyer whose personal international experience had only taken him as far as Paris, was made chair of the two boundary commissions and given only five weeks (!) to make decisions affecting the lives of many millions. In the event, it resulted in the chaotic displacement of 14 million people (7 million on each side of the lines) and the indiscriminate slaughter of a million and a half. Although personally I only have a limited understanding of the period, I came to the conclusion long ago that this was the worst failure of British foreign policy in the twentieth century. Britain may have dismantled the Empire relatively peacefully, but the consequences in the Raj were horrific. It is a bitter irony that Mountbatten himself was murdered in one of the aftershocks of another partition – in Ireland.

Leena captures the sense of her family's dispossession brilliantly, chronicling her return to India for part of her education and, later, her move to Britain to drama school. I first met her socially in 1961, and we have been friends off and on ever since. But it is only now that I really understand her back story, and, through her, a major historical convulsion whose reverberations continue to the present day. She tells the story simply, avoiding any judgements. It makes the narrative even more compelling, and I would urge people to read it.

William McAuley

53rd Triode meeting 8th January 2022

Good and bad about Covid

With Omnicom rampant and London in close-down, Triodes kept saying they couldn't make it, until it looked as it was just down to Addy and Martyn to meet at The George (where the Strand meets Fleet Street). Not that we would have minded, wasn't last year's kitty to be spent, but then we thought what if one of us were to go down with it?

So, a management decision was taken to meet via Zoom (see picture). Many thanks to Peter Cheung who set up an Imperial Zoom account for us. We had participants from Europe and Australia and we reckoned that we had about seven times as many Triodes as we would have had if we had stayed with a physical meeting this year.

Peter Cheung gave us an update; using videos shot by the students themselves of some of the projects that the Dyson School of Design Engineering and Imperial were working on. For example, The Tyre Collective, a project by students that aims to recover the tyre particles that come off tyres as we drive. This has the ability to reduce tyre pollution by half! Tyres are the second largest cause of plastic particulates in the air and sea! A great idea, and there are others such as a novel use of gyro effects to create a self-balancing Amazon box and even self-actuating dancing robots!

Important news about the next two Triode Reunions – 2023

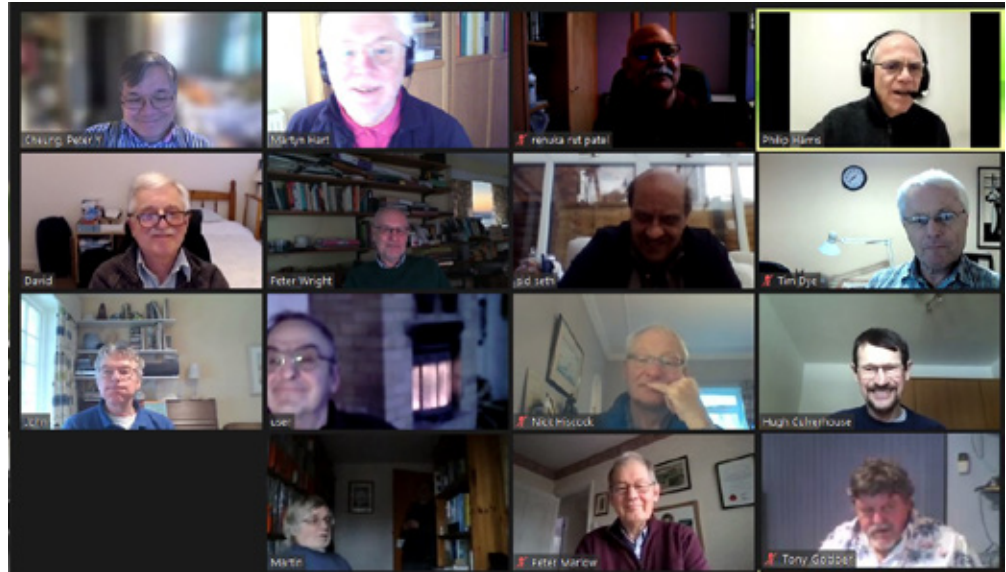
2023 is important to us and the college. Firstly, on 6th January 2023 it will be our 54th reunion at 7pm at the George, Fleet Street (see above).

Secondly, it is our 50th year since graduation!! Imperial will host a 50th decade lunch for us on the 18th November 2023. So, please block out that date now, we don't want to find you are on a holiday in November 2023, save that for 2024.

It would be really great to get as many of our old colleagues back to IC for a meet up, so do you know any that are hiding from us? Winkle them out, get them to come. They can't have heard all my jokes!

There is an opportunity to continue with our festivities after the decade dinner (lunch really), we could add on something like a trip around the Dyson School of Design Engineering (if that is OK with Mr Dyson and Peter Cheung). Or maybe memory lane would be good too? Such as visiting Elec Eng and the Union bars.

It's actually Professor Brown's 95th birthday in 2023, I wonder if he is mobile, could he be our star guest at the dinner? Sorry heavies, Prof.



1st (top) row, from left to right: Peter Cheung, Martyn Hart, Rut Patel, Phil Harris.

2nd row: David Mansfield, Peter Wright, Sid Seth, Tim Dye

3rd row: John Harding, Jorge Gabrielczyk, Nick Hiscock, Hugh Culverhouse.

4th row: Martin Clemow, Peter Marlow, Tony Godber

Laithwaite passed away some years ago but maybe Prof. Eastham could be found?

Do you have an idea? Perhaps mine are too lame? Please let me know and we can try it.

Of those who Zoomed in (there were 15 of us!):

Dave Mansfield

Dave is still carrying out building works at his house in Cambridgeshire, he's been living in Potton, Beds, since May and it looks like he'll be there until at least July before they can return to a more comfortable life.

Dave said that he was very lucky to have sold their house in France before the second Covid wave hit, and as a result decided to renovate his UK 1970's house – one of the houses that 'Jack built' very badly. He did all the architectural drawings for the renovation project on ArchiCAD, and got planning approval in early June (they live in a conservation area with fussy neighbours). This was just after the builder's 'demolition' gang had started work (and whilst on the call they were still demolishing bits) so the house currently exists with half of the roof missing, no ceilings, bare floor joists upstairs, ground floor slab with no screed and most of the windows missing!

This is indeed a big project, but Dave is very positive about it and his insulation/heat pump combination. "If anyone wants advice on this, just ask," he says.

Hugh Culverhouse

Hugh's news is that it's been more or less another non-year, with no travelling abroad and as good as no travelling within Germany either. He hasn't even managed to get out for

a few days hiking but in the first half of the year, he did a lot of running and completed another marathon on March 6th to "celebrate" exactly 50 years since his original hip stress fracture occurred whilst running for IC in 1971.

By May, he was getting out more on the bike, but unfortunately bumped into a car on the cycle path. The impact led to multiple right wrist fractures, but he managed to protect his already severely damaged left hip. But the wrist injury was a major blow, because he needed his right hand to hold his walking stick! Hugh's wife Margaret had to do all the shopping but he could at least park himself in front of the stove!

Hugh's been working again on his Plessey history book and also on the Family Tree. Plus, with his son, he's been completing a renovation of his Granny Flat (or "Hobbyraum" in German). He still gives English lessons, sadly all online, which he says keeps his brain a bit more active.

John Harding

John reported that he retired a couple of years ago and caught what appears to have been Covid soon afterwards. He is now recovered and is enjoying having time for family and hobbies.

George (Jorge) Gabrielczyk

Jorge reached out from his fortress of solitude in snow-bound Jelenino (-8°C and about a foot of snow at 3pm!). He said they are having a proper winter, the first for about five years, and it has to be the one where nearly all of the windows in the manor have been knocked out and most of the internal doors and ceilings removed!

Replacing the roof seemed a good

idea in Spring, with Covid receding and buds a-budding, birds a-singing and builders all het up and ready to go a-building. Fortunately, they did not get very far before the plague hit and the builders went sick, seemingly permanently. His stand-by builders managed to put back what had been removed on the roof, but not the ceilings and the windows were tacked over with polythene film. So, what we saw was Jorge in one rather draughty room with a very large wood burner!

The good news is that, as of end of October, Jorge has a fully functional carpenter's shop complete with professional machines, carpenter and supplies of carpentry-grade pine and oak. They are making themselves, in the correct style, all the joinery for the manor, including doors, but not windows as he hopes the Polish Heritage Department will let him use plastic as it's much more practical.

Although semi-retired, Jorge continues to chair one quoted company but otherwise he has devoted all his time to the rebuild work plus the deer herd, which now numbers well over 1000.

Martin Clemow

Martin says that he is lucky to live in an area of the country, Somerset, where the levels of Covid 19 are relatively low so he has not suffered much Covid effect. He is now (officially) fully retired but finds himself with less time than ever, being called upon, by other people, to work on classic cars, electrics and even plumbing.

They are trying to sell their house in France as it is currently tough to get there, though in the

summer they did manage to have 4/5 weeks "holiday". At the moment, there is little interest from buyers from the UK but he's found quite a bit of interest from Germany, Belgium and the Netherlands where they consider it to be a staycation because it is in Europe!

We saw two of his sons, Simon and David, on the screen when they asked for advice on the Mini gearbox that Simon was rebuilding in Martin's garage. Simon acts as Martin's IT guru (to assist with technicalities like muting the microphone!) and David is about to set up his own cabinet-making business. Daughter, Elisabeth, is a director of a company manufacturing printed sleeves for electrical wiring and his youngest son, Philip, is a senior tutor at Imperial College where he sees Peter Cheung on a regular basis.

Nick Hiscock

Nick stood down as Rear Commodore House to Warsash Sailing Club in mid-year as Sue, his constant companion/wife of some 50 years, became increasingly unwell during the year and then sadly passed away in December.

Some Triodes will remember that Sue (a veterinary surgeon) attended one of Professor John Brown's 3rd year lectures in Optical Electronics in December 1972.

However, Nick and Sue did manage to support the Napoleonic Cavalry at the UK Battleprom events this summer – Nick as the "armourer" and supplier of period weapons and Sue as ground crew.

Elder daughter, Jennie, continues as a Reader in supramolecular chemistry at the University of Kent where she leads a research team developing very interesting molecules that can be used to form novel anti-microbials and antibiotics or identify microscopic amounts of toxic compounds. Younger daughter, mathematician Pippa, a research team leader at Lockheed Martin, has just commenced maternity leave, the first Hiscock grandchild is expected in January.

Peter Cheung

Peter gave us an amusing chat about when he started as Head of the Dyson School of Design Engineering in 2019 and how all the memorable dates for the school seemed to coincide with disasters in the real world – such as Covid 19! We asked him to retire!

The School has been a great success and now has 90 students (of which 30% are female – completely different to our first year at IC – 3% female!). They are located in the old Post Office building at the corner of Exhibition Road and Imperial College Road which has had a £30 million refit.

He didn't have time to talk about his granddaughter but we

all remembered last year when he showed us the large rocking horse that he had carved for her – fantastic!

Peter Marlow

Peter and wife Sally staycated this summer in the Lakes, near Keswick, and the Yorkshire Dales and were rewarded with brilliant weather(!). Their son's wedding was postponed yet again until June 2022 (third time lucky). However, they were delighted by the arrival of a new grandson in February. Peter continues to work with PM4NGOs, an international NGO whose mission is to set the standard for project and program management in the social sector. PM4NGOs aims to reach individuals, community-based organisations, local governments, NGOs, and donor organisations with a comprehensive suite of project and program management resources.

Peter Wright

Peter amazed us all by reckoning he had walked some 2,500 to 3,000 miles in 2021! Much of it was with Peter Marlow, including completely around the M25 – we were flabbergasted.

When not walking, he has been involved with the Scouts, making sure they are Covid-free and taking the precautions to be so. Plus of course lots and lots of Zooms! But no lawn mower racing.

Phil Harris

Phil reports that he and wife Lina have been in good health during 2021 – barring some age-related creaks for Phil! They were able to enjoy a few holiday trips in England – including a weekend in the New Forest, memorable for delicious food and heavy rain! He was also pleased to be able to see his children, grandchildren and friends in person again and hopes we can learn to live with Covid (and the future pandemics) without severe lockdowns!

During the year, he has designed a couple of small printed circuit board layouts for his daughter (she's a Design Technology teacher and has a GCSE-level Electronics class). He says that he didn't do any layouts during his employment career and found it a really interesting challenge working in the 2-D confines of the pcb. Also Phil had his 70th Birthday in October and held a tea party at the Brooklands Museum – a great engineering location, especially as guests were able to roam the museum site before the tea. As entertainment during the tea, Phil employed the same magician as he had for his 60th – he says the tricks were just as unfathomable as they were ten years ago!

Rut Patel

Rut spent the early part of the year in supporting his two grandsons with their remote learning, which he found hard work as they got

distracted easily. The same thing happened the year before, when they were at home due to the lockdown. Once they were back at school it was relief as it was just the school run.

Summer was spent watching England play India at cricket. He even managed to get to Lords and The Oval to watch. The Oval had a gin bar which was run by Fever Tree, the tonic water company, who gave free pink 'Fever Tree' caps if you bought five G&Ts. He had a lively conversation with a bunch of guys from Somerset all wearing their pink caps – it was a bit one sided!

He also managed to get to Wembley to watch the Euro semi-final between Spain and Italy; this went to penalties and he didn't get home till 1 o'clock in the morning! The following day he went to Wimbledon to watch Roger Federer play in the quarter final. Unfortunately, Federer lost in straight sets. Rut and the crowd tried to encourage him to fight back but it wasn't his day.

Sid Seth

Finally, it happened! Sid's daughter actually got married after having Covid put it off since June 2020. Sid said it was the perfect Bollywood wedding. He showed us some pictures in which Sid's family all looked very smart in traditional Indian dress, but Sid had a western suit on, not a traditional Indian one! His leg was pulled a number of times about that, which he took in good spirit, pointing out the wedding was in Avington Park, Winchester, so it was the perfect compromise.

Some of his relations came over to stay on holiday in the UK for 40 days. This family, although here they would be thought of as "middle class", in India, that equivalent in the UK is "well-to-do" class. They were used to chauffeurs, cooks, maids, butlers, etc. and were very surprised that Sid didn't seem to have any! Sid and his wife did it all for 40 days – "and 40 nights" Sid added.

In 2022 Sid is planning to develop vegan products and he is also withdrawing his investments because he expects the stock exchange bubble to burst very soon!

Tim Dye

Like many others, Tim reported a slow year with Covid causing the cancellation of many of his favourite events. He has spent his time with his family, three grandkids and Alexa. He says Alexa kept him amused during the lockdowns, voice-controlling his house facilities and making his wife somewhat jealous!

Tim and Sue miss their holidays to Croatia, but they did a lot of walking and cycling around their home county of Norfolk, plus a couple of UK holidays, badminton, and even line dancing. Still addicted to the world of television, he has given

engineering support to EPIC Studios and their Outside Broadcast vehicles. (All up for rent at reasonable rates with broadcast standard HD). One gig was a lockdown-busting drive-in mixed martial arts event with a 46m² screen.

Tony Godber

Tony joined us around an hour in; he had just come home from having a Greek meal out with friends to celebrate his birthday, the temperature in Perth at 10pm was a cool +21°C!

He told us that this year he had a two-week holiday in Tasmania, which has had a similar success rate to Western Australia in keeping out Covid. He was allowed to travel both ways relatively unrestricted but still with a lot of form-filling and checking, which slowed down airport arrivals considerably.

Since May, Tony has been able to re-occupy his Perth house and commute between Perth and Karratha (where he works). The house is much busier now; Justin (youngest son) has relocated from Melbourne back to Perth with wife (Lauren) and now 1 year old daughter (Audrey), and also Tony's daughter Felicia gave birth to granddaughter no 2 (Astrid) in June.

Tony remains working 4 days a week with Rio Tinto on energy and emissions (eliminating diesel from rail operation). He expects to slip gently into retirement around 2023. Tony's wife Deb has been splitting her time between being a midwife and a vaccination nurse but hopefully the vaccination workload will reduce fairly soon. They hope to get Tony's father-in-law across from the UK in 2022. He is still in relatively good health at 91 and he has not yet seen his two great-granddaughters other than on a screen.

Martyn Hart

Martyn is a Parish Councillor for his village (Ingatstone and Fryerning) and the business rep for village businesses within the local Borough Council. Also, he works one or two days a week (often four or five!) in the public sector, mainly in the commercial area on large outsourcing/framework contracts. He continues to cycle, photograph, etc. and has also been busy redecorating the Triangle House and building electric Karts for his grandkids (and all the kids in the neighbourhood it seems!).

Those that couldn't make it and we've heard from:

Addy Adesara

Addy is a big hockey fan, although his wife says it's an excuse to get a few beers and avoid the DIY, but his story is that the club needs him. Even after a second hip operation he's still playing!

He continues to work for Vodafone and he also has a share in a

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manufacturing business that is being put up for sale so he should have bit more time. Unlike many, he did manage to get a holiday this year, in Crete with a few friends. It was quite interesting to hear from the holiday staff what pain they have gone through in these two years with very limited government support.

Addy's two daughters are still single but perhaps being front line doctors, they are far too busy to find partners!

Alice Spain

Alice told us that during 2021 she managed to complete most of the work on her 4-acre garden, finishing it off with a scented section that their resident deer likes to graze on. She says that they are getting to know what the deer likes to eat, particularly roses. The garden has a Mediterranean feel which they have encouraged with a bonsai olive tree. It's so old, it even has its own passport.

The house has taken a back seat through Covid lockdowns and shortages. Nevertheless, some limited progress has been made in insulating the loft area so the house is getting warmer at last. Unfortunately, their trip on the Orient Express was cancelled for the second time in the autumn so they've got all fingers crossed that it will be third time lucky in 2022!

Alice was also appointed London Walks Organiser at the 2021 City & Guilds Association AGM – well done Alice! We look forward to the walks, maybe we can have a Triode one? Martyn can suggest a Dickens-related pub walk (when they are open of course).

Chris Giles

Chris says 2021 didn't turn out as he and Daphne planned! Firstly, they took on the renovation of a semi-detached cottage on the edge of Cranfield, as part of an experiment to see if they really wanted to move away from living in the centre of a town. The cottage is in two parts, one totally derelict, while the other had been used as a couple of pretty rough student flats. The work on the latter is nearly complete but they won't do anything to the derelict part until their long-term plans (and those of the owner) have been sorted out.

Secondly, although Chris supposedly retired a couple of years ago, he's been dragged back to do odd bits for a small engineering company which builds aviation refuelling vehicles and fuel storage installations. The call was irresistible, not just because he liked the people but also the company is owned by the ultimate owner of the cottage he is renovating!

Thirdly, his obsession with analogue computers grew. He has set up the UK Centre for Analogue Computation (UKCAC) and has

increased its computing facilities by adding a pre-production version of The Analog Thing (a 21st century analogue computer). More here: <https://the-analog-thing.org/>

Geoff Banks

Geoff says that nothing has really changed during the last year but he has managed to finalise the sale of his late parents' bungalow and complete the closure on their estate. There were no problems with probate but an absolute nightmare dealing with the Land Registry and the buyer's pedantic solicitor. Then, three days before completion, the buyer decided to pull out of the sale after almost a year of negotiations and general bullshit from their solicitor. Luckily another potential buyer, with whom he was in contact via the estate agent, still wanted to buy the property and also wanted a quick sale. The sale was completed in just under five weeks! Nightmare over!

Graham Castellano

Graham says 2021 has been a bit quieter than usual. They got a second grandson in April, which is great, but have a 2½-hour journey to visit, which is not so great. They're helping out with child care for a couple of days every two weeks but he says it's strange looking after the children when his son and wife are both "working from home".

His son is working on the build for Hinckley Point 3 and it's interesting to hear him talk with his engineering team about concrete pouring and weld integrity – for a nuclear facility. His daughter-in-law is a solicitor and has been attending court via Zoom – apparently the defendants turn up more regularly when the hearing is on Zoom!

They did manage to fit in a quick trip by car to Italy for a week in September, making good use of the two microseconds that border crossing was allowed, and stayed with a friend from IC (Civ Eng) who has a house above Aosta.

Luckily dinghy sailing hasn't really been affected this year (except that getting changed in the boatyard instead of the clubhouse has become the norm) so he has been able to continue doing that. He volunteers at a "Repair Cafe", where the public bring in broken items (mostly electrical) to see if they can be fixed. The BBC filmed a piece for 'Morning Live' in which Graham played a small part (4 hours of filming for a 5-minute piece, and he "starred" for about 50 seconds!).

Hari Singh

Like most of the UK population, Hari and family have been locked in most of the time. Luckily the golf course was open most of the year and Hari won Senior Player of 2021 at Downshire Golf Club. This is the 2nd time Hari has won this – well done! But, unfortunately, annual golf

trips to France and Portugal and the annual holidays to Goa had to be cancelled again! However, they did manage to have a week's holiday away in August with his daughter's family. On the Covid front, both Hari and his wife had the virus even after three doses of the vaccine. Luckily Hari had no symptoms and his wife had very minor symptoms. Both are ok now and looking forward to seeing everyone face-to-face in 2023.

Joan Clemow

Joan says really very little has changed. She's another year older as are her children and grandchildren. She managed a trip to the Isle of Skye in the summer with her oldest son and his family and a few weekends with friends but otherwise it's been a very boring year.

She still volunteers for the National Trust at Montacute House (near Yeovil), however she hasn't yet started helping out at her granddaughter's school. She has become involved with a local film club and with the volunteers' social club at Montacute. So that, along with the grandchildren, keeps her very busy.

Patrick Mason

Patrick missed the call but reports he is still working much of his time with the internet international payments company he co-founded (GlobalWebPay.com). He was relieved that a total rewrite of their complex system was finally completed despite the challenges of the pandemic! He was also pleasantly surprised that, as the pandemic led to a lot more online business for many companies, GlobalWebPay managed to grow 25% during his first year.

When not working, Patrick enjoys his role as a grandfather to two "bundles of joy", plays tennis regularly, runs his local Wine Tasting Society and walks with the Mayfield Bonfire Society in the amazing carnivals in Sussex such as at Lewes! He's desperate to return to international travel as soon as it becomes practical again.

Paul Cheung

Paul retired from the University of Hong Kong (HKU) in July 2018 and is enjoying the retirement stage of life in good health. He and his wife, Jane, still live in Hong Kong where, much like the rest of China, he says they have handled the Covid-19 pandemic reasonably well! Although they had just about got through their 4th Wave and their daily local new cases were in single digits, Omicron had now brought the 5th wave and the whole population of Hong Kong was in high alert and most were faithfully observing the guidelines to guard against the pandemic spreading further.

Jane and Paul now spend more time with each other at home than

at any other period in their four-decades plus of being together! Paul still serves as an Honorary Professor at HKU and also runs a Pen Makers' Workshop teaching people how to make pens (which will restart after the pandemic). Their son Timothy is working at NYU in New York as a researcher into Parkinson's disease and their daughter Celeste is working from home in London as a Research Project Manager for an education research NGO. She is also being mum to her first child, Tina, who is now 27 months old.

Richard Lewis

As with many people, Richard found 2021 a mixed and rather depressing year. Being classed as clinically vulnerable, he spent a lot more time stuck at home but he continued with the online tutoring of A-level students in Maths and Further Maths. In the summer, he and Eleanor finally managed to escape to their second home in the Pyrenees for a long stretch – a welcome relief.

One highlight of their time away was visiting Albi and having a Michelin-starred meal on a terrace overlooking the cathedral for a mere €80 for the two of them! A more significant highlight of the year was the arrival of a second grandchild in March whom they've had the privilege of seeing frequently thanks to the creation of a support bubble. They finished the year post-Christmas back in their home in the little Pyrenean village (pop 200) where they oversaw the installation of fibre to the house. They now have a higher broadband speed there (300/200 Mbit/s) than in the UK with Virgin (200/20 Mbits)!

Steve Glenn

Steve and Anne have moved to the metropolis of Petersfield, Hampshire, and are getting involved in local activities.

Steve is doing a degree in History and some volunteer driving and Anne is an agent for AGE [UK]. He says it is always better to be helping others rather than be helped.

Recently Steve took a 102-year-old to the post office to renew his driving licence. Steve asked him why he was renewing at 102: He answered "Well someone's got to drive the old folks around".

Steve's family, 3 daughters and 6 grandkids, live fairly near so weekends are fairly busy and noisy!

And those that didn't make it and we haven't heard from:

(Can anyone help?)

John Baird, Jackie Buzzard, Al Farbridge, Chris Gaukroger, Ian Heap, John Macfarlane, Keith Marshall, Alistair Rogers, Richard Wysome.

Have a great 2022
Martyn, Arch Triode

He attributed much of his career success to Imperial

PETER MICHAEL PALMER
(Civil Eng 1951-54, 1956-57)

Peter Palmer was born on 27 February, 1930. After obtaining his degree at City and Guilds College in 1954, he was awarded a scholarship in 1956, by the Cement and Concrete Association, to attend the DIC course in concrete technology, which enabled him to pursue his interest in the design of prestressed concrete bridges.

While studying for his DIC he met his wife, Sheila, who was then undertaking research for the Medical Research Council, in the Post-Graduate Medical School at Hammersmith Hospital. They were married in September, 1957.

His first position after graduating in civil engineering was site engineer with Sir William Halcrow & Partners on the Invergarry hydro-electric project in the Scottish highlands, where he supervised construction of the Quoich Dam. From there he joined the design staff of Holst & Co, who specialised in the design and construction of industrial concrete structures, before accepting a position as design engineer with the Snowy Mountains Hydro-Electric Authority in Cooma, Australia. He spent the next seven years working on the design of tunnels, dams

and penstocks. Cooma is a small country town 100km south of the capital Canberra which had been transformed by the Snowy Scheme into a vibrant community of people from all corners of Europe. Their three sons were born there.

By 1966 the Snowy Scheme was nearing completion and he accepted a position as a design engineer in the Bridge Branch of the West Australian Main Roads Department, in Perth. He was design team leader for bridges in the Narrows Interchange, which was to be built on land reclaimed from the Swan River on the outskirts of the Perth CBD, and then became Resident Engineer supervising construction of the interchange. He was appointed Senior Engineer Country Bridges in 1972 and spent 12 years investigating, designing and building bridges throughout Western Australia. He was then appointed Superintending Engineer Bridges in charge of the Bridge Branch.

Perth became their permanent home and Sheila was able to resume her career teaching chemistry, while their three sons studied at the University of WA: one graduating in agriculture, one in medicine and one in architecture.

Peter retired in 2002, looking



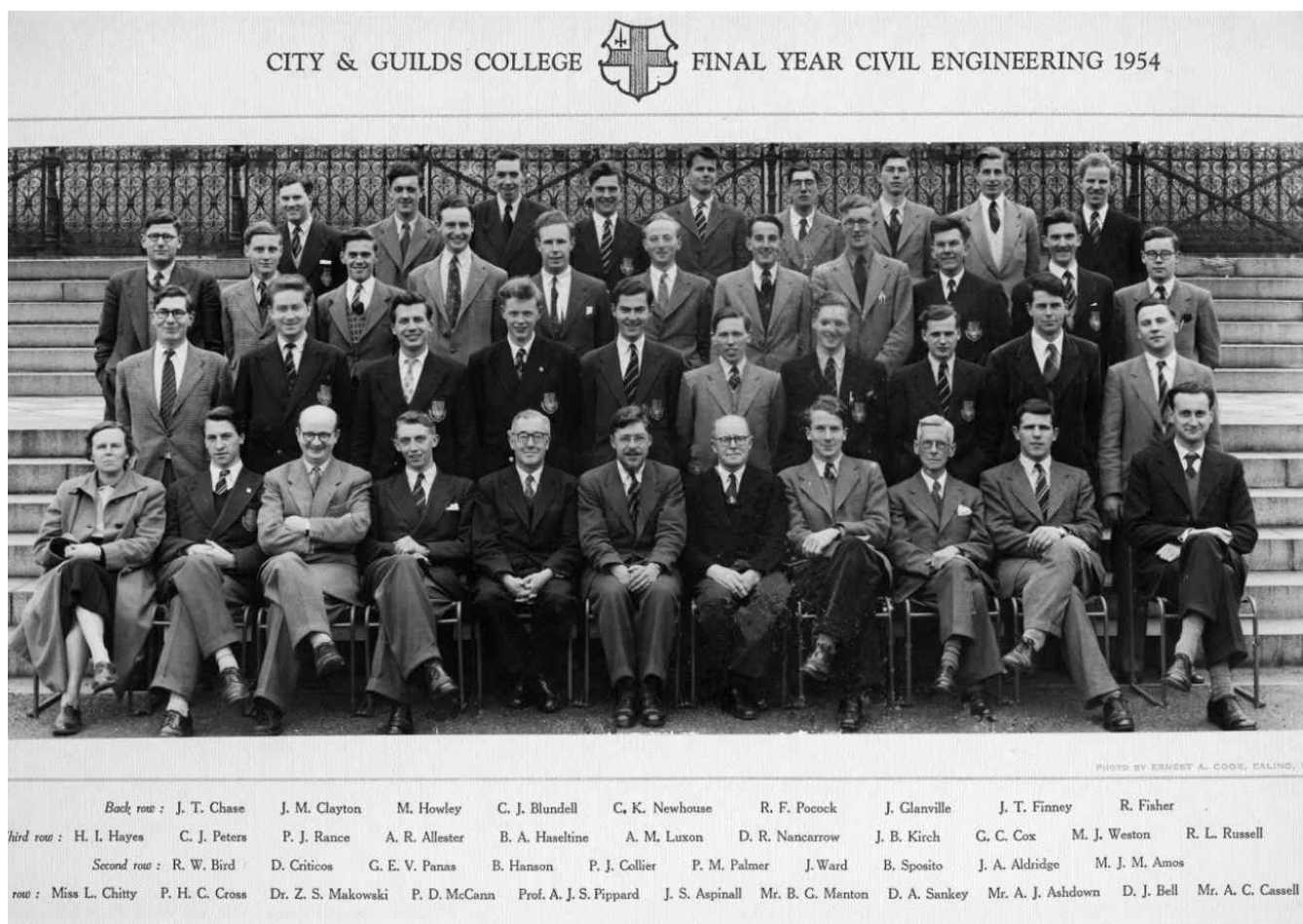
In September 2016, Peter attended an alumni and friends reunion event in Perth, hosted by Imperial's President, Alice Gast. He shared memories of Imperial in the 1950s, including a photo (see below) of his City and Guilds College Civil Engineering cohort graduating in 1954. He ascribed much of his career success – which involved tunnel, dam and bridge design in places like the Snowy Mountains and Mekong River – to Imperial.

forward to being able to spend time enjoying the many attractions and facilities of Perth and Western Australia.

Peter was a life member of CGCA

and former Treasurer and long-time member of the WA Alumni Association of Imperial College.

Peter sadly passed away after a short illness, on 16 August, 2021.



He was driven to “do what was right”

HARRY MORTON NEAL, CBE, FCGI, FIC, FCIQB, FRSA (Civil Eng 1950-53)

Morton Neal was not only a life member of CGCA and President in 1994-95, but was also a key link between College, CGCA and the City and Guilds of London Institute, of which he was the Chairman for many years, and remained on its council for many more years afterwards. He might be described as a true polymath but when asked what he actually did, that wry smile would come over his face and he would say that he was a builder, which indeed he was. Morton was the grandson of the founder of the well-respected building and development firms, Harry Neal and St Anselm. He joined his father, Liveryman Godfrey Neal, in the business in 1955 at the opportune time of the post war construction boom in London.

Morton followed his father, becoming a Liveryman in 1955 and Master in 1997. Born on 21 November 1931, he was educated at Uppingham School, where he captained the rifle shooting team, winning the Ashburton Shield in 1949. Knowing that his career would be in the family business, Morton read Civil Engineering at Imperial College. National Service was spent as a Flying Officer attached to the Engineering and Construction division of the RAF. At this time, he married Cecilia and their early life was spent in London, in order to be close to the firm's office at 117 Baker Street. His early training as an engineer was to be useful as the construction industry looked to new methods to rebuild London and the firm positioned itself at the forefront of construction in the City and West End.

Its reputation for quality building was crucial to the growth of the business after the war. Both Morton and Godfrey placed great emphasis on the calibre of its trades and site foremen, especially apprentices who would follow into foremen positions. The firm gained an impressive portfolio of projects such as Annabel's Club, contracts on the Grosvenor Estate, Stevenage New Town, the King Edward VII hospital extension, the Great Cumberland Place Synagogue and – dear to Morton's heart – the building of Baden Powell House. Another was Barclays Bank International in the City which required the 26 storey lift core to be constructed in 41 days, deploying Swedish technology. The crowning glory was the building of the new Berkeley Hotel in Knightsbridge for Savoy Hotel Ltd, with which Morton was closely involved.

Morton joined his father on the board of the Connaught Hotel, succeeding him as Chairman in 1980. He was appointed to the board of the Savoy Hotel Ltd in 1982. It was after WWII that the Connaught gained its great reputation for outstanding quality – partly due to General de Gaulle living close by during the War. In the 1950s its location by the new USA Embassy made it popular with Americans. As with Harry Neal Ltd, Morton was keen to encourage young managers, chefs and waiters to gain formal training and be recognised early in their careers. He was proud to be one of the few British hoteliers to be appointed Chevalier de Tastevin, Burgundy, in recognition of his work in the hotel industry.

Carpenters' asked Morton to be its representative on the Council of City & Guilds London Institute (C&GLI) and in 1979 he became Chairman, the first non-Great Twelve liveryman to be so appointed. During this time vocational training was thrown into disarray by reforms carried out by Keith Joseph and Margaret Thatcher and the enfranchisement of vocational training by the formation of the Business and Technology Council (BTEC), leaving C&GLI with the more practical courses. Morton took this raid on the business in his stride by joining the BTEC Council and helping to smooth out any difficulties. C&GLI continues to be a thriving business providing career training on an international scale. Morton had been at City & Guilds College while a student at Imperial College. It separated from C&GLI in 1901 when Imperial gained its Royal Charter. In order to maintain the connection between the academic and the vocational strands of the two institutes, Morton was asked to be a Fellow of Imperial in 1985. This connection is recognised by the City of London and the sixteen founding livery companies' shields hanging in the entrance of Imperial College, off Exhibition Road. Morton was awarded CBE for his role at C&GLI in 1991.

Morton's interests extended to the arts. Perhaps because the family business had refurbished many of the great art galleries of London, he was asked to co-chair (with Sir Nicholas Goodison) the Courtauld Institute of Art's move from Portman Square to Somerset House in 1988. His experience of the construction industry was invaluable to Courtauld in steering them from appointment of the architect to completion when the Samuel Courtauld art collection was hung in 1990. He served on Courtauld's Management

Committee from 1983–1999 and became an Honorary Fellow in 2007.

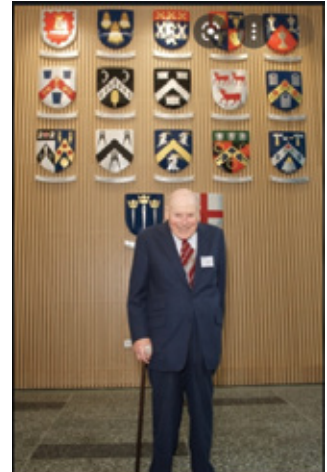
Morton and Cecilia moved to Hertfordshire in 1963 where he created a 'plantsman's garden' with an extraordinary array of unusual and rare shrubs and trees. He could not have managed without the full and energetic support of Cecilia. She went on to start her interior decorating business and lecture on history of art which complemented his career. Morton was elected High Sheriff of Hertfordshire for the Millennium year and was greatly amused when his Sheriff's outfit appeared in an episode of *Downton Abbey*. He was on the Court of the University of Hertfordshire and was made a Fellow in 2015.

Given his extensive and broad career, Morton never forgot how important it was to encourage young people starting in the building, hotel or other industries he was associated with. His logical mind drove him to “do what was right” and not let people forget how and why great professional institutions were created. Above all, he never forgot how lucky he was to be a Carpenter and how being a

liveryman shaped his career.

Morton, much loved husband of Cecilia, father of Michael, Camilla, Carolyn and Alexandra, grandfather and great grandfather, died peacefully at home on 8th June, 2021, aged 89.

Based on an obituary by Morton's son, Michael Neal.



Morton worked hard to get the shields of the 16 founding livery companies displayed in the Mech Eng Building concourse.



Morton presenting a handmade display cabinet to HRH, The Duke of Edinburgh, on 14 December, 2011 at Buckingham Palace to mark Prince Philip's nearly 60 years as president of City & Guilds, following his retirement on his 90th birthday.

'A quiet and very humble man'

PETER ACKERS

(Civil Eng 1942-44, 1956-57)

Peter was born on 30 June 1924 in Bootle, Merseyside, the son of Mary (nee Jones), a supervisor in a quilt-making factory, and Peter Ackers, a carpenter/joiner in the Mersey docks. Coincidentally, his future wife Margaret McGeagh was born on the same day very close to where Peter was born. He attended Bootle grammar school, where he excelled at physics and mathematics and won a place at Imperial studying civil engineering. As this was during WW II, his course was condensed into two years and its scope broadened to include air-frame design, useful for the war effort. He was also an air-raid warden, reporting to a unit behind the Royal Albert Hall, and suffered a near miss when a shell hit the road next to him, breaking the glass in a nearby telephone box.



On graduation he worked for the National Physical Laboratory where he carried out research into composite steel and plastic struts. In 1946, he was transferred to Bristol Aeroplane Company, where he worked on designs of the Bristol Freighter and Brabazon aircraft. He subsequently worked in local government in Preston and Stoke-on-Trent during which time he obtained an MSc(Eng) in Civil Engineering from Imperial and became a Member of the Institution of Civil Engineers (later becoming a Fellow). He also became a member of, amongst others, ASCE and the Institution of Water Engineers (subsequently becoming an Honorary Fellow of CIWEM).

In 1956, he joined the government's Hydraulics Research Station at Wallingford, where he spent the next 18 years rising to the position of Assistant Director. During that time, he carried out much work on practical engineering hydraulics including work on flumes and weirs, subsequently publishing the definitive book on the subject. He went on to develop the Wallingford tables, the ultimate set of hydraulic design tables for pipework. Furthermore, he developed, with Rodney White, the Ackers-White sediment transport equation. This took a novel approach and was based on similitude theory and was calibrated against a very large database. This equation still provides one of



the best representations of the transport of non-cohesive materials.

In 1974, he left HRS and joined Binnie & Partners as hydraulics consultant, where he was to remain for 12 years. He was supported by a small team of specialist engineers tackling a diverse range of hydraulic problems from across the globe. During this time, he was also appointed as visiting professor at Imperial College. He specialised in finding simple innovative solutions to complex issues, such as:

- Design tables for the new Cairo sewers ranging from 1m to 10m diameter, designed not only on hydraulic capacity but also on being able to transport the copious amount of sand that finds its ways into the sewers;
- The design of low head air regulated syphons for the spillways at Plover Cove reservoir, Hong Kong;
- The use of dolosse as the anti-typhoon sea defences at High Island reservoir, Hong Kong;
- The design of a stable artificial beach at Discovery bay, Hong Kong;
- He was also an expert adviser to the committee that investigated the feasibility of the Severn tidal power scheme which could have provided 7% of the UK's electricity generated as green predictable energy. The committee, led by Sir Hermann Bondi, reported to the government in 1981. It was a huge disappointment to him that this project, much larger but similar to the successful tidal energy barrage on the estuary of the Rance river in France, was not taken up;
- Locating water supply intakes on seven estuaries on the Malaysian peninsula to minimise salt water incursion;
- Identifying a strategy to extend the life of Guanting reservoir,

which was rapidly filling with sediment but was essential to the water supply to Beijing (on that visit he was amused when he was presented with a copy of his book on weirs and flumes, translated into Chinese which was a standard text in Chinese universities);

- Designing an innovative 100m deep vortex drop shaft for drainage at Ok Tedi gold mine in PNG;
- Developing anti-cavitation measures for the high RSK dam in Iran;
- Developing the theory to predict the hydraulic capacity of a rough-cut tunnel beneath the Andes from the Mantaro to the Rimac River to supply Lima and beyond (as a continuation of this, he developed the theory to cover segmentally lined tunnels, both theories were published in CIRIA publications);
- Development of the rheological theory to pump sewage sludges in Greater Manchester;
- He advised on the design of several major hydro projects in Pakistan, including the 52km Ghazi Barotha power channel carrying a steady 1300 m³/s. The design requirements were to minimise the headloss along this concrete-lined channel, whilst avoiding progressive blockage when Tarbela reservoir was sluicing high quantities of sediment above the power canal intake. This is the largest canal of its type in the world and hence there were no prototype data to rely on.

Peter delighted in resolving these types of issues. He had an incisive mind that could quickly break down a complex problem into a number of smaller manageable issues each of which could be analysed then combined to understand the overall picture.

He also wrote or contributed to about 70 technical papers and publications, and retired in 1994.

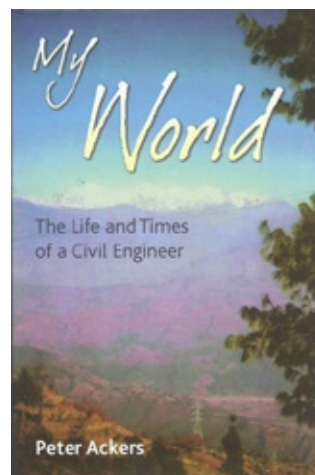
Then he worked on improving his French – he enjoyed travelling, especially on cultural guided tours and river cruises – and raised money for the RNLI. He donated his library of technical books to a university in Ethiopia.

For all of his intellect he was a quiet and very humble man. As a boss, he was supportive and always had time to listen and advise in a paternal way. His calm, supportive leadership style encouraged us to think that abnormally complex problems were just normal problems that we could readily resolve, with the right approach. This allowed us to confidently

design successfully at the very limit of technical knowledge.

His passing leaves not only a gap in the engineering community but also deprives many of us of a mentor and close personal friend. His wife predeceased him by seven years and he is survived by two sons, John and David and a daughter Sheila, together with four grandsons and two great-grandchildren.

Based on an obituary kindly provided by Peter's son John Ackers and colleague Graham Thompson.



As well as technical publications, including still-definitive text-books, Peter also wrote a memoir 'My World: the Life and Times of a Civil Engineer' published in 2007 by the Memoir Club ISBN 9781841041735

An excerpt from his book is available on the Imperial College Centenary Memories website, where Peter shared his memories of Civil Engineering at Imperial:

<https://bit.ly/IE36-Ackers>

IN BRIEF

DOUGLAS CHARLES BENFIELD (Civil Eng 1958-61)

Douglas Benfield was born 14 March, 1937. He was a member of CGCA and the IC Boat Club. He died suddenly and unexpectedly 16 April, 2021, shortly after his 84th birthday.

PETER JOHN TAYLOR (Elec Eng 1952-55)

Peter, born on 3 August, 1930, sadly died, aged 91, on 3 December, 2021.

