IOP | Institute of Physics
Molecular Physics Group

NEWSLETTER No 4

Comments from Andrew Ellis, Molecular Physics Group Chair

It's stating the obvious to point out that the world is a very different place since the last MPG newsletter was circulated in September 2019. The intervening period has been tragic, trying and highly disruptive and we are not yet out of the woods. However there is hope, and it is good that science has been at the forefront in bringing that hope, in the form of vaccines.

One of the things I would like this newsletter to reflect is the impact of COVID on the MPG community. To that extent, I've asked some of our committee members to outline how it has affected them during the past year or so and you will see some contributions below. I found these really interesting to read, as they bring home some of the many effects of the pandemic. For me personally, the change in working pattern has been profound. As a Head of School/Department, I would normally go to my office on campus office to work most days of the week. However, in the past year that's changed, and so dramatically that I have been on campus only a handful of times in the past 12 months, communicating with my research group and colleagues almost entirely by video and email. That has worked well in the sense that it has saved a commute and I am fortunate enough to live in a rural area where it is easy to get out into the fields and pathways for exercise and fresh air. At the same time, the workload in the transition from normal activities to remote working, and in particular for teaching, has been horrendous. I know I'm far from alone in experiencing that. Nevertheless, in my own case I can see light at the end of the tunnel. In particular, having spent the least amount of time on research in my entire career over the past 12 months, I've found myself starting to think about it just a little and that is incredibly uplifting!

Alongside personal commentaries you will find other things in this newsletter, including a piece on oximeters, a now standard medical item much on shows during the pandemic. We have also received a nice advert from Helen Fielding for the new ultrafast science laboratory at UCL.

I wish you all a more positive year than the last one.

Andrew M. Ellis
University of Leicester
Chair of IoP Molecular Physics Group

Pandemic experience for some members of the MPG committee

Jason Greenwood, QUB

For the last 12 months I have been working mostly from home and that has worked out okay. As Director of Education for the School of Maths and Physics, I have certainly needed to spend even more time than I normally do on administration and management. The shifting goalposts, alternative assessment procedures, etc., have sucked up a lot of time, but this has been quite rewarding as I think our students have been given as good and fair an experience as is possible in the circumstances. As a result my research has essentially been put on hold and my only engagement in research has been in supervising a couple of PhD students. On a personal note, I have found it challenging to home-school a teenage son who is very disengaged from his studies. I was also in very poor health for 5-6 weeks over Christmas and the New Year, being hospitalised for 5 days, due to an illness probably caused by COVID.

Julia Lehmann, Leeds

As a younger academic, now 4 years into an independent academic position, the COVID pandemic has brought an interesting turn of events both personally and professionally. Personally, there have been both positives and negatives, not least of which was being able to actually live with my husband for the first time (albeit only for the first lockdown). That was one of the positive outcomes, by the way! Professionally, the COVID pandemic has likely made a negative impact on my career as an experimental physical chemist, and one that will be hard to bounce back from. At this stage, every minute in the lab is critical: getting the experiment working, getting those first papers out, establishing yourself on a national and international scale. Research success is absolutely key in making a successful transition to an academic position (at least, that's typically the emphasis and certainly what it feels like). As an early career academic, I do not lead a large, experienced research group full of postdocs who can take the reins if I'm busy with other things. Instead, I act as both an experienced postdoc and supervisor to a very small, mostly inexperienced group of researchers. That means that any time away from research, and instead focussing on transitioning teaching material to online or developing new online tools for learning for example, is likely to be detrimental to the research group progress. Certainly, as an experimentalist who relies on being in a lab to do work, the working-from-home period has been challenging. I know other scientists who rely on visiting large facilities are much worse off in this regard, so I count myself lucky in only having 6-8 months away from my lab. I also count myself lucky to have supportive colleagues, especially more senior colleagues who are mindful of ensuring I have a balanced workload and my contemporaries who are always ready to have a virtual pint night to help maintain a "healthy" work-life balance.

Nick Walker, Newcastle

When lockdown happened, my day job of handling individual (extenuating circumstances) study adjustments, course switches and student communications for Newcastle University Chemistry degrees became a lot more complicated. I had an enthusiasm for online learning tools even before lockdown, which helped, and I've not found it too hard to adjust to online teaching. A much more significant effect on my job is that the lack of personal contact between staff and students has diminished both relatability and empathy. I have to talk to students who are going through significant personal hardships on a daily basis and I would ideally not wish to do that through Zoom.

My partner is an intensive care consultant at Newcastle's Freeman hospital. I remind Suzy- she's not

really the "first" line of defence - she's actually the last line. Everyone in society (looking after each other) is the true first line of defence. I am now a regular volunteer at the local vaccine hubs, for a day each weekend. As a car park marshall, my job is to wave my arms around. What has helped is being able to contribute something and having enough of a scientific mind to make sense of the jumble of stats and data we are presented with every night. I haven't stopped to think, or to dwell on what I'm feeling at all: nor have I developed any hopes, fears or expectations for any future emergence from the pandemic. I'm focussed on action, just one day at a time, and looking no further ahead than that. There is so much to do. When Suzy and I are finally able to take some time off, I expect we will struggle to process it.

Being an Early Career Researcher in a pandemic: a look at the future

by Natércia d. N. Rodrigues Lopes

When the first rumours of a then distant virus started, I was at the University of Warwick, in the UK, trying to finish up as much science as I could and handover my responsibilities to the postdoc that was to replace me when I moved to Spain to start a Marie Curie Fellowship. I was meant to start in March 2020 but, as lockdown hit all over the world and flights were cancelled, that start was delayed for whenever international flights were allowed again. Problem was, I had already given my notice and, as such, as the pandemic landed its first real blow to the UK, I found myself with no old job, no new job, no income and no idea what was to come.

This limbo, allied to the stress of an impending international move and the passing of my father-in-law (who lived in Portugal), had an immense negative impact on my mental health. I sought medical help for my mental health for the first time in my life, and it saved me. As did the financial help I received from the Chemists' Community Fund of the Royal Society of Chemistry – a true lifeline. Without this support, I would have been forced to find a job elsewhere and abandon my scientific (certainly my academic) career. But are those who cannot access such support an acceptable loss to science? How much talent is seeping through the holes of a flawed, unsupportive system that pushes individuals into precarious situations?

Fast forward a few months and I am now in Spain. I have started my fellowship and things are looking as stable as they ever do for an early career researcher. But this is not the case for many of my friends and colleagues. I have heard (and read) about numerous people, some of whom I know and many I don't, expressing how anxious and worried they are about their futures. Both PhD students and postdocs are looking at a gloomy future of few opportunities, fatally allied to a year (maybe two) of an inevitable break in their academic productivity, which the publish-or-perish culture will certainly penalise them for. It feels that it will not matter how hard we worked on our research so far, or how hard we worked to keep it together through a pandemic and global crisis – and by 'it' I mean work, just as much as I mean our mental health.

A recent article published in *Nature*[1] highlights not only the disastrous landscape of interrupted postdoctoral research, but also the exacerbated anxiety of postdocs in the face of uncertainty, which adds to an already precarious career stage by nature. In a pool of 7,670 respondents, 61% have reported thinking that the coronavirus pandemic has negatively affected their career prospects. 13% have reported having lost job opportunities due to the pandemic, with another 21% saying this might have been the case for them, too – but they are not sure. It is not fair, however, to blame these feelings of uncertainty on the unprecedented pandemic situation we are living through. Even without taking

the pandemic into account, postdocs have been extremely worried about their future careers, with a separate study with 7,600 respondents revealing 17% felt 'extremely negative' about their job prospects, with a further 39% feeling 'somewhat negative'.[2] Knowing what they know today, a little over half of the scientists surveyed either wouldn't or aren't sure they would advise their younger selves to pursue a career in scientific research.[2] In addition to all of this, it has also been noted that the pandemic is having a disproportionate effect on publication track records of women (particularly those with younger children),[3] further deepening the gender gap and reversing hard earned (albeit, frankly underwhelming) progress as far as gender balance in STEM goes. The future of early career researchers today is bleak, and we are bracing ourselves for the pain of being forced to let go of a dream. In the process, science will lose valuable talent that could lead to the breakthroughs we desperately need if we are to tackle the huge challenges the world is facing.

Academia must find a collective willingness to acknowledge the reality in which the next generation of academics are being forged. We must be willing to re-think the ways in which we measure success, and to once and for all accept that success does not look the same for everyone. Science stands to lose valuable talent along the way because we refused to adapt in a time of hardship and uncertainty.

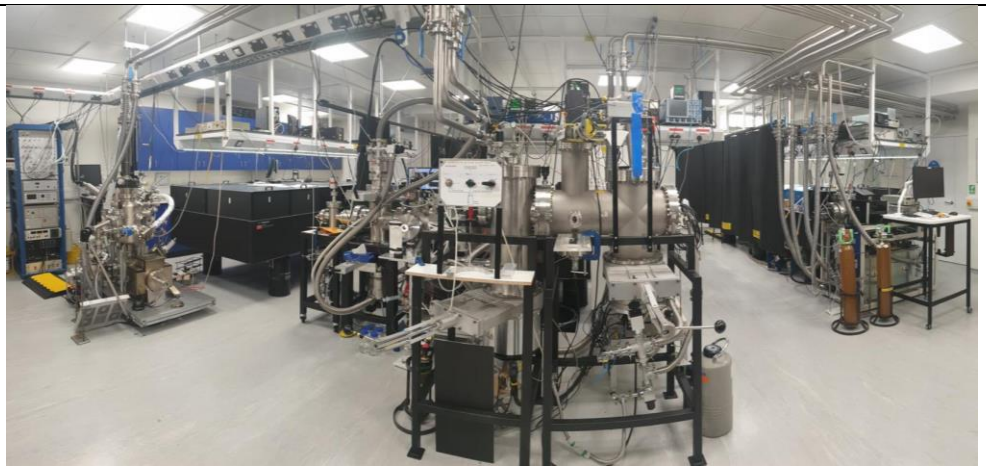
1. Woolston, C., *Nature*, **585**, 309-312, 2020.
2. Woolston, C., *Nature*, **588**, 181-184, 2020.
3. Krukowski, R. A., Jagsi, R. and Cardel, M. I., *Journal of Women's Health*, online ahead of print: http://doi.org/10.1089/jwh.2020.8710

New Ultrafast Laser Facility opening at UCL

A new Ultrafast Laser Facility is being established at UCL Chemistry, funded by EPSRC strategic equipment grant EP/T019182/1. The facility will provide femtosecond light pulses with a wide range of energies, from the infrared (IR) to the extreme ultraviolet (EUV), and is housed in a £2M purpose-built, environmentally controlled, stable basement laboratory in the new UCL Photon Science Hub. Experiments undertaken in the facility will include UV-pump UV/EUV-probe time-resolved photoelectron spectroscopy experiments in molecular and ion beams, liquid-microjets and on surfaces, as well as transient absorption spectroscopy, femtosecond stimulated Raman spectroscopy and multiphoton microscopy.

The facility has been established to enable research in a variety of areas aimed at improving our fundamental understanding of light-induced processes using a bottom-up approach to study systems across the complexity scale, from isolated gas-phase molecules to proteins, nanoparticles, soft materials and solids, for applications ranging from bioimaging and therapeutics to solar energy materials. The team, led by Professor Helen Fielding, includes Professors Ivan Parkin and Geoff Thornton, Drs Tracey Clarke, Julia Davies, Rebecca Ingle, Michael Parkes and Giorgio Volpe.

UK researchers wishing to access the facility are encouraged to contact Helen Fielding (h.h.fielding@ucl.ac.uk) to discuss possibilities.



Photoelectron spectroscopy end-stations in the new Ultrafast Laser Facility. Left to right: UHV hemispherical analyser photoelectron spectrometer for surface science studies, liquid-microjet magnetic bottle photoelectron spectrometer, molecular-beam photoelectron velocity-map imaging (VMI) spectrometer, electrospray ionisation VMI spectrometer).

Pulse oximeters

Pulse oximeters are likely to have been a familiar sight to those who have been in a hospital setting in recent years. These devices, which are most commonly clipped onto a finger, are now a standard piece of the medical diagnostics armoury and are used for measuring oxygen saturation levels in patients. They have been quite prominent during the COVID crisis as oxygen levels are a defining concern in the course of this illness, particularly when it escalates from mild symptoms into something more serious.

It's worth outlining how these devices work as there is some nice molecular physics underlying this. The basic principle is the difference in light absorption of oxygenated haemoglobin (oHa) versus deoxygenated haemoglobin (dHa). Oximeters emit light at two wavelengths, one in the red (660 nm) and the other in the near-infrared (940 nm). We all know that oxygenated blood is red, which means that it strongly scatters rather than absorbs in the red. In fact the oHa absorbs more strongly in the near-IR and the dHa in the red. The device that clips onto your finger is essentially a differential absorption measuring system at these two wavelengths. One side of the clip device acts as a light source and the other side act as a light detector.

Fortunately, red and near IR radiation penetrate human tissue relatively well and so oxygen levels can essentially be measured through application of the well-known Beer-Lambert law, which links the extent of absorption to the quantity of an absorbing material. In reality the data analysis is a little more complicated than that because of the need to distinguish residual absorption of oHa from underlying contributions from dHa, and this is in fact done by measuring how the absorbance changes with time as blood perfuses through the patient.

Because pulse oximeters exploit relatively low cost light-emitting diodes, they are relatively cheap

and can be bought for less than £20.

Conferences and symposia

The Molecular Physics Group is likely to be involved in several meetings this year. In particular we have agreed to contribute to QuAMP (Quantum, Atomic and Molecular Physics) and Physics in the Spotlight conferences later in the year. We do not yet know whether these will be run face-to-face, be virtual, or some hybrid of the two.

Current committee membership

Andy Ellis (University of Leicester) – Chair

Mike Parkes (University College London) – Secretary and Treasurer

Jason Greenwood (Queens University Belfast)

Nick Walker (University of Newcastle)

Julia Lehman (University of Leeds)

Derek Wann (University of York)

Natércia d. N. Rodrigues Lopes (co-opted member)

Twitter account

The MPG has joined the social media age via Twitter:

Molecular Physics Group IOP (@mpg_iop) / Twitter