

# pelican

Professor Christopher Howe

President of the College

Dr Jenny Zhang

Fellow in Chemistry

The Revd Canon Jeremy Davies

College Chaplain



# pelican

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# Professor Christopher Howe

Fellow in Biochemistry and President of the College

Some aspects of a person's career seem predictable; others do not. People who knew me as a child probably thought it inevitable that I would become a scientist. With the agreement of our extraordinarily tolerant parents, my brother (now a distinguished geologist) and I turned the spare bedroom at home into our chemistry lab. The house we lived in was called 'Southacres', so when we decided we ought to set up our own scientific journal, we duly named it '*The Transactions of the Southacres Chemical Laboratory*'. My first ever research paper appeared there, and was a study of the effects of acids and alkalis on the pigments extracted from lupin flowers in the back garden. The submission had a surprisingly easy time with the reviewer (my brother), as did my brother's paper in the same issue of the same journal (reviewed by me). Perhaps the relaxed approach to peer-review was why the journal had a rather restricted lifetime (one issue) and readership (our parents). My subsequent path to Cambridge, reading Natural Sciences at Christ's, might therefore have been predictable (in spite of a careers test at school that said I was good at everything except science), but my move to Corpus as a Research Fellow as I finished my PhD was probably less so. Like many people applying for Research Fellowships, I decided that because the process was something of a lottery the best chance of winning a prize was to have as many tickets as possible, and so I duly applied to all the colleges with Research Fellowships on offer. I remember cycling out to a distant college uphill and in the rain to deliver my application (this was well before the days of the web and online application systems) and secretly hoping that – excellent college though it was – I might end

up somewhere closer to the centre of town. As it turned out, I had two offers early on in the process, one from Corpus and one from another college nearby and had to choose between them. I confidently chose Corpus. If it was largely by chance that I came here as a Research Fellow in 1983, it was a very happy chance, and I remained at Corpus as I became Lecturer, Reader and then Professor, in the Department of Biochemistry.

What, then, have I been doing all this time? Most of my research work throughout my career has been related to photosynthesis – a very ancient process that evolved in bacteria about three billion years ago, only a billion or so years after the origin of the earth. It allows organisms to convert light energy from the sun into tiny electric currents within their cells and then to chemical energy in the form of chemicals needed for life and growth. In doing so, it breaks down water and gives oxygen as a waste product – something that was very toxic when it first appeared in the atmosphere!

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IF IT WAS BY CHANCE THAT I CAME HERE AS A RESEARCH FELLOW IN 1983, IT WAS A VERY HAPPY CHANCE, AND I REMAINED AT CORPUS AS I BECAME LECTURER, READER AND THEN PROFESSOR, IN THE DEPARTMENT OF BIOCHEMISTRY.

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For billions of years, only bacteria could photosynthesize, but around a billion years ago (and still well before the organisms whose fossils you see in museums), a remarkable thing happened. A photosynthetic bacterium was swallowed up by a larger, more complex, cell that was unable to photosynthesize. There would have been nothing unusual about that – cells eat other cells all the time, digesting them and using the constituents. In this case, something different and rather special happened. Instead of being broken down, the photosynthetic bacterium survived inside the predator, which became a benign host. The bacterium provided its host with some of the nutrient products of photosynthesis, and the host gave it a safe haven. The descendants of those photosynthetic bacteria are the chloroplasts – specialized photosynthetic compartments – of plant cells today. It's a remarkable illustration of the old proverb that if you give someone a fish you feed them for a day, but if you teach them how to fish (or photosynthesize) you feed them for a lifetime (and their descendants for over a billion years). I'm interested in the process that formed the chloroplast. Was it actually a one-off event, that happened at a single place and time, or was it the result of a series of transient associations? Has it happened again? And how did cells evolve to cope with the chloroplast once it had been acquired? Photosynthesis is actually a dangerous process, generating highly toxic things we call 'Reactive Oxygen Species' (as well as oxygen itself, which life has now tamed) – and getting hold of that first chloroplast was almost literally playing with fire. The process of a bacterium getting taken up by another cell is closer to home than





you might think. Inside (almost) all our cells are 'mitochondria', compartments that break down food molecules to liberate energy in a form your body can use. Those mitochondria were also formed by a bacterium getting swallowed up by another cell to form a long-term relationship.

As well as studying photosynthesis, and how today's photosynthetic organisms have evolved, I am interested in the practical applications. Some of those practical applications have been unexpected. For example, it turns out that the parasite that causes malaria, a single-celled organism called *Plasmodium*, has a photosynthetic ancestry. Some of its closest living relatives today are the dinoflagellate algae – widespread photosynthetic microorganisms supporting coral reefs, and responsible for the

phosphorescence of the oceans. At some stage in evolution, the ancestors of *Plasmodium* moved from being free-living photosynthetic organisms to parasites, but they retained some of the biochemical pathways unique to photosynthetic organisms, and we are trying to develop ways of interfering with those pathways to provide new ways of attacking malaria. Other ways we can try to exploit photosynthesis are more directly linked to the process itself. I explained earlier that photosynthesis depends on tiny electric currents, powered by sunlight, inside the cells of plants and algae. It turns out that small amounts of current can pass out of the cells, and we can collect the current with electrodes and use it to power small electrical devices. This is like using solar photovoltaic cells (the kind that are springing up as solar farms all over the country),

except that in our case we are using living organisms to turn sunlight into electricity, and we call the phenomenon 'biophotovoltaics'. We would like to be able to use these systems in places where there is no power supply network, but where small amounts of power can make a big difference, as in some low and middle income countries.

One of the good things about Cambridge colleges is the way they facilitate collaboration among academics. For example, much of the work I described above is done in collaboration with other Corpus Fellows, such as Alison Smith in the Department of Plant Sciences and Jenny Zhang in the Department of Chemistry. Just as my becoming a scientist was perhaps predictable, those interactions, with colleagues and friends in clearly related subject areas, might also be reasonably

predictable. But Cambridge colleges are almost uniquely placed to foster unpredictable interactions, too – and especially through High Table and the way it brings together people of very different disciplines. At least two of my research projects have had their origins in chance discussions at High Table. One involved a visitor from Stanford, John Haeger. He was working with the Parker Library, and is also an expert on the Pinot Noir grape. John explained that many well-known grape varieties, including Chardonnay, had been made by crossing Pinot Noir and Gouais, an inferior variety whose cultivation had been banned at various times in history, but that no-one knew which was the male parent (providing pollen) and which the female. I explained that the question should be easy to answer by looking at DNA found in the chloroplast, which

comes exclusively from the female parent. I gave the project to a final year biochemistry undergraduate, and John Haeger sent the necessary leaf samples. The student discovered that the chloroplast DNA of Chardonnay matched that of Gouais, passed down from the original cross, but not Pinot Noir. That meant the female parent of Chardonnay and some (but not all, we found) of the other varieties was the down-market Gouais and not the more sophisticated Pinot Noir. The undergraduate got a nice research paper out of the project (as well as an article about it in the *Daily Telegraph*!).

A more long-term interdisciplinary project also started at High Table, in conversations with Fred Ratcliffe (then University Librarian) and Linne Mooney (a Visiting Fellow). Evolutionary biologists, including

me, often use information in DNA sequences to reconstruct the evolutionary history of groups of organisms. As organisms reproduce, their DNA is copied, but the enzymes that do the copying sometimes make mistakes, resulting in slight changes in the sequence of units that make up DNA – changes that we call mutations. (It's a paradox that, although we often think of mutations as 'bad' – turning cells cancerous, for example – they also provide the essential variations that allow evolution to take place.) Mutations accumulate in species during evolution, but different mutations occur in separate species. As a result, the more distantly related species are, the more differences there are between their DNA sequences. Biologists have powerful computer programs that use the differences between DNA sequences of sets of species





to work out their evolutionary relationships – which species shared recent common ancestors to the exclusion of others – and construct something like a family tree. I learnt from Fred and Linne that textual scholars do very similar work, with different versions of the texts they study. They use the changes made by scribes while copying those texts (analogous to mutations occurring in DNA sequences as they are copied by enzymes) to construct tree-like representations showing which extant versions of the text were copied from the same earlier one. At that time, the textual scholars did much of their work without the aid of computers, but the process of inferring the copying history of sets of texts and inferring the evolutionary history of species is so similar that we reasoned that our biological programmes ought to be able to work with literary data. Linne put me in contact with a like-minded textual scholar, Peter Robinson, who had the ideal database of versions of the *Prologue* to the *Wife of Bath's Tale* in the *Canterbury Tales*. The biological programmes worked amazingly well, allowing us to infer copying histories in a fraction of the time taken by traditional methods, and hopefully offering a useful tool to the textual scholars. We published the results in the scientific journal *Nature*, with widespread media interest. The project is still going strong, over twenty years later, and we have now started to turn our attentions to collections of music manuscripts.

My time at Corpus hasn't been limited to eating and talking at High Table, though. In 1987, I was appointed as Director of Studies for Preclinical Medicine when the then Director of Studies, Rod Thompson (who sadly died last year, and who was a great support to me as I started on my academic career) moved to be Professor in Southampton. My own appointment as Director of Studies was intended to be a short-term one, until the College found someone better qualified, but I am still enjoying the role over thirty years later. The medical students are a great group of people to

work with, having a really strong sense of shared purpose. Among other roles, I spent five years as Warden of Leckhampton (1999-2004). Living for that time as part of a thriving, international and interdisciplinary community in such a beautiful setting was a real pleasure. Leckhampton and its community make, to my mind, one of the College's great treasures. Outside of academic work, I enjoy 20th and 21st century British art, so I loved being able to greet Henry Moore's 'Fred' each day as he sat contemplating the Leckhampton gardens. In October 2019, I took over from Andrew Harvey as President of the College, which I'm looking forward to very much – although Andrew and his predecessors will be a hard act to follow. It's not easy to describe the President's role exactly. Descriptions I've been given combine (with varying degrees of accuracy, I think) elements of Head Prefect, Shop Steward, and Leader of the House of Commons. Military friends suggest it's like being the President of the Officers' Mess. Certainly, it involves oversight of important events like College Feasts and other dinners, working closely with College staff. It involves helping to welcome people to the College, such as newly admitted Fellows, or visitors at High Table. I look forward also to supporting the Development Office in their work of ensuring that Old Members feel part of the College community. At events for Old Members, I am always struck by the wide range of roles people move into, as well as the sense of loyalty they show to the College. My own experience has shown how valuable High Table can be as a way of spontaneously fostering new ideas as well as enjoying social interaction. I'm keen to nurture those benefits, and I look forward to welcoming Old Members there, with their own perspectives and experience. It's a pleasure to see you, and find out what you have been doing, so please keep coming back to see us!





# Dr Jenny Zhang

## Fellow in Chemistry

I CAME TO CAMBRIDGE FROM AUSTRALIA OVER 5 YEARS AGO AS A MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOW; I NOT ONLY MOVED COUNTRIES, BUT ALSO CHANGED RESEARCH FIELDS. I AM NOW RUNNING MY OWN LAB AT THE DEPARTMENT OF CHEMISTRY AND BECAME A CORPUS CHRISTI FELLOW IN 2019.

When I turned one, I had my first career assessment test. There is an old Chinese tradition called ‘zhuazhou’ where on a child’s first birthday, they are to be presented with several objects from which to grab. The object that the one-year old chooses forecasts the child’s future career path. On my first birthday, the items presented to me included a yuan note for a career in business and finance, a small accordion for a career in the arts, a doll for a career as a housewife, a stethoscope for a career in medicine, a shiny jade bracelet and a couple of colourful toys for a life of luxury and leisure, and so on.

In some families, relatives would watch on and place bets on which object the child would grab. In mine, however, all hopes were placed on the stethoscope. Both my parents were doctors, my entire paternal family had esteemed careers in medicine; the stethoscope was pushed encouragingly towards me. To everyone’s dismay, I grabbed instead one of the dullest items on display - a plain white pen. A career in writing...perhaps in scholarship...? What else could a pen allude to? The room became unsettled. I was born five years after the one-child policy was enforced in China, so my future possibly determined my family’s legacy. The stethoscope was offered one more time, but I held on to the pen.

Of course, I do not remember any of this birthday grab business. And knowing what I know now, perhaps if there was a choice of a test tube rack or safety goggles, I might have grabbed one of those instead. Hints of my inclination towards science only surfaced later and was very much

fostered by my mother. My mother was not a Chinese ‘tiger mother’ who pressured me to study hard and strive for a certain success; instead, she had inspired achievement and hard work in me through example. I was a constant witness to her multi-tasking talents as a successful paediatrician and homemaker, mostly whilst being a single parent as my father was away overseas. My earliest memories are of my mother feeding my love for learning and science through bed-time stories. On most nights, she would unravel to me, one scientific fact at a time, the magic behind why stars blink at night, how the human body works, how a radio transmits sound, how eggs become chickens, and so on. Some of these had unexpected effects on me: eggs would go missing from the kitchen and turn up nestled snugly under blankets in beds; the radio and sewing machine would be found dismantled, apparently by someone who wanted to have a better look inside...

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We immigrated from the populous city of Guangzhou to the quiet suburban city of Gosford, two hours north of Sydney, Australia, when I was just under eight. Moving from China to Australia at this age meant that I was armed with an ability to perform long division, but had no knowledge of the English language. The sharp transition and being away from family and friends were extremely tough. I went from being in amongst the top of my classes in China to being placed in the bottom classes in Australia, and I had to work very hard and caught up slowly. It took a long time for me to understand what the teachers were expecting from me and what my classmates were chatting about at lunchtimes. Even after then, straddling between the demands of two different cultures required more maturity than I could muster on several occasions. However, there were also many moments of wonder and discovery. I loved the colourful nature of coastal Australia, where there seem to be more rainbow lorikeets, blue-tongued lizards and red-back spiders than people. I loved the generous clear blue skies and golden beaches. I missed many things from my original home, but also loved being able to cherry pick the best from the two cultures (for example when it came to food and holidays). Straddling the two worlds gave me a unique perspective that empowered me to challenge cultural conventions and not be afraid to deviate from the norm later in life.

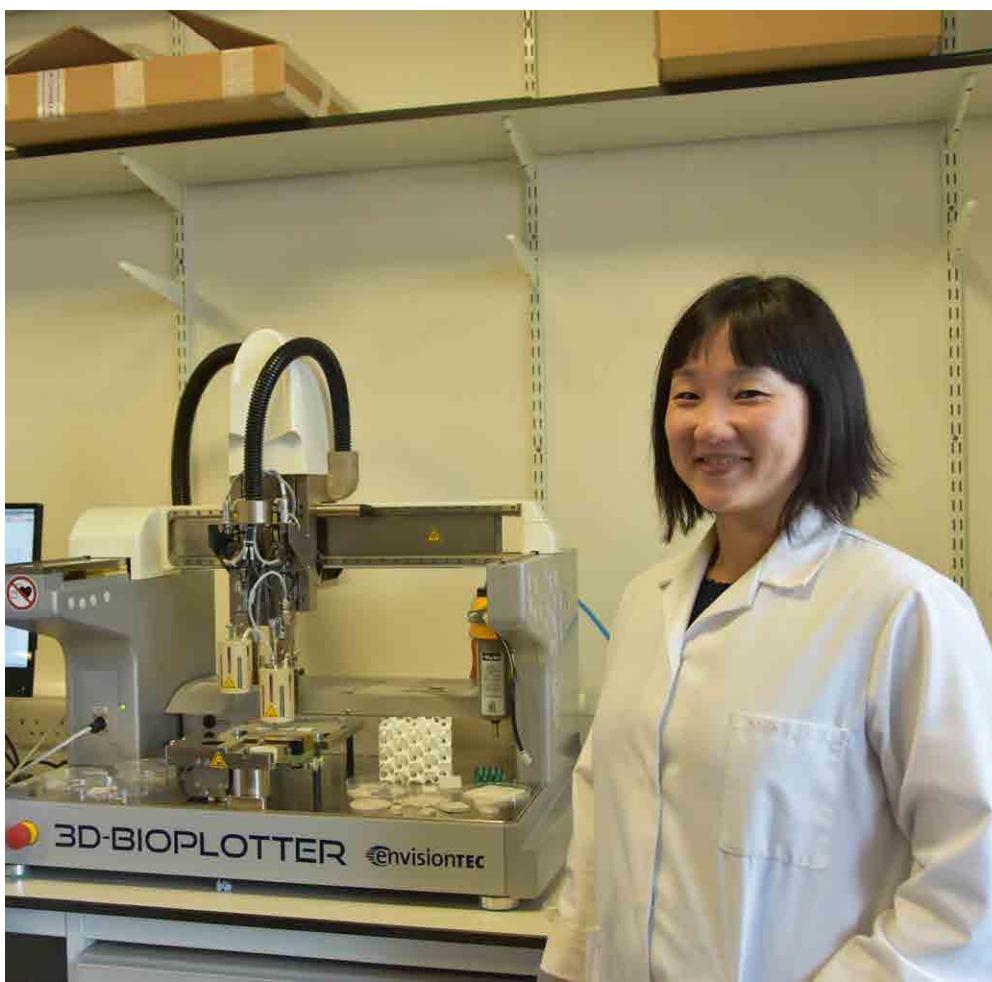
During my final high school years in Australia, when I had to pick my university subjects, I was less decisive than my one-year-old self. I enjoyed so many subjects, yet none was an obvious calling. Finding solutions



to complex mathematical problems gave me an enormous buzz, whilst examining English texts opened my mind to new worlds and ideas. I loved how art subjects challenged me to tell stories in creative and abstract ways, and how physics revealed invisible relationships that connected multi-scalar spaces. High school chemistry, however, I found un compelling. The descriptions of chemical processes gave me the sense that it was an important and pragmatic subject, but impact statements could only go so far. Furthermore, my family still hoped for me to pursue a career in medicine. In the end, I decided to find out what I was capable of first before deciding what to be. For this reason, I picked a general degree in science at the University of Sydney, without knowing what would come out of it.

I chose science because I wanted to better understand what makes up our physical world, and where we stand in it all. Importantly, I wanted to be armed with the right knowledge to help solve important problems facing our world. Seeing the limited life path options of my cousins (and my own alternative reality) in China from afar, I greatly appreciated the privilege and freedom that was gifted to me by my twist of fate in immigrating to Australia. I wanted more than anything to make the most of this gift by using it to reach my potential, to give back where possible, to live a full life that leaves positive ripples in this world.

I took a spread of science and maths subjects in my first year of university with chemistry included. By the start of the second year, chemistry emerged clearly as my favourite subject. My enthusiasm first ignited in lectures showing organic chemistry reaction mechanisms... molecules suddenly came to life for me. I loved visualising the movements of electrons and possible interactions between different molecules based on the properties of their functional groups. I remembered my spine tingling when we started lectures on inorganic chemistry - the chemistry of the metallic elements. The shapes and reactivity of the compounds multiplied in complexity, and we



began making brilliantly coloured salts and solutions in laboratory practicals. It was easy to imagine that one was in a potions class in a Harry Potter novel. At this point, it was abundantly clear to me that chemistry was more than just a pragmatic subject. Chemicals make up the mind-blowingly rich and dynamic fabric of the universe and understanding chemistry is like being able to peak behind the curtains of the magic show that is our fascinating world. I truly believe that chemistry is a springboard from which to make a difference in the world in an informed way.

Fast forward a few years, I was doing a PhD in chemistry in Sydney with Professor Trevor Hambley. My research topic addressed the common problem of poor penetration by anti-cancer agents into solid tumours, which contributes to reduced efficacy and the development of multi-cellular drug resistance. In this research, I synthesised a library of anti-cancer platinum agents that differed rationally in their chemical properties and probed their bio-distribution and interactions within tumour models using a variety of biophysical methods. I loved the research experience for many reasons. I loved the creative problem-solving elements needed in finding synthetic pathways to make new molecules, and piecing together clues derived from various characterization techniques to reveal, for example, the identity of a newly synthesised compound or an unknown process occurring within a complex system. The beauty of the scientific method means that even if a mistake was made during a discovery, it is likely to be systematically corrected later. I loved travelling around the world to exchange ideas with sharp-minded people at conferences. I was fascinated to see how science is done in labs across the globe and went on an exchange to the Middle East. I flew to several synchrotrons (which are large cyclic particle accelerators) developing techniques with beamline scientists to push a little further each time the ways in which we could probe into my tumour models. All the while, I was fortunate enough to be working alongside cellular biologists, spectroscopists, physicists and other



chemists; it was eye-opening to see how one problem could be tackled in such different ways.

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I went into my science degree wanting to see what I was capable of; I came out with a PhD and a thirst to do more science. At the end of my PhD, I realised that I wanted to pursue a post-doc, but as much as I had enjoyed research in the field of medicinal chemistry, another challenge was calling to me. Climate change was starting to sit heavily on my mind, and I wanted to find out what chemists were doing towards addressing this looming problem. It turned out that one of the biggest challenges facing chemists today is within the field of artificial photosynthesis: that is, chemists are trying to develop synthetic systems that could better harvest and store solar energy in the form of chemicals than nature can via biological photosynthesis. This is a possible step towards replacing fossil fuels with renewable fuels. Fortunately, I found a principal investigator, Erwin Reisner, in Cambridge who was working on this topic and was also crazy enough to support me in this change in research direction. He himself, had a similar research field transition post-PhD.





Photo credit: Gaby Bocchetti.

Although many were supportive of my change in research direction, a few well-meaning individuals tried to dissuade me from changing fields: “You’re doing so well in medicinal chemistry, do you really want to change?”. It is true that changing fields post-PhD may mean the loss of research momentum and established networks, with a general drop-off in publication rate; a new start is always hard and could jeopardise a career in academia where ‘publish or perish’ is a mantra. It was a big risk and I knew it. However, having been empowered by the personal experience of transitioning between worlds earlier in life, I saw such changes as enormous opportunities for growth and learning. I was, perhaps naively, looking forward to the challenge and the possibility of breathing fresh ideas into old problems.

I started working in Cambridge as a Marie Skłodowska-Curie Fellow in 2013, studying the photo-catalytic properties of the water oxidation enzyme photosystem II (PSII) using electrochemistry. PSII is responsible for kickstarting photosynthesis in plants, algae and cyanobacteria, and serves as an inspiration in artificial photosynthesis in which water oxidation is a rate-limiting step. As expected, the learning curve was very steep; the reading list for this project was both broad in context (spanning the fields of catalysis, materials science, interface chemistry and biological photosynthesis) and it became highly technical when it came to the mechanics of how the PSII enzyme works. Furthermore, electrochemistry is a technique that seems deceptively straightforward to execute, but the results can be very challenging to interpret. Indeed, it was tough, but I believe that it was my chemistry background that helped me to get to grips with the fundamentals of the field much quicker. With some patience and hard work (from both me and my team mates in the new research group), we began to have many exciting moments of discovery and progress, from the development of new electrodes for enzymes that resulted in three-orders of magnitude increase in electrochemical output, to the wiring of PSII to other enzymes to artificially re-wire biological photosynthesis, to the uncovering of

new electron transfer pathways at the enzyme-electrode interface.

By the end of my post-doc five years later, we have well and truly opened up the field of ‘semi-artificial photosynthesis’. This emergent field aims to integrate components of artificial and biological photosynthesis to access novel bio-hybrid systems for solar chemical or electricity production. It is a highly interdisciplinary area of research and the ability to bridge between different worlds is crucial to its success; again, here I was able to draw inspirations from my personal background.

I started my own research group in 2018 at the Department of Chemistry as a BBSRC David Phillips Fellow, where I am taking semi-artificial photosynthesis one step further. My research now focusses on wiring live photosynthetic microorganisms (which are much more robust and complex than photosynthetic proteins) to electrodes. My team aims to develop tools for studying fundamental photochemistry of microorganisms, and to use this to help guide us to better exploit them in agricultural and solar energy-conversion technologies. My group members and collaborators are an exciting concoction of engineers, chemists, biologists, theoreticians and spectroscopists, including Corpus Christi Fellow Christopher Howe.

Having seen Cambridge from the inside for many years now, it is easy to still wonder sometimes... what am I doing here? My narrative is so different to many within the Faculty and the colleges, it is easy to come down with the dreaded ‘Imposter Syndrome’. However, I have come to realize that diversity (provided that it is not oppressed) brings with it creativity and balance, and is vital to the health of an organisation. With my time in Cambridge, I hope to not only drive great science, but also to set an example for those who do not have a typical Oxbridge profile to embrace their difference and use it to fuel their own success. If I could inspire future parents to place test tube racks and safety goggles in their one-year old’s cots as part of the birthday grab, that would be a bonus!





# Dr Thomas Nelson

## Research Fellow in Classics

My interest in the classical world was sparked at a young age. I can trace it back to the Greek myth comics which I loved reading as a child, as well as the encyclopaedias of Norse, Egyptian and Graeco-Roman mythology which I pored over for hours. The legends of ancient gods and heroes fascinated me far more than modern history or fiction. There was something about these fantastic narratives that kept me hooked: the conflicts between forces of order and chaos, the hybrid creatures that were neither fully human nor fully beast, and the topsy-turvy fortunes of both individuals and whole communities, all overlaid with a deep sense of these stories' great antiquity. In hindsight, I think I was drawn by these ancient tales' ability – despite their temporal distance – to reflect timeless facets of the human condition.

It was the opportunity to learn Latin at school, however, that first made me aware of Classics as an academic discipline. I was enthralled by the allure of this dead language with its elaborate rules, systems and (seemingly) insistent logic. I also fondly remember my teacher's attempts to spice up the language learning with his 'nine jokes of Latin'. Among my favourites were the pub patron who 'declined' a martini (*martini, martini, martinus, martinorum...*) and the pair of writing frogs who kept saying '*scribit, scribit*' ('it writes, it writes'). What felt most special about Latin, however, was its ability to unlock the past. By learning this language, I could start to read what real people had written about their lives and beliefs thousands of years ago. And as I went on to read Latin poetry, I really appreciated the artistry of this inflected language – in comparison to English, the flexibility of Latin word order allows for far more creative expression in the positioning and juxtaposition of individual words. Later in my school career, I also started learning Classical Greek,

which clicked with me even more than Latin. I took it for A Level alongside History, Maths and English Literature, where I especially enjoyed tracing the influence of classical literature on later authors such as John Milton. Given my twin interests in the ancient world and literary criticism, Classics was the natural subject to pursue at University.

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I promptly went off to the 'Other Place' for both my undergraduate and master's degrees, spending five happy years at University College. I quickly discovered that my strongest interests lay in the field of Greek literature, especially the poetry of the archaic (8th – 6th centuries BCE) and Hellenistic (late 4th – late 1st centuries BCE) periods, and it is in these two areas that the majority of my research has focused to date. For my PhD, I relocated to Cambridge (Trinity College), and I'm delighted to be able to continue living and working in this thriving city during my Fellowship here at Corpus.

My current major research project focuses on early Greek literary history, investigating how our earliest known Greek poets signposted their debts to their predecessors. Ancient poets repeatedly retold the same myths with the same sets of characters, whose stories would have already been familiar to their audiences. In modern media, we might compare the likes of Sherlock Holmes or James Bond. We don't need to be told about these characters because we're already familiar with their backstories. The same was true for the ancient Greeks and their myths. In my research, I argue that the earliest known Greek poets self-consciously acknowledged the familiarity of their subject matter and signalled their references to prior tradition – placing markers in their works for alert audiences to recognise (much like the knowing 'Easter eggs' of modern cinema). This kind of signposting is usually considered the preserve of later literary cultures, closely linked with the development of libraries, literacy and writing. But I argue that these same devices were already deeply engrained in our earliest oral archaic Greek poetry.

A particularly intriguing instance of such signposting involves cases where characters' memories of events from their fictional past coincide with the poet's (and audience's) recollection of earlier literary texts and traditions. In Homer's *Iliad*, for example, the Greek hero Achilles threateningly asks his Trojan enemy Aeneas if he remembers the previous occasion when he chased him down from Mt Ida and nearly killed him. We know that this episode belonged to the canon of Trojan myth against which Homer worked and with which his audiences were familiar. By explicitly 'recalling' this event, Achilles parallels and triggers the audience's own recall of former poetic treatments of it. Notably, this is precisely the same kind of cross-





referencing that we find in far later literature, as when the literary Sherlock Holmes remembers events which Conan Doyle had narrated previously: in *The Adventure of the Sussex Vampire* (1927), the protagonist consults a record of previous cases, in which he reads about the ‘Voyage of the Gloria Scott’ and has ‘some recollection’ that Watson ‘made a record of it’. As in Homer, this back-reference (to *The Adventure of the Gloria Scott*, 1893) is cued through the language of memory. These two texts, separated by over two and half thousand years, exhibit the same literary strategy: characters’ memories map onto those of the audience. By exploring many examples such as this, my project encourages us to rethink how we understand our surviving archaic Greek poems, both individually as elaborate compositions in their own right, and collectively as part of a larger literary tradition that bridges many centuries and cultures.

Throughout my time in Cambridge, I’ve also maintained an active research interest in a different period of Greek

literary culture, that of the Hellenistic age, and it is in this sphere that many of my future research plans lie. The Hellenistic world (late 4th – late 1st centuries BCE) was a period of seismic cultural change. After the unexpected death of Alexander the Great in 323 BCE, his vast empire crumbled into a mosaic of successor kingdoms, radically reshaping the contours of the Greek-speaking world. With the foundation of new colonies and the expansion of earlier settlements, Greek culture stretched far and wide into North Africa, Syria and even India, blending Greeks and locals in an uneasy mix of assimilation and confrontation. The surviving poetry of this period offers a fascinating window onto how the Greeks of this era constructed, contested and legitimised their own identity and heritage.

In recent years, scholars have focused particularly on Ptolemaic Alexandria in Egypt as a privileged site to explore these issues. Alexandria was a major hub of literary and scholarly patronage, bolstered by the Ptolemaic kings’

construction of a vast Library and Musaeum (‘Institute of the Muses’, a distant ancestor of the modern-day ‘Museum’). Numerous texts produced in this Ptolemaic context survive today, allowing scholars to explore how Alexandrian poets fashioned a shared past and collective identity for their readers: legitimising their new reality through recourse to distant myth, mapping out their new panoramic world away from mainland Greece, and incorporating non-Greek Egyptian traditions into their works. In my research, however, I seek to expand our gaze beyond Alexandria and re-incorporate the forgotten tales of other literary centres. The literature from these sites tends to be less well preserved, but by tapping into a rich dossier of fragmentary and inscribed poetry, I aim to unearth the plurality of poetic styles and traditions throughout the Hellenistic world, with all their synchronic and diachronic diversity.

One way to approach this material is to investigate all the surviving texts and fragments from a specific locale.

To take just one example, I’m currently very interested in the Attalid kings of Pergamon in Asia Minor, latecomers to the international Hellenistic stage who rose up from very humble origins: their founder Philetaerus was apparently a half-Greek eunuch, the son of a flute-playing courtesan. Despite these lowly origins, however, the kingdom managed to secure a place among the top tier of Hellenistic monarchies by presenting itself as a harmonious and cultured defender of Greek civilisation, while also teaming up with the rising power of Rome – an opportunistic move which would eventually prove its undoing (the kingdom became a Roman province in 133 BCE). Today, Pergamon is best known for its monumental architecture, especially the massive ‘Great Altar’ which resides in the Pergamon Museum of Berlin and whose exterior is decked with baroque scenes of the cosmic conflict between giants and gods. In my research, however, I concentrate on the scraps of poetry that survive from Pergamon – fragments of royal praise poetry, inscribed *epinicia* (poems celebrating athletic success) and epigrams attacking

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THROUGHOUT MY TIME IN CAMBRIDGE I’VE ALSO MAINTAINED AN ACTIVE RESEARCH INTEREST IN A DIFFERENT PERIOD OF GREEK LITERARY CULTURE, THAT OF THE HELLENISTIC AGE, AND IT IS IN THIS SPHERE THAT MANY OF MY FUTURE RESEARCH PLANS LIE.

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the scholarly priorities of Alexandria. Such underexplored snippets allow us to gain a glimpse of how Pergamene poets positioned both themselves and their rulers within a wider pan-Hellenistic literary and political system.

Another approach is to track the workings of one specific type of literature across its numerous appearances throughout the Hellenistic world. The genre of epic is a prime example. We possess a wide array of Hellenistic epic fragments which concern many other places beyond Alexandria, ranging from Messenia and Delos in ‘old Greece’ to Syria and Jerusalem beyond. Since the time of Homer, epic had been a key vehicle for articulating and contesting cultural identity, and this is no less true of these poems. Many fragments promote local legends and traditions, such as the Thessalian King Aleuas’ love affair with a snake (!) or a princess’ betrayal of her hometown Methymna for the promise of Achilles’ love (one of the many amatory episodes appended to the Greek hero’s post-Homeric biography). Most exceptional of all, however, are





the fragments of two epics which re-tell Jewish biblical traditions in Greek literary form, recasting prominent biblical figures like Joseph and Jacob in the guise of Homeric heroes. In the future, I'd like to investigate how these Hellenistic epics manipulated myth and history to construct local and national ideologies, how they appropriated the literary and cultural authority of Homer, and how they balanced two very different literary traditions and cultures (both Jewish and Greek).

I am very grateful to be able to conduct my research in as welcoming and collegial a community as Corpus. I have only been here a year, but I already feel very much part of the Corpus family. Conversations over lunch and dinner are always entertaining and stimulating, the

grounds at Leckhampton are fantastic, and teaching Corpus students is an extremely rewarding experience. I teach a wide variety of subjects, ranging across Greek and Latin language and literature, but I am always impressed by students' enthusiasm and deep engagement with whatever we are discussing. I always enjoy the unexpected links that emerge between my teaching and research; the two major aspects of academic life complement each other so well. To that end, I'm looking forward to being Corpus' Director of Studies for Part II this year, helping to guide final year Classicists through to the end of their course.

I am also an enthusiastic advocate of outreach and widening participation, giving more people the opportunity to explore the myths, history and culture of

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**DURING MY TIME AT OXFORD, I SPENT MANY EVENINGS PLAYING THE FRENCH HORN IN UNIVERSITY ORCHESTRAS, BUT I NOW SPEND MUCH OF MY FREE TIME TRAINING AND COMPETING AS A BALLROOM AND LATIN DANCER.**

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the ancient world. In addition to giving regular school talks, I collaborate with the Young People's Puppet Theatre, a charity which encourages creativity and teamwork in primary schools ([www.yppt.org.uk](http://www.yppt.org.uk)). I've recently written a puppet version of 'Theseus and the Minotaur' for their projects with Year 6 classes in the UK, which has so far been performed in Cambridgeshire, Hertfordshire and London. Over the course of an academic year, the children (aged 10-11) make their own marionette puppets, paint backdrops, build props, learn how to puppeteer, and finish off with a spectacular performance on a high-tech stage in front of their friends, parents and local community. I particularly enjoy talking with each class about ancient myth and culture before attending their final performance at the end of the year.

Beyond the academic world, I am also passionate about dance and music. During my time at Oxford, I spent many evenings playing the French Horn in university orchestras (alongside a stint as President of the university music society, OUMS), but I now spend much of my free time training and competing as a Ballroom and Latin dancer. Over the past five years, I have represented England and Cambridge internationally in Austria, Germany, Hungary, Poland and China, and I captained the University team to an undefeated year at home and abroad in 2016-17. I compete in both couples dancing (performing with one partner against other couples) and in Latin formation dancing (with XS Latin Cambridge). The latter is a bit like synchronised swimming: eight couples dance a routine of around six minutes with elements from each of the five Latin dances (Cha Cha Cha, Samba, Rumba, Paso Doble, Jive), making different shapes and patterns on the floor alongside various tricks and lifts. During my time with the XS Latin team, we have been British Champions, UK Champions and WDC European Champions and we have also reached the semi-final of the WDSF World Championships. It is an intense and physically demanding sport, but I firmly believe that an active mind requires an active body, and dancing is an excellent way to unwind after a long day of deep intellectual thought. I feel very fortunate to be able to pursue my passion for both Classics and dance during my fellowship.



Thomas with his partner Caitlin after winning the British National Championship 2018.  
Photo credit: Reggie Thomson.



# The Revd Canon Jeremy Davies (m1965)

College Chaplain



I had just sung the aria *The trumpet shall sound* from Handel's *Messiah* in King's College Chapel and was wondering how it had been received when a gowned figure with a clerical collar emerged out of the shadows and invited me to attend an interview at Corpus (my third choice) at 8 pm that evening. Having discovered where Corpus was I attended in good time to be interviewed (surprisingly since I was proposing to read English) by the Senior Tutor (a Japanese specialist) and the Tutor for Admissions (an education expert). Later that evening I learned I was one of the fortunate candidates to have been awarded an unconditional place and a choral scholarship at Corpus. A fortnight later I was hit in the throat captaining my school rugby fifteen and lost my singing voice for six months. Fortunately by the time I arrived at College the following October after a nine-month stint as a VSO in Jordan my voice had recovered and I was able to take my place in the Corpus choir. The choir was in those pre-co-education days an extraordinary affair. We sang a predictable church music repertoire with no sopranos. Baritones like me sang the treble line an octave lower. What amazes me now is that we put up with that arrangement. But the chapel choir was in many ways the backbone of College music with a succession of very distinguished organ and choral scholars, and other musicians (from Daryl Runswick and Nicholas McGegan to Mark Elder, Edward Higginbottom and Richard Shephard to name but a few of the glitterati whose contribution to international music-making has become legendary).

I came up to read English at a time when Corpus (maybe fearful of becoming embroiled in the F R Leavis controversies of the 1960s) had no English literature specialist among the Fellowship. That seeming deficiency was more than compensated for by having Dr Michael Tanner as our DoS. Michael saw to it that we were farmed out to supervisors in other colleges, (such as Jean Gooder, Catherine Duncan-Jones and Germaine Greer) or were supervised by 'peripatetic' lecturers from other universities like the playwright Simon Gray, and indeed, for one very special year, by Queeny

Leavis herself who occasionally hailed FR in from their garden in Bulstrode Gardens to give us his wisdom on the English novel. I'm afraid the brilliance of my teachers was not reflected in the quality of my examination results - for which I can only blame my own ill discipline in allowing myself to be distracted by musical commitments, (horn playing as well as singing in CUMS and being a founder member of Richard Marlowe's University Chamber Choir), Corpus rugby, and the Fletcher Players- none of which in my heart of hearts I regret.

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The Fletcher Players along with the choir and College sport provided just the kind of leaven that a small College with a hard-won reputation for academic achievement needs in order to maintain a sane balance. The May Week play put on by the Fletcher Players in the Old Court was a high point of the College calendar. In my first year I played Cupid in Vanbrugh's *The Relapse* with music by Daryl Runswick which included a duet that I sang with Duncan Perkins, who

later became a distinguished basso profundo lay clerk at Canterbury Cathedral, but in 1966 put on drag and an immense wig to sing contralto to my mellifluous baritone. The following year I directed a production of *Twelfth Night*, and in my final undergraduate year I played MacHeath in Gay's *Beggars Opera*, expertly arranged by Richard Shephard and directed by Anthony Harding, FBA (now Emeritus Professor of Archaeology of Exeter University). In those heady days the Fletcher Players then decamped to Cornwall to perform the May Week production at the Minack Theatre. It's a tradition that I hope the current Fletcher Players executive might consider reviving.

I had known from a very early age that I was going to have some involvement with the church and my five years as a cathedral chorister at Llandaff (just outside Cardiff) both confirmed and stimulated my interest in religion. I often describe myself as a religious freak as I was endlessly fascinated by church ceremony and ritual (despite having been brought up in a Welsh-speaking Baptist family) I was never bored in church and revelled in the catholic emphasis of the Woodard School I attended in Sussex. So it was no surprise to family or friends when, after graduating, I moved to a seminary to begin ordination training. John Bowker was Dean of Chapel at Corpus - in my view the most distinguished theological polymath of his generation - and he persuaded me that I should stay in Cambridge where the theological teaching was unrivalled, and so I began three years at Westcott House studying for Part 2 of the Theology Tripos.

It was exactly 50 years ago that I attended one of those famous Sunday evening, Great St Mary's sermons that sometimes changed not only perceptions but the course of one's life. The great charismatic bishop Trevor Huddleston, with a nod to his book which alerted the world to the evils of apartheid, preached a sermon entitled *England - Naught for your desire*. The bishop, having left South Africa after his courageous stand against the South African police state, had again returned to Africa as





Fletcher Players performing *Macbeth* in Old Court (1968). Jeremy in the red coat and next to him in green coat, Dr Richard Bainbridge (former Senior Tutor).

Bishop of Masasi in Tanzania. In 1968 he came back to Britain as Bishop of Stepney, and his sermon in Cambridge reflected on the contrasts between the Africa he had left and the east end of London where he now lived (the first Bishop of Stepney to live among his people in east London). It was full of political insight and was a powerful challenge to the status quo but it was also full of spiritual depth and I recognised that this bishop who spoke truth to power was also a monk, whose struggle for social justice was not at odds with, but indeed sprang from, his life of contemplation.

It was this sermon that caused me to write to Bishop Trevor who then invited me to meet him at his home on the busy Commercial Road. He persuaded me that having completed two Cambridge degrees I would be better occupied working for a

year in the east end of London as a youth worker rather than remain at Westcott for a further year (they'll only encourage you drink sherry and play croquet was the good bishop's acerbic observation). I duly took his advice and a year later, after my blooding as a youth worker (at a club where the infamous Kray twins had once been members) Bishop Trevor ordained me as a deacon and then as a priest to work as a curate in the parish of St Dunstan Stepney. It was a formative four years in an east end parish where I learned how to be a priest and discovered that theology and spirituality have a relevance and an importance in the lives of people beyond the cloistered tranquility of the academy.

In 1973, with a fellow curate I wrote the script for and directed a great passion drama to be performed

through the streets of Stepney called *The Way of the Cross*. It was the first of many similar productions I directed in different parts of the country (three of them in London) over the next almost forty years. Ordinary church members from across the denominational divides put on costumes and told the story of Christ's journey to Calvary and his resurrection. There were no lines for the hundred-strong cast to learn as the story was told by amplified narrators and at each of the stations as we wended our mile long way through the streets and high rise blocks of Stepney, our charismatic Bishop Trevor commented briefly and powerfully on the scenes we were witnessing. The hymn singing accompanied by the local Salvation Army Band, and the music provided by the large choir and other musicians, added to the celebratory character of the story we were telling.

It was performed as darkness fell and so each of the eleven or so scenes performed in the natural theatres provided by that urban landscape had to be lit by a group of electricians - who were part of the army of non-acting technicians, carpenters and seamstresses and van drivers who were an indispensable part of the production. Whether it was fine or rained the story was told and on each occasion some five thousand people came to watch and participate.

After the parish came four years across the road from Stepney at Queen Mary College as college chaplain, where I was able to renew my friendship with two of the people who had taught me as an undergraduate and who taught at QMC - Roger Gard and Simon Gray. Curiously all the jobs I have done since I was ordained (including my present stint as chaplain at Corpus)

have come about as the result of an invitation rather than an application on my part. And it was an invitation by the then Bishop of Llandaff which occasioned my return to Cardiff, where I had been brought up, to be Senior Chaplain at Cardiff University and the Polytechnic of Glamorgan). My seven years back in South Wales also involved a sabbatical term at Corpus as a Fellow Commoner. I had intended in that term to begin the research for a book. However, I was distracted by an audition advertisement by the Clare Players who were planning a production of Peter Schaffer's *Equus* - one of my favourite twentieth century plays. I auditioned and got the part of the psychiatrist Martin Dysart - certainly the longest part I had had to commit to memory since I played Hamlet as a sixth former. The book project was put on hold for a year or so.

Towards the end of that sabbatical term at Corpus I was invited by the then Dean of Salisbury to meet him and the Bishop to entertain the possibility that I might become Canon Precentor of the cathedral there. That interview resulted in my accepting the Bishop's invitation and the following October I became Canon Precentor of Salisbury with responsibility for the liturgy and music of that great cathedral, with its tradition of liturgical excellence and pre-eminence stretching back to the pre-Reformation Sarum Use. It soon became clear that there was a huge task of liturgical refreshment and renewal that needed to be undertaken by the new Precentor. My first task was to update the cathedral's Sunday worship, recognizing that cathedrals, though they are part of a tradition that needs to be respected and worked with, also need to be models of the imaginative crafting and





presentation of liturgy and worship, that can become resourceful for the wider church. It was a great privilege to be able to devise the services for Holy Week and Easter, and the great processions for Advent, Christmas and Epiphany, and introduce a Marian Procession to celebrate the cathedral's Matron Saint. In addition that great shrine accommodated services to reflect on the plight of the homeless, to celebrate the annual Salisbury Festival, the Creation Festival of 1991 and the Poetry Festival, and many ecumenical services for Churches Together in Salisbury, including Taizé and Iona services. The *Way of the Cross* was performed four times during my twenty-six years as Precentor and in all these liturgical undertakings I found myself grateful not only for my Cambridge formation in literature and theology, but for the musical and dramatic experiences of my undergraduate years.

It is therefore with a great sense of indebtedness and gratitude to my alma mater that I have returned to Corpus for a short while to be chaplain while the College seeks to appoint a new, permanent chaplain. The chapel choir still remains at the centre of the College's worshipping life, though it's such a relief now to hear the soprano line sung by sopranos. The services day by day follow the liturgies of the Church of England, but I am delighted that every term there is a Roman Catholic mass in chapel, and that members of the Christian Union use the chapel for private prayer and occasional services. But the chapel is open every day to be visited and used from morning to evening prayer and is available for all members of the College as a place of prayer and quiet reflection whether we have a religious allegiance or not. And I see myself, though a Christian priest, as a companion and friend to all in the College - not least because I realize how much I learn about my faith and how to put into practice from many - young and old - who do not share my beliefs.





# Dr Charles Read

## Hong Kong Link Fellow in History

Perhaps I was fated from the very first week of my university career to become an economic historian. The month before I first came up to Cambridge to study history as an undergraduate saw the collapse of Lehman Brothers, an American bank with over \$600bn in assets. This is still to this day the world's largest bankruptcy in history. And it sent markets into a tailspin. My first week in Cambridge saw the crisis spread to Europe in a dramatic way. On Monday of freshers week—when I was given my first ever university essay title and reading list—Iceland's banks collapsed, and its currency, the krona, fell 30% against the euro in one day. Britain's FTSE 100 index of leading British shares had its largest absolute fall since it was established in 1984. The rest of the week, while I got stuck into making new friends and writing an essay about the causes of the First World War, saw more bank collapses and government bail-outs, with new economic and financial records set every day. I remember reading with horror in that Saturday's newspapers that stock markets in Asia, Europe and America lost 10% of their value the previous day.

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THE GLOBAL FINANCIAL CRISIS ALSO HAD AN IMPACT ON MY PERSONAL TRAJECTORY. I BECAME INTRIGUED BY WHAT CAUSES EVENTS OF SUCH MAGNITUDE, AND WHAT THEIR ECONOMIC AND POLITICAL CONSEQUENCES ARE.

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The world today is still shaped by the events of that week. Economic historians have long recognised—even if no one else has—that financial crises, involving the collapse of a country's banking system, are different to ordinary downturns. After a recession without a banking crisis, growth quickly returns and output goes back to the same upwards path it was on before the slump. But that is not so for a banking crisis. Banks, in a simple economic model, are the beating heart of an economy, pumping savings into investment, which spurs growth. A banking crisis is like a heart attack: banks stop pumping cash into businesses that invest and create new jobs, damaging output. Economies go into deeper recessions, take longer to start recovering and grow much more slowly when they do. That goes some way to explaining why Britain's recovery from recession has been the slowest in recent history. And it could explain the rise of nativist populism across the world in the form of Brexit and the election of Donald Trump as America's president in 2016. One relatively recent paper by three economists found that, taking data for 20 economies across a 140-year period, a normal recession without a banking crisis had no impact on a country's political spectrum. One with a banking crisis and tepid growth—the slowness of which fuels discontent against the elites in power—reduces support for moderate parties, and on average, causes support for right-wing populist parties in elections to rise by 30%.

The global financial crisis also had an impact on my personal trajectory. I became intrigued by what causes events of such magnitude, and what their economic and political consequences are. And what could be learnt from previous economic disasters to prevent ones reoccurring in the future? Determined to tackle such questions, after my

undergraduate degree, I eventually returned to Cambridge to study a PhD on the biggest economic and humanitarian disaster in the modern history of the British Isles; the Irish famine of the 1840s. This crisis was caused by a series of potato-harvest failures, which, in a country where three million relied on the tuber for their income and employment, resulted in a quarter of Irish people dying or emigrating within a decade. The crisis also had a long-term demographic and political impact still visible today. Today it remains the only European country area with fewer people than in 1845. And the idea that the British government mismanaged the handling of relief efforts fuelled support for Irish nationalism and demands for Irish independence, which were eventually granted with the creation of the Irish Free State in 1922.

What got me interested in Ireland? This is a question of great amusement even among economic historians of Ireland, among whom very few non-native born can be found. I have no Irish ancestry that I know of. But it was in fact researching family history as a hobby that led me indirectly to Ireland. My great-great-grandfather and great-great-grandmother were gardener and housekeeper at Wrest Park in Bedfordshire, a French-style chateau designed and built by 2nd Earl de Grey in the 1830s, now in the care of English Heritage. The two servants turned out to have lived happy and relatively uneventful lives. De Grey, on the other hand, was far more interesting. In a varied career, he founded the Royal Institute of British Architects, managed the construction of the new Houses of Parliament and the front of Buckingham Palace, was a pioneer of gun-control laws in Britain and Ireland, invented truncheons and championed their use instead of firearms by the new London Metropolitan Police, and lastly but not least, was the Lord





Lieutenant, or chief administrator, in Ireland between 1841-44. Oddly little had been written about him and his story was completely unknown—and that which there was completely libellous due to a transcription mistake in the 1880s that erroneously portrayed him to be an anti-Catholic bigot. Worse still, Wrest Park was under threat of falling into ruin after the research institute that was using it suddenly closed down in 2006. So I set about visiting the archives—where I discovered that he had written several memoirs including one running to some 107,000 words detailing the reasons behind every decision that he had made as Lord Lieutenant between 1841-44 that no historian had bothered to find or read before—and from which I produced a short biography entitled *Earl de Grey* and a prize-winning undergraduate thesis now published in the journal *History*. The result is that English Heritage is now spending many millions of pounds on restoring the house and gardens to their former glory as one of their most important properties in the country. De Grey and his wife—also known until 1833 as Lord and

Lady Grantham—are also possibly one inspiration behind the characters of the same names in *Downton Abbey*, the popular ITV costume drama and film.

But rummaging in those archives—focussed on the years just before the Irish famine—I noticed a massive gap between what historians had written about Ireland during this period and what was in the archives, much of which was being ignored by scholars. And it came to my attention that the same applied to the period of the Irish famine too. Historians of British politics writing about the famine tended to emphasize the good intentions of British policymakers formulating famine-relief policy. Irish scholars, to varying degrees, tended to emphasize the suffering of the Irish people during the crisis. What went wrong if good intentions in London were not reflected on the ground in Ireland? The problem here was the disciplinary division in universities between economics and history departments. Historians who did use archives were operating without any economics training and did not understand the full complexity of the financial

issues that policymakers had to deal with in the Treasury. But economists who did have the required training tended not to visit the archives to discover what actually happened. My approach was to delve deeply into the archives to understand the intentions of policymakers during the famine from their official and private papers. However, I also used the economic theory and methods I had picked up in a previous career as an economist and researcher in the banking sector to analyse the impact on the ground in Ireland during the crisis.

That joined-up approach resulted in a radically new answer to this question. The influence of libertarian laissez-faire ideologues did not cause the government to mistakenly abandon relief efforts in the middle of the famine. What caused the damage on the ground was a set of austerity measures in Ireland, introduced after two severe financial crises in London in 1847, designed to keep the United Kingdom on the gold standard. In short, it was a misplaced faith in the gold standard—at its core an interventionist creed that believes

in government interference in the currency market—not laissez-faire or libertarian ideas, that caused so many people to die.

This research, which became a doctoral thesis entitled, *“British Economic Policy and Ireland, c1841-53”*, has subsequently won several awards from the Economic History Society, including the Thirsk-Feinstein Prize PhD Dissertation Prize for the best doctoral thesis in economic and social history completed in 2016, the TS Ashton Prize for the best article published in the *Economic History Review* in 2015 or 2016 and the New Researchers Prize of 2014 (no scholar has ever won all three prizes before). More recently, it has also won a prize from the International Economic History Association for the best doctoral thesis on nineteenth-century economic history completed at any university in the world in 2015, 2016 or 2017, and will be published soon as an academic monograph.

My next project, for another book, looks more broadly at the causes of a series of severe financial crises that occurred in Britain between 1825 and 1866, and why they disappeared for more than a century after 1866, only to reappear with a vengeance in recent decades. This is a surprisingly important topic for policymakers today: Britain is the only major economy in the world to avoid having a systemic banking crisis for so long. Understand why this was so, and the hope is that you can avoid their reappearance in the future. But nineteenth-century financial crises are still very poorly understood, and this is where I hope my methods of detailed attention to the archives and the careful deployment of econometric analysis will help to untangle matters. Economic historians are no futurologists. History does not always repeat itself in the same way. But they can hold the use of the past by policymakers to account in a rigorous way. To quote the words of Cormac Ó Gráda, the leading Irish scholar of the Irish Famine, “shattering dangerous myths about the past is the historian’s social responsibility”.





# Dr Paul Kattuman

## Fellow in Economics and Management Studies

I WAS FORTUNATE IN MY SCHOOL. SAINIK SCHOOL, TRIVANDRUM, IN THE STATE OF KERALA IN INDIA, HAS BEEN AN INSPIRATIONAL SPRINGBOARD FOR ITS STUDENTS. AFTER SCHOOL, A TERM AS AN ARMY CADET AT THE NATIONAL DEFENCE ACADEMY TURNED OUT TO BE AN INTERREGNUM, BEFORE I MARCHED RIGHT BACK TO ACADEME-- TO CALICUT UNIVERSITY, TO STUDY ECONOMICS, SPECIALISING IN ECONOMETRICS FOR MY MASTERS. I JOINED THE INDIAN ECONOMIC SERVICE STRAIGHT AFTER, AND STARTED AS AN ECONOMIST AT THE FINANCE MINISTRY IN NEW DELHI. MY CIVIL SERVICE EXPERIENCE HELPED DEEPEN A GROWING RESOLVE TO SEEK OUT MORE RIGOROUS RESEARCH TRAINING IN ECONOMICS, AND LED TO CAMBRIDGE -- TO THE DEPARTMENT OF ECONOMICS AND TRINITY COLLEGE. STRAIGHT AFTER MY PHD I JOINED THE UNIVERSITY OF DURHAM ECONOMICS FACULTY, AND THEN RETURNED TO CAMBRIDGE, TO A FELLOWSHIP AT CORPUS, AND THE DEPARTMENT OF APPLIED ECONOMICS. I NOW TEACH AT THE CAMBRIDGE JUDGE BUSINESS SCHOOL.

Over 200 years before the publication of Adam Smith's *Wealth of Nations*, Matthew Parker, Lord Archbishop of Canterbury and former Master of the College, penned an absolute gem in applied Economics, on what we would now call incentives under asymmetric information. It was in 1574 that Matthew Parker entrusted the care of his priceless library of manuscripts and early printed books to the College. The medieval ages were not the best of times for libraries, and it must have been the sad state of the many library collections he had seen that led him to stipulate clear rules to protect his gift from loss or damage. To mitigate incentive problems in the maintenance of the collection, his bequest took the form of a "quadripartite indenture", involving Matthew Parker himself and Corpus Christi College, and two other colleges to which he had attachments, Gonville & Caius and Trinity Hall.

He bequeathed his valuable collection, requiring that it be kept within the library of the College, and stipulating that:

*Each year on the sixth day of August, ... the Masters of Gonville & Caius College and Trinity Hall [are to conduct an independent] review and examination. [I]f in the yearly inspection any of the printed*

*or manuscript books [are] missing, ... [Corpus Christi] shall make up the said number of books on pain of a fine imposed on them at the judgment of the two supervisors for the time being, so that the full number of books is extant at the next yearly inspection.*

*[In the event of breach, Corpus] shall forfeit at that time not only whatever silver plate there is recorded as given and handed over by the same Matthew to the aforesaid Master and Fellows, ... but they shall also hand over, totally and entirely, to the Master and Fellows of Gonville & Caius College the custody of each and every one of the said books within the next month. And that if the Master and Fellows of the said Gonville & Caius College are also found guilty of similar negligence, it is decreed that the silver plate recorded as given and passed over to that college, together with the custody of the aforesaid books, ... shall be handed over to the Master and Fellows of Trinity Hall to be kept in the manner stated above. ... But if they too are not zealous in performing and fulfilling that same custodial office, then indeed it shall return in a circle to Corpus Christi College, back to the state in which it was first established."* (as translated from the original Latin by the late Professor Raymond Page of Corpus Christi College).

The Parker bequest was in fact an elegant solution to what economists now call an agency problem, one which took due note of the potential for moral hazard. The solution was achieved through the design of a mechanism of self-enforcing audits by the agents themselves in a perpetual game played out between the three colleges. The design solved the so-called end-period problem in game theory, and ensured that the equilibrium outcomes of the game played by the agents themselves would preserve the collection. It was surely Matthew Parker's profound appreciation of the University milieu, marked as it was by altruism, self-interest, agency, asymmetric information, moral hazard, free-rider problems, and possibilities for collusion among agents, that led him to this sophisticated but low-cost solution.

The Parker bequest is an outstanding example of game theory at work well over 400 years ago. Rather than going on about how he solved the problem of assignment of constrained property rights with incentives for monitoring, and graduated contingent punishments for agents shirking in the care of the collection and so on, I'll just say that Brexit negotiators would be well served by asking themselves: what would Matthew Parker do?

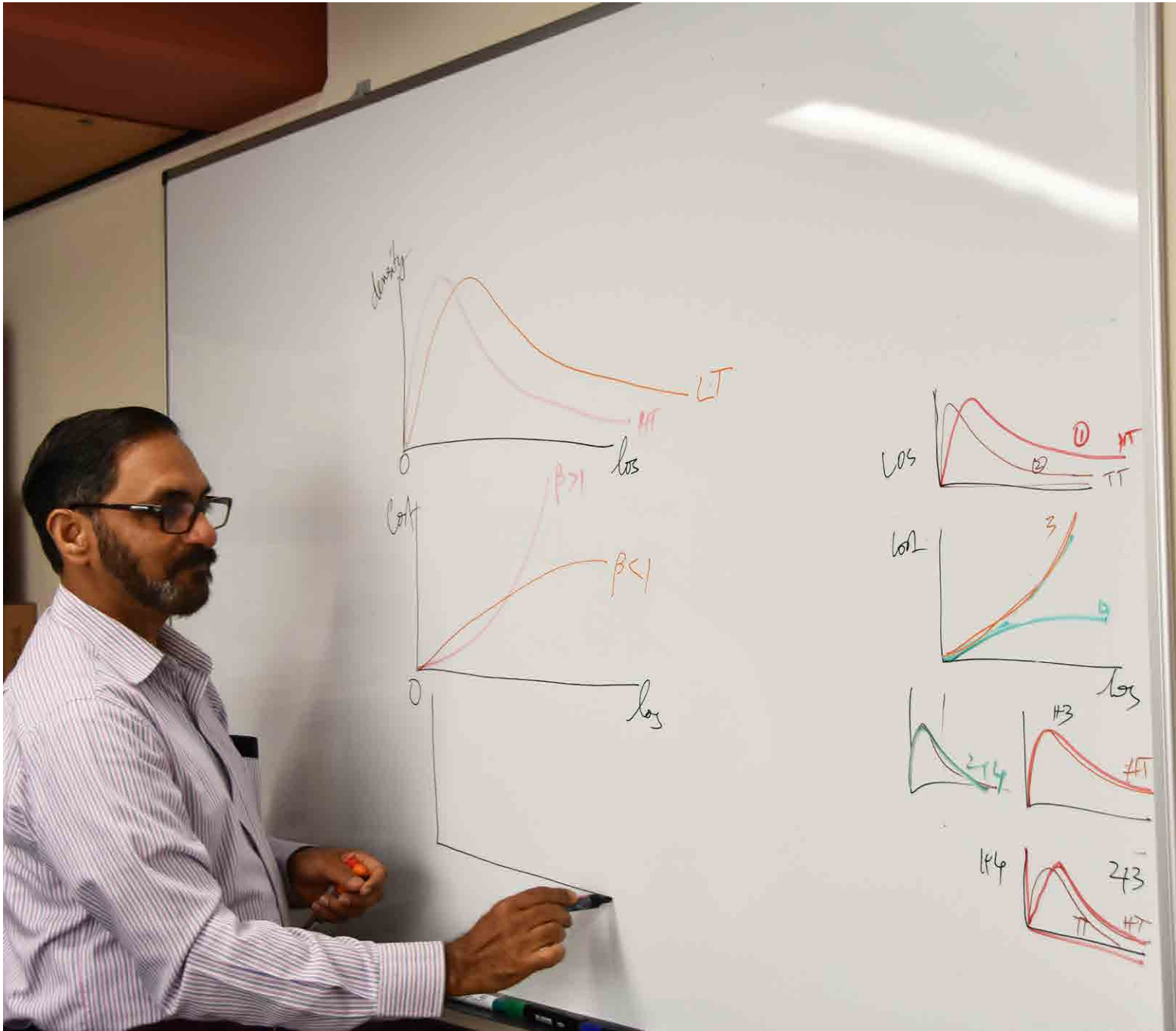




But my acquaintance with this brilliant economic mechanism lay far in the future, when as a 17 year old, I entered one of the splendid lecture rooms of the National Defence Academy, nestled in the hills south-west of the city of Pune in India. A neatly bowed curve that traded off guns against butter appeared on the board half way through that first lecture in economics. The mere possibility of such a trade-off had never caught my attention before, perhaps because it was quite at variance with the complete lack of substitutability in my life as a cadet. This was pre-liberalization India. There were precious few career options as the economy chugged along at a growth rate barely above 1% on a per capita basis, Indian industry shackled by a fantastically restrictive licensing system. My seniors from school appeared to lead charmed lives as young officers in the army and navy. Anyway, by the end of that first lecture in Economics a smattering of elegant diagrams and equations adorned the board. The analytical promise of the subject was not only clear to see, but seemed both liberating and within reach. It did not take me many weeks to hear the call and step off the uniformed career train and go back to university to study economics properly.

Many years earlier Keynes had captured the allure of the subject in his inimitable way, saying that an economist must "... understand symbols and speak in words. He must contemplate the particular in terms of the general and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purposes of the future. No part of man's nature or his institutions must lie entirely outside his regard. He must be purposeful and disinterested in a simultaneous mood; as aloof and incorruptible as an artist, yet sometimes as near to earth as a politician."

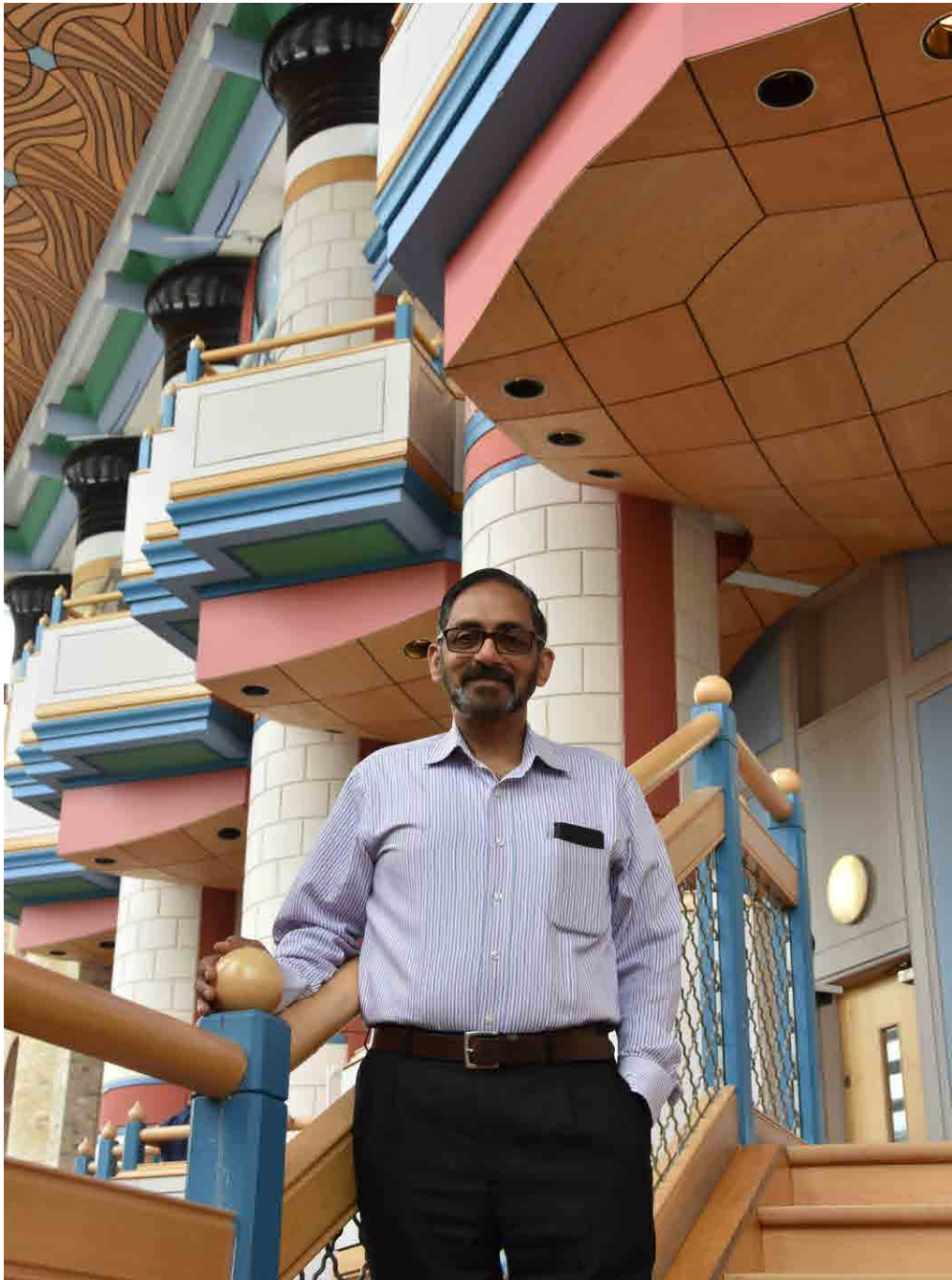
I was probably lucky that I had not read Keynes' pronouncement that economics was a subject in which



few excel, when I enrolled. To cut a long story short, my career as an economist began with time served as a cog in the economic administrative machinery in the finance ministry in India, where my main responsibility was to draft statements about the economy with just the right degree of opacity for the finance minister to deliver in parliament. Tedium set in all too soon. My path back to the world of academic economics ran to the Sidgwick site in Cambridge, where over my MPhil I filled some substantial gaps in my knowledge of economic theory, and over my

PhD I learnt the value of thinking and writing as clearly as I could, and just as much, the value of resilience. It did not take long for an aspiring economic theorist to give way to an applied econometrician with a bridging interest in theory. David Hendry has captured the flavour of the (generally) good natured jousting between the two branches with his four golden rules of econometrics: Think brilliantly; Be infinitely creative; Be outstandingly lucky; Otherwise, stick to being a theorist! An abiding empirical research interest I developed during

my time as a research student was in issues connected with economic heterogeneity, agreeing somewhat with Galton, who wrote disapprovingly of those: "[who] limited their inquiries to averages, and do not seem to revel in more comprehensive views. Their souls seem as dull to the charm of variety as that of a native of one of the English counties, whose retrospect of Switzerland was that, if the mountains could be thrown into its lakes, two nuisances would be got rid of at once."



“IT REMAINS A CHALLENGE TO CONVINCE SCEPTICS OF THE ALLURE OF THE GRAND THEORETICAL SOLUTIONS OFFERED BY ECONOMICS.”

It remains a challenge to convince sceptics of the allure of grand theoretical solutions offered by Economics. An undiscerning banker I attempted to convert in my student days stopped my sermon quickly saying that Economics sounded like a singularly impractical subject. The problem persists. An eminent mathematician colleague who is immune to the charms of Economics loves to chat about the disarray in the global economy and insinuates, only partly in jest, that I, as a card-carrying economist, was personally responsible for the global economic



crises. How could I not foresee the crisis in good time? How is it that economists cannot come to agreement on clear and intuitive remedies? When the admission season comes around, he never misses the cue to ask if there were any credible takers at all for the dismal science. In the event, there is always an embarrassment of riches among economics candidates.

What kinds of students commit themselves in times such as these to the study of economics? Pre-2008, through the boom years of finance, economics was the subject of choice for bright students looking to transform themselves into investment bankers. Clever and hard working, they mastered theory, techniques, empirics and even the intellectual spirit of the subject, but could not wait to get to the City and its bonuses.

Times have changed. Many of the aspirants are more thoughtful. For a larger number, their genuine interest lies in learning about how the jigsawed edifice of the economy works. There is more enthusiasm for understanding institutions, psychology, and even economic history, along with econometrics and mathematical models, and more skepticism about theory. There is a clearer sense of vocation, knowing that a malfunctioning economy can destroy millions of everyday lives.

The great depression spawned economists of the highest calibre. The late Paul Samuelson, a leading theorist and policy advisor of his time, and one of the first Nobels in Economics was “born” into the subject in 1932 (he was 17) due to the first great recession. John Maynard Keynes too was driven to economics impelled by a recession: his first research paper was on “the effect of the recent global economic downturn on India”.

Economics is not dismal, though dismal times are unsurpassed for teaching economics.





# Dr Claudia Bonfio

## Research Fellow in Biological Sciences

I never knew I wanted to be a chemist. But looking back, all the signs were there.

My story began on a weekday in spring, 30 years ago. I was born in Siena, a medieval city in Tuscany, mostly known in Italy and abroad for Palio, a horse race that takes place twice a year in the city centre, and for the wine produced in the surroundings. A few years later, I received the best gift I could ever ask for, a partner in crime and in life; a beautiful younger sister. We used to spend every summer in my grandparents' villa, creating "magic potions" by extracting essential oils from plants and flowers and collecting coloured powders from smashed rocks and pebbles. I remember my grandpa was not very happy with us destroying his garden, and I feel a bit guilty now. Still, those memories seem to hint that my passion for science likely started in those sunny days.

Despite my love for science, I was not sure which kind of science I had a preference for. Since I was enrolled in a humanistic secondary school (my dad likes to say that it is the only school that opens your mind and broaden your horizons...), I had no opportunity to gain some experience with different lab activities related to physics, chemistry and biology. Anyway, after five years of ancient Greek and Latin (language and literature), I was even more convinced that science was my choice.

I ended up choosing chemistry rather than maths for my undergraduate courses after tossing a coin. While the coin was in the air, I suddenly realized how much I wanted to become a chemist, to understand how the identity and arrangement of microscopic molecules could

explain a certain macroscopic behaviour of everyday life objects. The coin landed on the 'maths side'. Luckily, I am stubborn enough to follow my own intuition.

I completed my undergraduate studies in my home town with a thesis on protein crystallography, analysing the functional organisation of amino acids (the building blocks of our proteins) in structured proteins related to DNA synthesis. In those years I realized that I was most interested in the relationship between chemistry and biology, between simple chemical systems and complex biological machineries. To further expand my experience in the biochemical field and challenge myself in a new environment, I decided to move to Padua (close to Venice) for my Master's studies. There, a year-long internship gave me the opportunity to get my hands dirty with some organic and inorganic synthesis, focusing on peptide-based metal complexes that could potentially be used in anti-cancer therapy. The idea behind those studies was to prepare new drugs that could be specifically recognized by cancer cells to get internalized first and then target the DNA, leading to cell death. I still remember when I synthesized my first peptide (a chain of amino acids), and how proud I was when the purification went well. During that time in a biochemistry lab I realized how much I enjoy working with small molecules and using them to understand cellular processes.

One of the PhD projects (with Sheref Mansy, in Trento- close to the Alps) I applied for was aimed at discovering the chemistry that led to life about four billion years ago. Attractive yet challenging, exactly at the interface where chemistry and biology meet. My journey into the origin of life

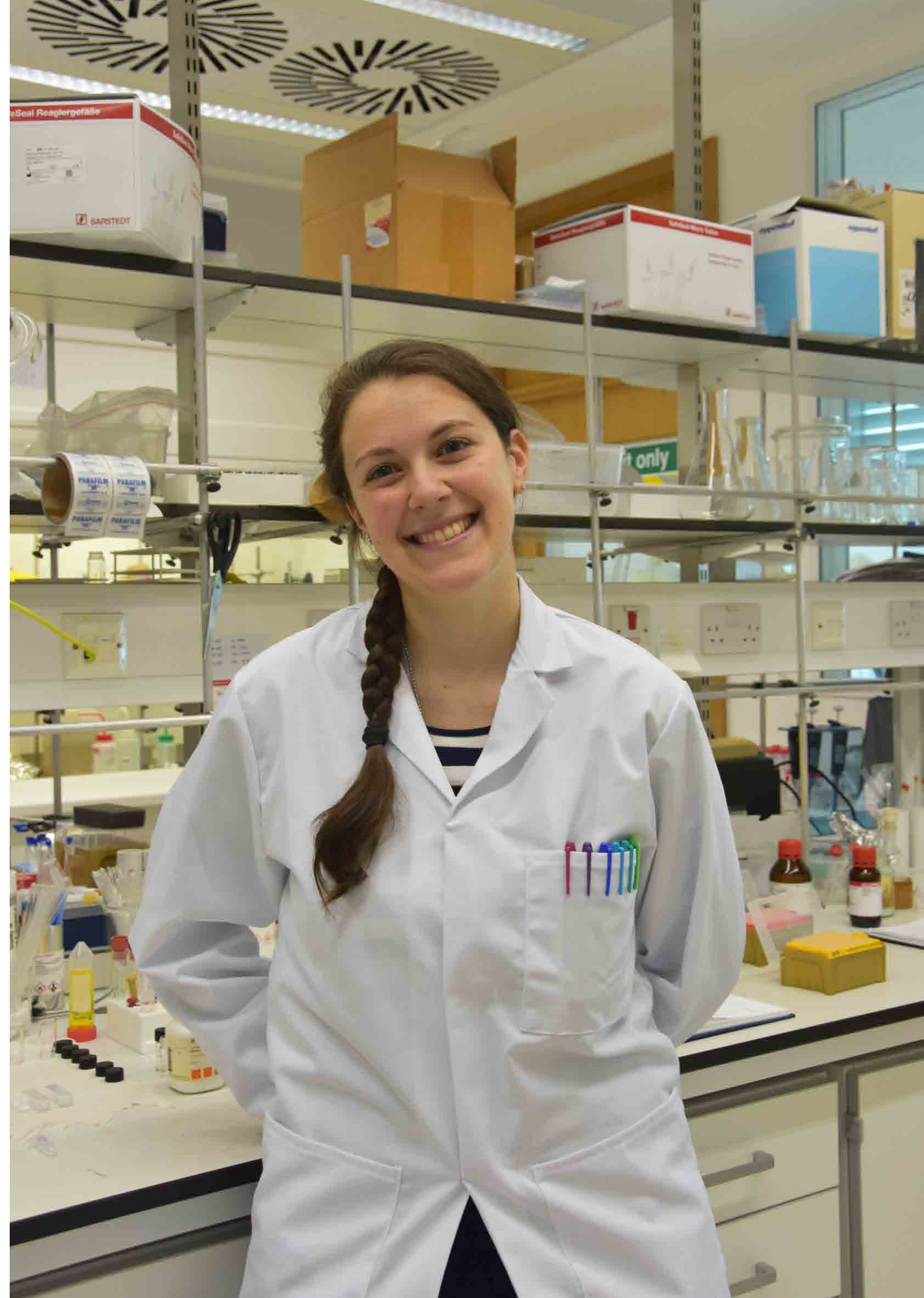
field started in 2014, and since then I truly believe I am focusing on the most exciting question a scientist could ever ask: Where do we come from?

“

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The origin of life is one of the greatest unsolved scientific problems. Origins research requires interdisciplinary support on topics including the astrophysical context of planetary formation, the development of prebiotic chemistry, the assembly of the first cells, and the advent of Darwinian evolution. In particular, the term “prebiotic chemistry” refers to a set of interconnected chemical reactions occurring on the early Earth before the advent of life. Therefore, prebiotic chemistry informs our understanding of how simple molecules present on our planet may have given rise to and evolved into the complex systems and processes that we know today.







Extant organisms reflect the environments from which they evolved. Therefore, it is logical to suppose that life began as a spatially-defined, self-replicating and metal-dependent chemical system. Indeed, the earliest forms of metabolism likely relied upon primordial enclosed metal-based systems that preferentially drove reactions that led to the emergence of a restricted set of chemical networks.

Among all metalloproteins, iron-sulfur clusters are indispensable components of modern metabolism and constitute one of the most ancient, ubiquitous and structurally diverse classes of biological prosthetic groups. For this reason, I spent my PhD trying to find out when and how these inorganic clusters started to play such a fundamental role in life.

It took me about four years to show how a nascent primordial cellular system could have exploited peptide-coordinated iron-sulfur clusters to drive metabolic networks, delineating an evolutionary pathway from short prebiotic peptides to complex extant proteins coordinating iron-sulfur clusters. Firstly, we described how the iron-sulfur cluster synthesis within

model protocells can be mediated by UV light coming from the young sun, suggesting that biological iron-sulfur cluster assembly could have occurred at a very early phase in the evolution of life. Moreover, the UV light-driven synthesis of iron-sulfur clusters appears strikingly similar to the protein-mediated biosynthetic processes for the assembly of iron-sulfur proteins. Finally, we showed

that ferric ions coordinated by short peptides can mediate the electron transfer between biologically-relevant substrates within model protocells and generate a proton gradient, thus mimicking modern biological machineries. Such results suggest that iron-sulfur systems could serve as useful models and prebiotic analogues of the prebiological steps leading to extant life.

Beside science, I learnt two things on my journey through my PhD. First, research is collaborative, communicative and collegial. I had the opportunity to spend part of my PhD here in Cambridge working with John Sutherland and in Boston working with Dimitar Sasselov and Nobel Laureate Jack Szostak. I had the opportunity to learn not only about chemistry and biology, but



also about geology and astronomy. And I am sure I would not be here if I had not shared my research and promoted new collaborations. The second important lesson is that not all the battles are worth fighting. A project can fail; it happens. It is up to us to understand when we should keep fighting for a good result or when we need to move on.

While taking an important step towards understanding the emergence of metalloproteins, I found myself profoundly intrigued by several unanswered questions regarding the emergence and the stability of primordial cells. Lipid bilayer membranes are an integral component of living cells, providing a permeability barrier that is essential for nutrient transport and energy production. Therefore, it is reasonable to assume that a similar boundary structure would have been required for the origin of cellular life. However, even though bilayer membranes are a cellular necessity, seemingly little progress has been made towards understanding how such fundamental boundaries emerged and evolved on our planet.

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To pursue this line of research I moved to Cambridge, to the MRC Laboratory of Molecular Biology. As a Marie Skłodowska Curie European Fellow, I am investigating how a prebiotic self-organized cellular system could have emerged and evolved, thereby defining a plausible pathway from simple prebiotic amphiphiles to defined compartmentalized entities.

The chemical diversity of the lipid structures present in extant living systems may be consistent with a level of sophistication brought about by evolution at a later stage. However, the structural similarity of prebiotic lipids and modern membrane components suggest that the latter originated from primitive amphiphiles, and later became specialized according to the needs of each specific organism.

So far, the effect of compartmentalization on prebiotic reactions has been studied only with simple molecules such as fatty acids, which partially mimic the behaviour but not the chemical structure of modern lipids. At the same time, biological components of extant membranes such as phospholipids have been exploited to better resemble the functionality of modern cells, even though their chemical synthesis is far too complex to be considered prebiotically plausible.

Recently, we have shown that the activation of mixtures of prebiotic lipid precursors and fatty molecules lead to the formation of a library of phosphatidic acids, which can be considered as intermediates between simple amphiphiles and modern phospholipids. Such phosphatidic acids can self-assemble into membranes that are stable to a wide range of conditions and capable of retaining mono and oligonucleotides. Moreover, iterative cycling of activation and hydrolysis steps allowed for the selection of longer-chain, thus more stable, phosphatidic acids.

Finding a plausible route for the emergence of modern membranes

will strongly contribute to our understanding of the origin of life itself, since compartmentalization is needed for the definition of cells as self-contained entities. Moreover, a deeper knowledge of the core chemistry of early life is likely to be of benefit to our understanding of fundamental issues in microbiology and molecular biology, as well as to support applied engineering and synthetic biology.



My experience in Cambridge is profoundly changing me, as a person and as a scientist. Here I am exposed to culture in its deepest sense, a manifestation of human intellectual achievements shared with the whole community. In this first year as a Research Fellow at Corpus I have had the opportunity to exchange ideas, share experiences and discuss a wide variety of topics ranging from physics to philosophy with researchers who share my enthusiasm and passion.

I have met outstanding colleagues who are always ready to encourage and guide me. I have met talented students and I feel so rewarded by the few hours we spent together reviewing chemical biology. Looking back, I feel so grateful for the opportunity of living the "Cambridge experience" at Corpus, which profoundly contributes to shaping my future in a familiar and supportive environment with passionate and encouraging researchers.

"... l'amare il proprio lavoro (che purtroppo è privilegio di pochi) costituisce la migliore approssimazione concreta alla felicità sulla terra..."

La chiave a stella, Primo Levi.

"Loving one's work, unfortunately the privilege of a few, represents the best, most concrete approximation of happiness on Earth..."

The Wrench, Primo Levi.





# Dr John Biggins (m2003)

## Fellow in Engineering

I will never forget when Corpus first pinged on my radar: I was at school, in Sheffield, sitting in a rather depleted further maths class. The school was of the type Tony Blair had just christened “bog standard,” but it was university recruitment season, and about half the students were attending an Oxford outreach event in the city centre. Suddenly a flustered deputy head appeared: “John, we’ve an unexpected visitor and urgently need a student to talk to him.” The visitor was Corpus’s Barrie Fleet and half an hour later I was sold. Corpus was small, central, crenelated, interested, and the ideal college for me.

However, the ideal subject to read took longer to come into focus. I clearly had a mathematical brain, but I enjoyed the concrete more than the abstract. I remember telling Barrie that physics, engineering, (applied) maths and economics were all strong contenders. In the end, I decided by elimination. Economics involved essays, maths required STEP and engineering was altogether too unfamiliar, so physics carried the day. Except, at Cambridge, physics means natural science. This worried me because, if I learnt one thing at school, it was that I was done with chemistry, but the appeal of Corpus and Cambridge nevertheless sustained my application.

Later in the year I visited Corpus, first for an open day and then for interview. The buildings felt imposing and profoundly unfamiliar, and the people, though friendly, were decidedly odd. My first interviewer wore an A4 sign around his neck proclaiming “George Bush, International Terrorist,” and his interview started a gliding “stop the war” postcard. My second interviewer, the theoretical physicist Mark Warner, went on to be my director of studies, undergraduate

supervisor and ultimately supervised my PhD. Years later, he is still my most significant academic mentor, and it is a real privilege to return to Corpus as his colleague.

I vividly remember my first day at Corpus. All the freshers were corralled in the McCrum lecture theatre, and the Senior Tutor, one Christopher Kelly, intoned “there is no one in this room who cannot get a first,” then, after a suitably dramatic pause, “well, perhaps in some cases a high 2.1.” I remember thinking, ah yes, that’s me. Graham Pink explained that, in a building like Old Court, one is only ever moments away from incineration. Then, after some pub golf and a ghost tour, we were off on the intellectual ride of a lifetime.

I was always a thoughtful and studious child. At school the one thing that was absolutely unacceptable was enthusiasm, so this was a recipe for rejection and loneliness. At Corpus, everything changed. Suddenly I had a peer group who wanted to learn, and teachers who really knew how to stretch. I learnt more, and faster, than I ever had before. I also found a circle of like-minded friends, which remains a close-knit community to this day.

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”

Rather to my surprise I also found considerable academic success, and with it came College perks including feasts, silver cups, and palatial sets. I was lucky enough to spend two years living on N staircase in Old Court: first on the ground floor in N2 then on the first floor in N3, with three large sash windows overlooking the court. I suspect that, even if I spend my entire career at Corpus as a fellow, I will never again enjoy such significant College real estate.

One thing I didn’t find was good food. Jamie Oliver was just starting on his canteen revolution, and Corpus was still routinely serving wallpaper-paste stew and unspecified meat pie. Salad had not yet been invented. Necessity being the mother of invention, several of my firmest friendships were forged in the miniscule gyp rooms of Old Court.

And, of course, there were College societies. I never excelled at anything, even at the level of Corpus seconds, but I had fun trying. The highlight of my Corpus sporting career was a stint as stroke of the Corpus second boat. I remember being triple over-bumped by Hughes Hall in what, I suspect, was the worst performance of any boat Corpus has put on the river. After that, I decided to focus on my studies.

The breadth of first year NatSci delighted and stimulated me. That summer I reflected that my subject choices (physics, evolution, geology and maths) had formed a better version of “a brief history of the universe” by Billy Bragg. I was particularly enamored with the mathematics of evolution, and more generally with the application of mathematics to biology, an idea that completely passed me by at school, but ultimately I decided to stick with theoretical physics, and started to think about a career in research.





My director of studies, Mark Warner, clearly recognized my potential, and did three things which were, in hindsight, decisive. First, he poured effort into tuition, personally teaching mechanics, electromagnetism, estimation, fluids, and statistical physics. Secondly, he found me a formidable supervision partner from Sidney Sussex who pushed me every step of the way, and remains a close friend and academic sparing partner. Thirdly, he suggested I do a summer's research project at CalTech in Los Angeles, to get both a taste of research and some exposure to American academia.

That summer in California was amazing. It was my first time in America, and I was determined to see it all: Hollywood, the Grand Canyon, Death Valley, Yosemite, Universal Studios and much else besides. More importantly, Mark sent me to work with a professor of mechanical engineering who worked on shape memory metals. On the first day Kaushik gave me a wire of shape memory metal bent into a cursive squiggle, and invited me to bend the wire into any new shape. Then I dipped the wire into a cup of hot water, and watched it magically come alive and twist back into its original cursive squiggle; the

wire had remembered what shape it was supposed to be. I have always particularly enjoyed thinking about the mechanics of things I can see and feel, rather than, say, galaxies or chromosomes. Moreover, the squirming of the wire reminded me of my previous enthusiasm for mathematical biology. All in all, this was right up my street.

Unfortunately the shape memory alloy was already well understood, so I started work on a different shape-changing material called a liquid crystal elastomer. These are soft stretchy materials, very much akin to rubber-bands. However,

unlike a rubber band, if you heat a strip of liquid crystal elastomer up by a few degrees it will contract dramatically, perhaps halving in length, reminiscent of a contracting muscle. Later, on cooling, it will elongate and recover its original shape. Mark was the world expert on these brand-new materials, and my job was to investigate whether existing theories from shape memory alloys would carry over to this new area. The project was a big success, and rapidly formed into a PhD proposal, supervised by Mark, but with me splitting my time between Leckhampton and CalTech. I had a few sleepless

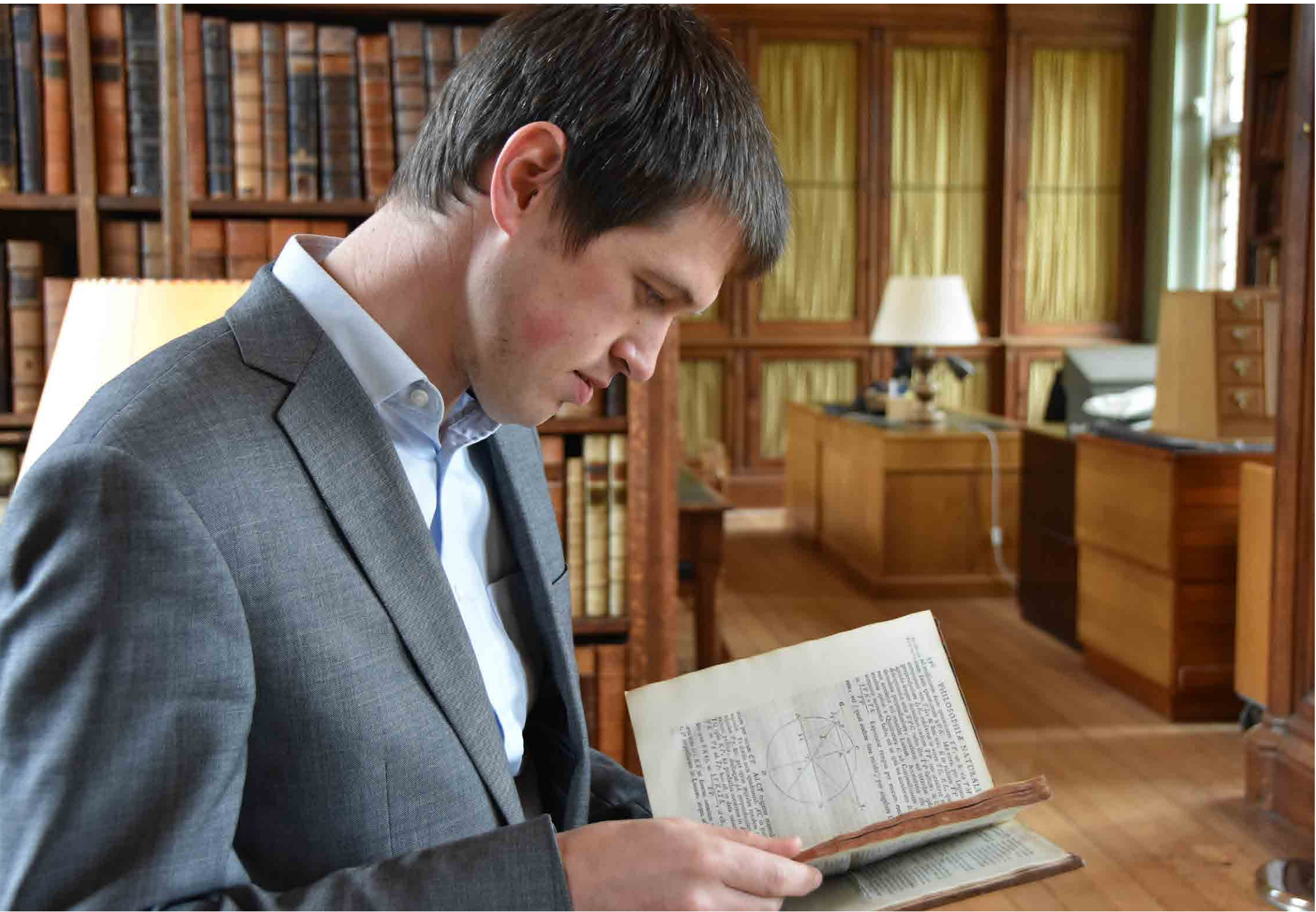
nights deciding whether this was sensible, or whether I really needed to move further afield and move on, but in the end I went for it, partly because I believed in the science, partly because I wanted to spend more time in California, but mostly because Mark was clearly an excellent supervisor, and I knew that I wasn't likely to strike such gold twice.

During my PhD I was lucky enough to live in Leckhampton house, overlooking the gardens, and was pleasantly surprised to discover that the Corpus cooking had vastly improved. I also served as treasurer

of the MCR, and was a vigorous participant at LeckSoc, including giving a talk about my research entitled "teaching rubber how to dance." A close friend accused me of giving the talk at a primary-school level, but I like to think that simply reflected the clarity of the explanations, and the same slides still regularly feature at conferences around the world.

However, at the end of my PhD, I felt I needed to move on from shape-changing liquid crystal elastomers. On an academic level, it seemed that we now understood the basic science. Correspondingly,





the leading experimental groups were winding down, and there was no obvious interest from engineers or companies in taking over. Furthermore, although I had enjoyed the life-like nature of shape changing materials, I was increasingly convinced that the most interesting open questions were in biology itself.

There are two elementary types of shape change in biology: during

development growth sculpts complex organisms from round eggs, and during life muscular contraction brings them into motion. Building on my expertise in shape changing materials, and funded by the proceeds of the 1851 great exhibition, I moved to Harvard to tackle problems of the first type: how does biology create complex shapes from simple shapes in developing organisms? The first serious answer to this

morphogenesis problem was given by Alan Turing, of WWII enigma fame: chemistry comes first, with “Turing instabilities” laying down a chemical map in the developing embryo, which distinguishes head from tail and guides complex growth. Many rounds of this process later, a fully-fledged human emerges from a spherical egg.

At Harvard, I worked on a very different hypothesis for biological

morphogenesis. Every engineer knows that if a column is subject to sufficient compression, it will buckle and bow outwards. In rigid materials such as steel and stone, buckling is a catastrophe leading to fracture and failure. However, soft materials, such as rubbers, gels and most biological tissues can buckle without failing, instead adopting interesting and complex shapes, the literal definition of morphogenesis. Perhaps tissues in

developing organisms buckle into their final shape? Our team worked on several examples: the length of the gut buckles into loops within the abdomen, the interior of the gut buckles to form villi, and, most importantly, the surface of the brain buckles and folds to form its iconic pattern of gyri and sulci.

For an academic, the gap between PhD and faculty post is a fraught hinterland of temporary postdoctoral assignments. After a few years at Harvard, I returned to Cambridge, first as a research fellow at Trinity Hall, then as a temporary lecturer at the Cavendish. Even by academic standards research fellowships are comically underpaid, but they provide full room and board, and a unique opportunity to think for yourself and think big. Most importantly, Trinity Hall accommodated me in a flat next to another research fellow, Emilie Ringe, who is now my fiancée. From the outset our relationship generated a tough “two-body problem.” Not only did I need a permanent lectureship, Emilie and I both needed one in the same town. Such problems are common in academia, and very hard to resolve satisfactorily, but I am delighted to report that Emilie and I are now both permanent features in the University.

During my time at Trinity Hall, I continued to work on buckling and wrinkling, both in biology and in engineering. I also had an unexpected foray into the limelight by explaining a viral YouTube video of a chain fountain, a surprising and hypnotic phenomenon in which a chain of beads in a pot spontaneously jumps above the pot before flowing down to the ground. The effect was discovered and popularized by a BBC science presenter, but he lacked an explanation. Mark and I figured it out, and our explanation lead to an appearance on BBC1’s the One-Show, a demonstration by Stephen Fry during QI’s Christmas special, and a three-story chain-fountain sculpture in Guatemala. More importantly, the explanation

was sufficiently simple that the chain fountain is now a staple of University outreach.

As time has passed, my focus has increasingly moved from the description of shape changing materials to their deployment to do something useful. Imagine a prosthetic arm with artificial muscles rather than motors, or a braille Kindle with dynamically shifting topography. In the abstract, a mechanical machine is a device that changes shape to do something useful, such as a car engine or the shutter of a camera. Traditionally engineers have been limited to stiff passive materials such as steel, so machines involve many separate rigid components that slide past each other. In contrast, animals achieve locomotion, digestion, circulation, and many other mechanical functions via an active soft system of muscular contractions. The key questions are, how do we deploy shape changing materials to engineer animal-like machines, and when is it advantageous to do so?

In pursuit of these questions, I have taken up a lectureship in the Engineering Department, and returned to Corpus as an engineer. In perhaps a bigger change, I have also won a UK government 'Future Leaders Fellowship' which will allow me to move beyond theory and set up my own laboratory making liquid crystal elastomers, and deploying them as artificial muscles in machines. The future is exciting and academically enticing.

I am struck in writing this profile how my whole trajectory is tied up with Corpus. I have no idea where I would be if Barrie hadn’t turned up, unexpectedly, at my school all those years ago, but I certainly wouldn’t be directing studies at Corpus, building soft machines or concluding this profile.



# Nina Jeffs (m2016)

Former JCR president & Girdlers' scholar

It's 11am, I've just finished my morning lectures in Canberra's baking heat when I check my emails to find that I've got an interview for a Cambridge scholarship. Just two months ago I'd upped sticks from New Zealand to start an undergraduate degree at the Australian National University, which had been my first preference university. My school careers counsellor had recommended that I apply for the Girdlers' Scholarship to Cambridge – and I knew it was a long shot. Having applied and not heard back for three months, I assumed I hadn't even got an interview. Following that email, I hurriedly returned to New Zealand for a two-day set of interviews and ended up being fortunate enough to be chosen for the scholarship. That September, I moved to the UK to start a new degree at Cambridge.

The Girdlers' Scholarship fully funds one New Zealander a year to complete an undergraduate degree at Corpus Christi College, Cambridge. It's intended for students with academic and leadership potential, with the idea that they will eventually bring the benefits of their education back to New Zealand. Like many previous scholars, I studied Human, Social and Political Sciences, but there has been great diversity in terms of subjects: including physics, law and music in recent years.

You may be wondering at this point – what on earth is a Girdler? The Girdlers' Company is one of the oldest guilds in the City of London, responsible for tradesmen making decorative belt buckles for royalty (girdles). This incredibly niche trade is no longer, but the Girdlers' continue their charitable work today. A chance encounter between members of The Girdlers' Company and the New Zealand Society at a church service in 1933 led to an afternoon tea, a strong friendship between the two organizations, and eventually a scholarship programme.

While scholars originally attended either Oxford or Cambridge, over time, Corpus became the home of the Girdlers' Scholars. Much like Corpus, the Girdlers' Scholars have a lifetime membership – alumni stay engaged through a newsletter organized by the Girdlers' scholars and by attending the annual Livery Dinner if they are based in the UK.

Cambridge appealed to me in the way that it does for most people – its history, traditions and the prospect of a huge academic challenge – although admittedly, my impression of Cambridge was largely formed by *The History Boys*. Cambridge also struck me as an opportunity to understand interstate relations in a totally different context from the Asia-Pacific region in which I grew up and to be at a university with an international outlook with bright people from all over the world. I had been learning Mandarin since I was eleven and was particularly interested in studying International Relations at university, being broadly interested in journalism and international affairs.

Impostor syndrome came for me as it does for many starting at Cambridge. The welcome speeches on my first day at Corpus reassured us that we had all been hand-picked by the College, and we'd been picked for a reason. In fact, I was acutely aware that I hadn't seen the College before or even been interviewed by any college at Cambridge (the Girdlers' Scholarship entrance process is separate from UCAS). I even tried to shed my Kiwi accent in Michaelmas. Luckily, these feelings were familiar to the older Girdlers' scholars, and I found myself part of a very supportive community – including a lovely older couple in Cambridge, Jenny and John Chaplin, who acted as surrogate grandparents and took us in for termly home-cooked meals. The other scholars and I regularly visited the Girdlers' in







A few Corpuscles and me meeting Jon Snow at the ITV Studios in London.

London for Kiwi events such as ANZAC Day and to chat about welfare. The Girdlers’ never put me under any academic pressure – in our yearly updates to the Board, they just wanted to know that we were supported and having fun at Cambridge (and to hear our embarrassing stories!).

Having never expected to end up at Corpus, or at Cambridge, everything was a novelty and I decided to try and squeeze the most I possibly could out of the place. I was amazed by the number of talks, debates, plays and comedy shows taking place at any given time, evidenced by the constantly changing smorgasbord of posters in the central city. In my first year, I lent my hand to rowing. While I was excited to make it into the W1, I made my impact – certainly contributing to the team’s achieving ‘Spoons’ (the worst possible result) in May Bumps. I decided for the team’s sake not to return in second year! Luckily, I found my niche in other activities – I represented international students on the JCR, wrote part of a policy paper on homelessness in Cambridge and

continued my involvement in Model United Nations.

Attending weekend Model United Nations sessions during high school was what had sparked my interest in studying International Relations at university in the first place. Model UN is a diplomatic simulation: participants act as delegates, representing the interests of a country on a certain issue area – for example, North Korea in the Human Rights Council. There are great advantages to Model UN rather than traditional debating: it emphasizes constructive negotiation rather than zero-sum antagonism and forces you to think from often completely different cultural or religious perspectives from your norm. I wanted to help other young people benefit from Model UN and had the opportunity to do so by helping to organize the UK’s first university-run conference for high school students. I was also lucky enough to travel to Dubai for one of the Middle East’s first conferences of this kind, in which I chaired the UN Women committee, facilitating students to discuss equal

parental leave and women’s careers in STEM. Whilst discussing women’s issues was at times a little tense, it was hugely rewarding to see the girls and boys discussing such issues on an equal platform and voting democratically, especially given that they may not get the opportunity to do so outside of a diplomatic simulation.

I also brought my first-year enthusiasm to ‘Jailbreak’, an annual charity competition run by Raising and Giving (RAG), where you are sponsored to get as far away from Cambridge as possible in 36 hours without spending any of your own money. My friend Jack and I managed to make our way to Ankara, Turkey, but not without a bit of help from College: we rung Stuart and Sibella from Ankara airport to desperately ask for help with fundraising. In the knowledge that we were very close to winning, Sibella’s competitive streak emerged, and she managed to fundraise £200 in under an hour at the Nicholas Bacon Law Dinner. While we ended up placing second equal, we were very happy to have raised over £800 for 10 national



Designing focus groups for a Water, Sanitation and Hygiene (WaSH) project in Dar es Salaam, Tanzania.

and international charities, including the homeless shelter Jimmy’s Cambridge.

This is far from the only kind of support I received from Corpus during my three years – I received excellent mental health support and guidance on my degree. Human, Social and Political Sciences is a broad degree, so I had the chance to dabble in Archaeology and Social Anthropology on the way to finding my third-year specializations in Modern Political Thought, China in the International Order and Gender Studies. I was blessed with brilliant academic supervisors, including Dr Aaron Rapport, who sadly passed away earlier this year. He had the unique ability to make studying topics such as nuclear weapons both hilarious and incredibly engaging, and I feel very fortunate to have been supervised by him for several papers during my time at Corpus.

The Corpus Development Office also offered some fantastic opportunities for me to develop my interest in journalism. I had gained some

experience by writing an investigative column for *Varsity* and some articles for the University international development magazine, but was able to take this to the next level when I met Jonathan Rugman, Foreign Affairs Correspondent for Channel 4 News, who was the College’s Fellow Commoner (an honorary position at College where a person prominent in their field offers insight, career advice and sometimes professional experience to students). Jonathan kindly gave me and some other Corpus students a tour of the ITV Studios in London, offering us insight into every stage of the production process, and later offered me some constructive feedback on my writing. Following this, I was offered another fantastic opportunity by the Development Office and another former Fellow Commoner, the TV journalist Tim Sebastian: this time to organize a talk and workshop by a group of investigative journalists from the BBC’s new ‘Africa Eye’ programme and the online news organization Bellingcat to teach students how to use cutting edge open-source

online journalism techniques. I found their work genuinely inspirational, particularly learning about how satellite technology and social media has enabled ‘citizen journalists’ the world over to hold human rights abusers to account.

My initial hopes for a university with an international outlook were certainly satisfied. Although I wasn’t aware before I arrived, I soon found out that Corpus stands out as a college for its generous travel grants to students. Over the last three years, the support of College donors enabled me to undertake some incredible adventures in my summer holidays. I was able to continue my Mandarin language learning through a month-long course at the prestigious Fudan University in Shanghai and to conduct an interview project on the effects of air pollution on the lives of Shanghai residents. In second year, the travel grant enabled me to volunteer for two months on a Water, Sanitation and Hygiene (WaSH) project in Dar es Salaam, Tanzania with the Cambridge Development Initiative. As a Community





Vice President Olivia O'Connor and I while organising Freshers Week (in the iconic fluorescent pink Corpus JCR jumpers!).



Meeting Helen Clark at the European premiere of her film 'My Year With Helen'.

Engagement volunteer, I worked with my Tanzanian colleagues to ensure the community's ownership over the project, organize health and hygiene workshops and explore other possible areas of need. Moreover, a Corpus travel grant is currently supporting me as I undertake an internship with the UN Office of the High Commissioner for Human Rights in Geneva, as part of which I will be helping to organize the 42nd Session of the UN Human Rights Council. These experiences have been personally enriching, and at times challenging, and overall have given me much greater insight into what I might like to do in the future.

While Corpus supported me in travelling the world, living at Corpus felt like a second home to me. Given the College's size, I loved how easy it was to get to know students from different year levels, simply by bumping into each other at the Pelican Bar, at brunch, or at a slack (the three key Corpus social occasions). My fellow students have been not only academically brilliant but quirky too, and I've learned so much from my peers' niche talents and interests – with my year level boasting a Footlight, a rapper, a bunch of Blues and thespians and even a magician. Of course, May Week provided experiences that I wouldn't have been able to have anywhere else – my family and friends at home were incredulous when I showed them a May Ball programme! Living in College has been a unique and fun environment, and it was a treat to have my best friends living just down the corridor.

In second year, I had been floating around being involved in a range of small University-wide projects and really wanted to focus my energy on something worthwhile. I had enjoyed my time as International Officer on the Corpus JCR committee, helping international students to settle in and providing welfare support, and had also personally experienced how the JCR could really benefit students' time at College. I decided to run for JCR President on the platform of improving the College's environmental record and JCR accountability, and was fortunate enough to win the election.



It was only after I had been in the role for a few months, however, that I really started to understand the importance of the JCR's role in amplifying students' voices to be heard by the University more widely: for example, through successful University-wide campaigns for refugee scholarships and changing the University Disciplinary Procedure for sexual misconduct to a 'balance of probabilities' model.

By the end of my time in the JCR, I was particularly proud of the agreement we came to with the May Ball committee to ensure long-term environmental protections, and the way that our committee acted to protect student welfare during a tumultuous year of staff strikes in the University and significant College renovations. Most of all, I enjoyed working with such a motivated, creative and fun committee, especially my partner-in-crime/JCR Vice President, Olivia O'Connor. On a personal level, I found it a huge learning curve for my leadership and organizational skills that I'm sure will be useful for the future. It was also completely surreal to live in the Christopher Marlowe room in Old Court – the room dates

back 500 years before New Zealand became a country!

My time at Cambridge has involved some surprising links back to New Zealand. One of my personal highlights has been meeting previous New Zealand Prime Minister, Helen Clark, after she gave a talk at the Cambridge Union. Having talked about her as my personal role model during the Girdlers' Scholarship interview, I felt incredibly fortunate for the opportunity to quiz her about her incredible career in New Zealand politics, leading the UN Development Programme and recent work on drug law reform. These sorts of encounters become easy only at a place like Cambridge, and I was incredibly privileged to have a Kiwi dream of mine come true in the UK.

While I eventually hope to study for a master's degree, this year I am taking time out of formal education to undertake some work experience and to travel. Through the wonderful opportunities provided by the Cambridge Careers Service Global Health Internship Scheme, I have been fortunate enough to secure an

internship at the UN Office of the High Commissioner for Human Rights in Geneva for two months, and an internship at the Executive Director's Office of UN Women in New York for three. I am also excited for the opportunity to undertake some work experience with the New Zealand High Commission in London next year. I hope that these different experiences will give me insight into how different kinds of organizations address overlapping international issues, and which might be the most effective.

While I'm still working out my next steps, the opportunities I've been offered during the last three years have equipped me for the future. My experience at Corpus has been completely life-changing: enabling me to meet an amazing range of people as well as expanding my horizons and sense of possibility. I am incredibly grateful to the Girdlers' Company for their generosity in running the Girdlers' scholarship and for supporting me throughout my time here.



# Dr Patrick Pietzonka

## Research Fellow in Applied Mathematics & Theoretical Physics

I AM A JUNIOR RESEARCH FELLOW AT CORPUS AND A POSTDOC IN THE SOFT MATTER GROUP AT THE DEPARTMENT OF APPLIED MATHEMATICS AND THEORETICAL PHYSICS. MY RESEARCH IS MOTIVATED BY THE QUESTION: HOW CAN SMALL LIVING SYSTEMS THRIVE IN A CONSTANTLY FLUCTUATING ENVIRONMENT? WORKING ON THIS TOPIC CAN SOMETIMES YIELD ANSWERS TO QUESTIONS ON A SURPRISINGLY GENERAL SCOPE, FOR EXAMPLE ‘WHAT IS THE MINIMAL COST TO RUN A PRECISE CLOCK?’

When I began my undergraduate studies in physics at the University of Stuttgart, I did so – like most of my fellow students – because I was fascinated by the mysteries surrounding modern theories like quantum mechanics or relativity. My first lectures in these subjects had indeed been very exciting, but when in my third year I found ‘Statistical Physics’ on my timetable, I feared that this lecture would be rather dull. From what I had heard and read before, statistical physics seemed to be mainly about the laws of thermodynamics. And these laws still bear the smell of the 19th century, when people tried to build good steam engines but didn’t know what an atom was. I couldn’t have been more wrong. Sure, we did learn about the laws of thermodynamics, but not in a phenomenological way but rather as an emerging consequence of the microscopic laws of physics I had learned before. And this is exactly what statistical physics is about. It does not seek to uncover new fundamental laws of physics, but rather tries to understand the consequences of the known laws when there are a large number of particles at play. For instance, statistical physics identifies the temperature as an emergent property of a physical system. While quantum mechanics can describe the shape, mass and energy of a water molecule, it doesn’t say anything about its temperature. Yet, a full jar of water always has a well defined temperature, which is a statistical property of the large number of molecules moving chaotically within.

I was captivated by the beauty of the concepts of statistical physics and decided to join the group of Udo Seifert, who had given that course, for a Bachelor and a Master project. There I got introduced to a fairly young field of research that goes by the name ‘stochastic thermodynamics’. Its objective is to formulate the laws of thermodynamics not only for large machines, as they are presented in the classical textbooks, but also for very small ones. Such tiny machines – often consisting of only one or a few biomolecules – are ubiquitous in living organisms. There they perform such diverse tasks as synthesising fuel, transporting cargo, contracting muscles, or transcribing DNA. Recent experimental advances have enabled biophysicists to directly observe and manipulate such machines, thereby creating the need for a theoretical framework that can make sense of experimental data. For a theoretical physicist, this comes with two main challenges. First, one has to cope with ‘thermal fluctuations’, random kicks that come from surrounding water molecules, which are constantly in motion. While these kicks are hardly felt by a large machine, they may have a noticeable impact on a tiny one. The second challenge is the fact that biomolecular machines are constantly supplied with energy, invalidating the usual assumption that the system of interest would be in an equilibrium with its environment.

I had never intended to stay in my hometown Stuttgart for long after

completing my Master’s degree. Even though I quite liked living there, I was curious to explore other places. But when the time came, Udo Seifert invited me to do a PhD project with him and to join research on a fascinating question that had recently arisen and had the potential to give a new direction to stochastic thermodynamics. Partly also due to the prospect that I would get to visit experimental collaborators in Barcelona for a couple of months, I happily agreed to do the PhD project.

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WHEN I BEGAN MY UNDERGRADUATE STUDIES IN PHYSICS AT THE UNIVERSITY OF STUTTGART, I DID SO – LIKE MOST OF MY FELLOW STUDENTS – BECAUSE I WAS FASCINATED BY THE MYSTERIES SURROUNDING MODERN THEORIES LIKE QUANTUM MECHANICS OR RELATIVITY.

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The question driving our research kind of connected the two big challenges mentioned above. It addressed molecular machines functioning as clocks, which for example allow organisms to anticipate the time of sunrise. We knew that systems in equilibrium with their environment do not experience the flow of time. A tiny clock that has run out of ‘battery’ may sometimes tick due to thermal fluctuations, but fundamental symmetries in the laws of physics stipulate that such a tick is equally likely happen in a forward as in a backward direction. It is therefore clear that energy needs to be supplied to drive the clock, so that it can outrun these random fluctuations. But how much energy is actually needed for that? The answer to this question lies in a result that has become known as the ‘thermodynamic uncertainty relation’ (even though it has nothing to do with the famous Heisenberg uncertainty relation in quantum mechanics). This relation is an astonishingly simple one, so I dare to burden the esteemed reader of the *Pelican* with some mathematics: The squared imprecision (or ‘uncertainty’) of a clock times the

energy cost for driving it is always greater than two times  $kT$ . The latter is a small unit of energy determined solely by the temperature of the surroundings – at room temperature it is  $10^{26}$  times less than the calories in a bar of chocolate. The beauty of the thermodynamic uncertainty relation is that it universally applies to any type of clock, from the small ones in bacteria to a certain golden one that attracts crowds of tourists on Trumpington Street. A small imprecision of, say, 1% in a day is possible only if at least 20,000  $kT$  are supplied. Dr John Taylor certainly did not need to worry that winding up the Corpus Clock would overburden the energy bill of our College. But on the microscopic scale of bacteria, it costs some effort to provide this amount of energy.

Much of my work during my PhD has been devoted to proving, generalizing, and refining the thermodynamic uncertainty relation, and together with our collaborators in Barcelona we have demonstrated its validity experimentally. Beyond its application to genuine clocks, the relation also provides a tool to analyse similar biomolecular processes, such as the stepping

motion a molecular motor makes walking along a track inside a cell. While the energy intake of such a motor is notoriously hard to measure, a simple measurement of the fluctuations in its speed (ie its imprecision) yields at least a lower bound on this quantity. Even though now I am no longer actively working on the thermodynamic uncertainty relation it is still dear to me. I remain in contact with my collaborators and I am happy to see in the literature how these ideas keep spurring further research by groups all over the world.

During the work for my PhD, I got interested in an emerging new field in physics called ‘active matter’. Usually, physicists consider matter as an assembly of particles that may be subject to external forces and may interact with each other, but which respond to these forces in a passive fashion. In contrast, active matter is formed of particles that are deemed ‘active’ because each of them is endowed with some self-propulsion mechanism. Examples for such systems can mainly be found in biology, and range from assemblies of bacteria, through cells in organic tissue, to swarms

of fish or birds. But in recent years, experimentalists have also realized artificial active matter systems, for example using particles that are propelled by some chemical reaction they catalyse at their surface. From afar, active matter often looks like passive matter, for example, a flock of birds may look like a droplet of water, which makes it tempting to apply the same laws of physics. But active matter can interact with its environment in a fashion very different from passive matter, for example when the flock of birds avoids an obstacle or a predator.

Most research on active matter has been and still is largely phenomenological, describing the effects it exhibits in experiments and computer simulations. However, a versatile theoretical framework to understand these effects is still lacking. I first learned about this fascinating challenge in a plenary talk at a conference of the German Physical Society. I remember that the lecture hall was buzzing with excitement, partly because the speaker, Michael Cates, had recently been appointed to the prestigious Lucasian Chair of Mathematics at the University of Cambridge. When

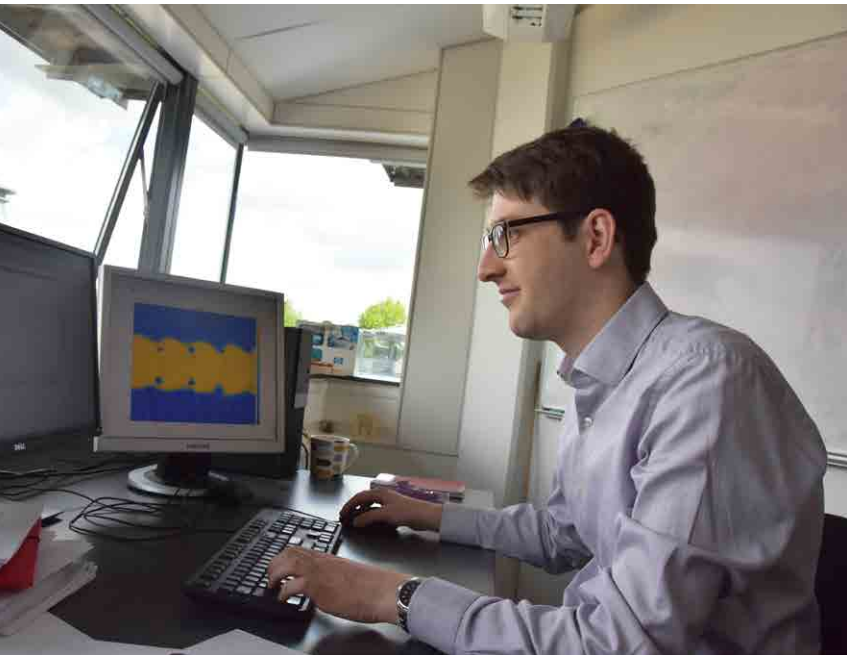
in the last year of my PhD I saw a job posting by Michael Cates looking for a postdoc with skills in stochastic thermodynamics, I knew this would be an extraordinary chance for me. I was happy that my application was successful, and I moved to Cambridge in March 2018 to start my new job at the Department of Applied Mathematics and Theoretical Physics (DAMTP).

I am now working on a project in which we are trying to find out more about the nature of active matter by asking how one could build an engine that extracts useful work from it. This question is similar in spirit to the 19th century’s quest to build heat engines that extract work from passive matter, for example hot steam. Since the answers to such questions had yielded the laws of thermodynamics for passive matter, we hope that the same path will reveal some general physical laws of active matter. Recent experimental realizations of engines running with active matter were still heavily inspired by the classic design of passive engines. However, radically different designs that would be useless for passive matter may work all the better

for active matter. For instance, it would be futile to expect that a ‘ratchet and pawl’-type mechanism could turn random kicks from molecules in a passive surrounding into unidirectional motion, as the laws of thermodynamics forbid any such perpetual motion machine. In contrast, a ratchet immersed in active matter, for example a bacterial bath, does rotate in a persistent direction, which can be used to extract useful work. We have investigated theoretically general principles for the efficiency of such ‘active engines’ and have found some fairly surprising results. For example, we have identified an array of obstacles that look like little kites with wings as an optimal design for a ratchet mechanism, moreover, we could show that for a large number of active particles cooperative effects yield higher efficiency.

After moving to Cambridge, I was glad to experience a very lively atmosphere in the group I joined at DAMTP. But still I soon found out that most University life is happening in the colleges, to which basically everyone except for postdocs belong. In particular, Corpus with





its splendid architecture and its little obsession with clocks had a special allure for me. Hence, I was very happy that out of the many applications for Junior Research Fellowships I had sent out the one at Corpus was successful. When Michael Cates congratulated me on my election to the Fellowship, he commented that at Corpus I would get the ‘real Cambridge experience’. Now, after my first year at Corpus, I understand what he meant. Being one of the old colleges, Corpus cherishes its many traditions, while at the same time the thoughts that are being exchanged are very modern. I felt warmly welcomed at the College by both the old and the new Master, the other Fellows, and the porters, and I soon became familiar with everyone in this small and tight-knit community. A particularly memorable experience of this community I had earlier this year when three other Fellows invited me to escape the Cambridgeshire flatness for a few days and join them on a trip to North Yorkshire. With the excellent guidance of Andrew Harvey as a Yorkshire native, we mastered the ‘Three Peaks Challenge’, a 40 kilometre day hike around the Ribblesdale valley.

Another benefit of my Fellowship at Corpus is that it brings me closer to the community of mathematics students there. I have always enjoyed teaching theoretical physics, and with the smart students I had in supervisions it has so far been a pleasure to not only go through the solutions they have handed in, but also to delve into exciting discussions about the interpretation of physical theories. I am very much looking forward to intensifying the relationship with the students when I take up my new role as a Director of Studies in applied mathematics in the new academic year.





# Dr Kai Ruggeri

## Fellow in Psychological and Behavioural Science

It had been essentially treated as a fact since 1979, when two psychologists confirmed the idea: people are loss averse. We dislike losing things more than we like gaining them, or so the story went. So it came as quite a shock when, in summer 2018, an explosive piece appeared out of nowhere undermining the entire idea. For behavioural researchers like me, loss aversion – the idea that people dislike taking risks where there is a chance of losing what we have – is canon.

But how did an early career researcher from Rolla, Missouri, in the foothills of the Ozarks, end up leading a 19-country study with 31 collaborators to see if loss aversion really was a myth? That is a much better story – because it weaves together a Corpus story, a scientific story, a teaching story, a family story, a personal passion, and now, a New York story.

In 2009, as I was completing my doctoral dissertation at Queen's University in Belfast, I had taken on a research position at the UNESCO Centre in Northern Ireland. Statistics is a great skill to learn and develop, in that it creates opportunities to work on subjects well outside your standard academic area. While reviewing material for one such project over a coffee in the staff canteen, the bartender asked me about my general research, to which I gave my usual reply: Why do people hate statistics? I explained how it is common that students, particularly in social sciences, really dislike learning stats, and how that has long-term consequences in the real world.

Before finishing even that brief spiel, she had already informed me that it was no interest to her whatsoever,

and had almost no practical value to society. Naturally, the immediate reaction to such a comment would be irritation followed by a bemused need to respond. However, surprised by the entire interaction, I found myself fixated on her final point: what practical value was there for my work to society? Unbeknownst to me at that moment, but only months before that conversation, an economist in Chicago and a Harvard law professor had just published a book that gave the best possible answer. But we'll come back to that.

It is certainly popular for stories to celebrate individuals who rose to prominence in spite of underwhelming performance in their early education. For situations where those individuals had faced great adversity, these stories can and should serve as inspiration to those who deal with struggles in their youth. However, we need to be careful to distinguish between overcoming...and celebrating what is simply underachieving.

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THEN A SINGLE CLASS  
CHANGED MY WHOLE  
WORLD. IN 2005, HAVING  
SWITCHED DEGREES FOR  
THE THIRD TIME IN THREE  
YEARS, I WAS REQUIRED  
TO TAKE STATISTICS  
FOR MY BACHELOR IN  
PSYCHOLOGY. I FELL IN  
LOVE WITH IT.

”

Being raised in the 80s and 90s by a single mother in southern Missouri, I grew up with a lot of independence. Many people from low-income homes can probably relate to the trial-by-fire development that comes with being on your own a lot during your youth. You choose whether or not you study, or play sports, or take on odd jobs to get money. In such situations, even with a wonderful parent like my mother who was clear on the value of education, being committed to your studies is a long-term investment that is easy to put off when thinking only about today. Unfortunately, in those days, I too often chose the latter.

While never a bad student, my early education was marked by too many missed opportunities. I was twice placed into the gifted programme, only to be removed for misbehaving both times – though third time lucky, as they thankfully tried a new approach with me that stuck. Through secondary school, I would produce exceptional exam results that would be completely mitigated by not submitting standard coursework. To illustrate, imagine scoring in the top 5% on national university entrance exams, but having overall scores barely above average. Things have come a long way since, but I would not like my story to be one of criticising my early educators – I simply did not meet expectations, and it made things much harder than they needed to be in the early years of my education.

Then a single class changed my whole world. In 2005, having switched degrees for the third time in three years, I was required to take statistics for my bachelor in psychology. I fell in love with it. Though it was my 16th year of formal education, it was the first time I had felt genuinely passionate about a subject.







CCK Team Photo Lent 2012.



Above: Policy Research Group Annual Dinner. Below: JRP in Corpus 2016.



In the final year of my undergraduate degree, my stats professor asked me to assist him in teaching the course. During that period, I realized I was not ready to finish studying and began looking at postgraduate degrees overseas. I was invited to interview at Queen's University in Belfast, and frankly, the interview hadn't been going well, not least because they were asking me about my interests in their doctoral programme, which I hadn't actually applied to. Aiming to conclude the interview, they offered me the chance to ask questions, to which I only enquired if they allowed doctoral students to teach classes. They seemed puzzled by the question, until I clarified that I had assisted teaching statistics already, and would really enjoy the chance to do so again.

The immediate silence was broken only by the sound of their collective jaws hitting the table. Not only had this changed the entire discussion, it had caught them so off-guard that they were already scrambling to propose a research plan on the subject. Weeks later, I was off to Ulster to explore statistics anxiety and negative attitudes toward statistics in the behavioural sciences.

Several years later, I would get to pay it forward. In the days after the bartender told me I was working on irrelevant research, I was invited to lead a small team of early career researchers. The beauty of statistics for me has been that it always allows me to bring together personal matters of importance with research. In this case, I was expanding my research on behavioural policy in education at the UNESCO Centre by engaging with a student organisation that had brought this small team together. While preparing to run our study, I happened to have a conversation with a student from one of the other teams, who had shared her disappointment that their research had not made progress and was unlikely to carry out their work. She was frustrated at this outcome for professional development reasons,

as well as knowing how much her family had invested in supporting her so she could participate in the research project.

This left a major impression on me. Of course, I had struggled for years to find solid ground in my studies, and once I was given the opportunity to do a PhD, a whole new world had opened up. In front of me now was a young person who was putting in all the effort and commitment, but the opportunity had closed on her in spite of her best efforts. Something had to be done.

Shortly after this event, I successfully defended my doctoral research and returned to the US. In the months that followed, I spent time as a statistics consultant in Chicago, while also continuing to lead my team of young people, eventually as a postdoctoral researcher in Portugal. As the postdoctoral position finished in 2010, I completed a postgraduate certificate at Oxford and then relocated to Serbia, where I worked with a few organizations dealing with a number of policy challenges in the Balkans. But the conversation with that student never left me.

In early 2011, I was invited to Cambridge to support Professor Felicia Huppert on a study she was overseeing at the Well-being Institute, which she had established in the Department of Psychiatry. Professor Huppert quickly became a mentor and friend (or as I refer to her, my Academic Godmother). She also became the biggest supporter of my newly found passion: establishing a formal research programme for highly motivated students just looking for an opportunity to develop skills in a way that benefits society.

In the early days of this initiative, I heard "no" a lot. But more importantly, we heard "yes" just enough times to make it happen. And the most critical of these came in late 2012, when Corpus Christi said yes to hosting the Junior Researcher Programme or JRP (we finally had a name) for the first time.





Photo credit: Mailman School of Public Health, Columbia University.

What is rather amazing is that this meeting came together for the most unlikely of reasons. When I first came to Cambridge, I was invited to join Darwin College, which did not have a rugby team. Because of that, I ended up playing for the combined Clare-Corpus-King's team, known as CCK. (Anyone familiar with the social scene in Cambridge will undoubtedly have heard the invigorating chant "YOU ARE CCK!" emanating from a lively group of young men). While watching autumn internationals in 2012 in the JCR with the Corpus contingent, I mentioned the JRP story to a teammate, who was certain that the College would want to support such an endeavour. He was right. They did. And we've now hosted seven research projects, six conferences, and over 250 people in Corpus since.

Given that experience, it was an indescribable honour when Corpus asked me to be the Director of Studies for Psychological and Behavioural

Sciences (PBS) in early 2014. Teaching is something I consider a huge privilege, and the experience working with the wonderful PBS students during my five years as DoS was irreplaceable. It was then especially meaningful to me when nominated and elected to the Fellowship in 2017.

Throughout this time, the JRP grew and solidified in our work. Beginning in 2016, our annual summer volunteer internship project has involved translating evidence from behavioural sciences into real world applications, such as policy. Ever wonder why you get a colourful letter showing you how your energy usage compares to your neighbours'? Behavioural science. Ever wonder why there are lines painted on the floors in your local hospital? Behavioural science. Ever wonder why ... okay, you get the point – our work summarised those insights, first into a report, then a textbook. (I promised a family story: in 2016, my cousin Josephine spent

her entire summer volunteering to coordinate the JRP after finishing her own psychology degree.)

One of the most critical theories for behavioural science applied to policy loss aversion (yes, now we're back to the opening story). In 2018, I was offered a professorship at Columbia University in New York. Since my research position at Cambridge continues with a five-year grant, it means I spend a lot of time in both places. In August of that year, the JRP research team was working on a second edition of the textbook. You may have picked up on it, but statistics is an addictive skill, because once you realize what you can do with it, all existence becomes a subject of tangible interest. Or, as we say in the Ozarks, 'Once you have a hammer, everything starts looking like a nail'. Loss aversion is itself a combination of our ability to reason cognitively, and our understanding of probabilistic statistics like risk: would I prefer a

sure-thing today or the possibility of a better thing tomorrow?

How do we know this? Well, the book that was published in 2008 showed exactly this. When Richard Thaler (University of Chicago) and Cass Sunstein (Harvard) published *Nudge*, they showed very clearly that we can see how people behave based on their understanding of risk. These patterns emerge in individuals and especially across populations, making them perfect topics for a behavioural researcher who loves statistical thinking.

The article suggesting there was no evidence to support loss aversion sent shockwaves through the profession. This is no small claim, and is especially concerning given that social sciences are going through what has been called a "replication crisis": a large number of highly-cited studies were tested again, and researchers failed to generate the same impacts as originally published. Unsurprisingly, social media was abuzz from the debates. Were we wrong this whole time? Were these just bitter people who wanted more recognition? Whose argument is right?

Given how much we had invested in the topic so far, we had to consider our position, when it occurred to us: why not just test it ourselves? So we did just that. Leading a team of nearly 30 committed young researchers plus a few colleagues, we put the original study to the test. Thanks to the support of Corpus, Columbia, and the JRP, we were able to observe decision-making in over 4,000 people spanning 19 countries and 13 languages. We ran the exact same methods used in 1979, updating only the currency values and expanding the methods.

What did we find? Well, I do not want to spoil all the results, but safe to say it worked in 2019 almost in the same way it worked in 2008. Relieved? Yes. Surprised? Not really. After all, they received a Nobel Prize for it, so I guess the subject really must be of interest to somebody. If nothing else, though, it will still be another special part of my Corpus story.



*This article is dedicated to the memory of Dr Aaron Rapport, and his wife, Dr Joyce Heckman. Those who read the College newsletter or website will be aware of their passing in the summer of 2019. On top of being a genuinely good human being, Aaron was a wonderful colleague and peer, and played a major part in my experience in Corpus, like so many others. Since I was unable to ask him to proofread this article in advance, I have attempted to write it in a style that might reflect how he would have told the story: with great energy, random asides, and a healthy dose of self-deprecation.*





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