DARWIN COLLEGE
CAMBRIDGE

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2018

THE Darwinian

Darwin College and the Nobel Institute

Richard Henderson is interviewed by Harry Bhadeshia

Bradfield Court - an update

Prehistoric women were stronger than elite Cambridge women rowers

News for the Darwin College Community

A Message from Mary Fowler
Master

As 2017 became 2018 I enjoyed reviewing what an excellent year it had been for Darwin. Colleges, of course, don't make New Year's resolutions as individuals often do. Instead, a college must look down the centuries.

Our task is to build for generations to come, and at the same time to support each person here, now; to make Darwin a home, as Milton says, for a quick, ingenious, and piercing spirit, acute to invent, subtle and sinewy to discourse, not beneath the reach of any point the highest that human capacity can soar to.

In Cambridge, each Vice-Chancellor is appointed for a fixed term of 7 years. Professor Sir Leszek Borysiewicz, who has served with much distinction, stepped down on 30th September. On Monday October 2nd, Professor Stephen Toope, took over

"2017 was a wonderful year for the College with many prizes and distinctions for members."

with due Latin formality in the Senate House. Stephen is a distinguished human rights lawyer. He is a Cambridge alumnus having been a PhD student at Trinity, and was President of the University of British Columbia in Vancouver before moving to Toronto School of Global Affairs. In case you are wondering who was running the University on Sunday 1st October, it was the outgoing Senior Proctor, on his own last day in the post. Fortunately the day was trouble-free. The new Senior Proctor is Darwin Fellow, Tim Milner, whose other role is as the University's Ceremonial Officer.

2017 was a wonderful year for the College with many prizes and distinctions for members. So many students graduated at the July degree congregation that even the largest marquee possible in the garden was not big enough: we had to use the Dining Hall as well to accommodate all the graduands and their guests. We particularly congratulate our chefs on the awards they have received this year – and day-by-day we especially appreciate their skill.

Several of our members have achieved distinctions of the highest levels and we warmly congratulate them all. Anne Ferguson-Smith and Chris Bishop were elected as Fellows of the Royal Society. In June, the University conferred an honorary ScD on alumna Janet Rossant. Then in the autumn, came the crowning surprise of the year – the award of the Nobel Prize in Chemistry to Richard Henderson, who has been a Fellow since 1981.

In memory of two of our longstanding, dedicated and distinguished Fellows, Professor Sir Patrick Sissons (1945-2016) and Professor Sir David MacKay (1967-2016) we have established 3-year Fellowships for early-career researchers. Dr. Adrian Weller, the first David MacKay Fellow, took up his post in October 2017 while the first Patrick Sissons Fellow should start in October 2018. We are most grateful to the Newton Trust and to the Evelyn Trust whose support has enabled these first Fellows to be appointed while we undertake fundraising to establish the Fellowships in perpetuity.

The building works for the John Bradfield Court are underway. The first noticeable change has been the removal of the tower/fire-escape on the old Granary that was built to enable Gwen Raverat to access her flat there once she used a wheelchair. The replacement route is via new steps directly from the Old Granary to the Court. Next was the installation of a cofferdam so that work can commence on the river frontage of the building – it's good that this is happening in the winter without the complexities and amusements of tourists attempting to punt... The refurbished and renovated Old Granary should be back in service waiting new student occupants for the Michaelmas Term.

I had most enjoyable visits with Darwinians in Los Angeles, San Francisco and Vancouver in May, Dusseldorf in July and then just at the end of the year New York and Washington. It is always such a pleasure to meet Darwinians, to hear reminiscences, to pass on news and the latest on life in Cambridge, and to seek your ideas for the ways in which we might enhance our support for students in the years to come.

Lastly, I should mention the significance of 2017 for my own discipline – the 50th anniversary of Plate Tectonics. To celebrate the 1967 publication of a paper in Nature, "*The North Pacific: an example of Tectonics on a Sphere*", a major meeting was held at the Geological Society in London. Several of the first key researchers were able to attend together with many others who took the science forward from then. The theory of Plate Tectonics brought together the many different and separate disciplines within what is now termed Earth Science or Geoscience, by providing the link to understanding disparate observations across geology and geophysics. Plate tectonics is now firmly in school curricula and a term in common parlance too.

I send you my best wishes for a peaceful year ahead.

Left:
Mary Fowler in conversation with our new Nobel Laureate, Richard Henderson. Photo credit: Sir Cam

Emeritus Fellow, Richard Henderson: Chemistry Nobel Laureate 2017

An Interview by Harry Bhadeshia

Richard Henderson, Joachim Frank and Jacques Dubochet were jointly awarded the 2017 Nobel Prize for Chemistry. The Nobel citation reads, *"for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution".*

This is in essence a technique that allows unfettered molecules to be imaged directly, leading to models of their atomic structure, and therefore, their functions in biochemical reactions.

Richard is based at the Medical Research Council Laboratory for Molecular Biology in Cambridge and has long been a Fellow of Darwin College in Cambridge. He kindly agreed to be interviewed by Harry Bhadeshia for this article.

Right:
Our new Nobel Laureate discusses his work. Photo Credit: Sir Cam

Harry: Many congratulations, we all are basking in your glory. There was uncontained delight in College about one of our own achieving the ultimate honour in science. How did you come to be in Darwin?

Richard: I came from Edinburgh for research in 1966. Keith Moffat (King's College) wrote to me with a paragraph about the pluses and minuses of each of the then around 25 Colleges in Cambridge. His number one recommendation was Darwin, followed by Corpus. However, I selected the latter because it had, at that time, more of a community at its Leckhampton campus. I enjoyed my time there but did not see eye-to-eye with the then Bursar, so after graduating, I did not have much contact with Corpus until I recently became an Honorary Fellow there.

In 1982, César Milstein invited me to dinner at Darwin and shortly afterwards, I learnt that I had been elected to a Fellowship of the College. I ran some discussion groups, was wine steward for three years, and assisted Torsten Krude in the organisation of the 2003 Darwin Lecture series on DNA. My role in the Lecture Series was that of a `fixer', in persuading busy and clever people to contribute to the series. At one point I felt my contribution to Darwin was insufficient but was persuaded otherwise by Geoffrey Lloyd.

Harry: Richard - we are delighted you stayed on! What happened on the day the prize was announced?

Richard: Well, I was in Leicester at a meeting listening to talks when *the* phone call came. I thought I could just go back into the meeting but some three hundred emails arrived in just one hour so I had to abandon the occasion. I spent three nights until the early hours responding to the messages. I imagined that there would be a spike of activity and then life would return to normal, but there have been some nice consequences. One of our former post-docs, Vinothkumar, who is now in India was having difficulties in getting adequate funds to do cryo-microscopy – that problem has now disappeared! I keep getting invitations to participate in meetings, but obviously, the demands on time are intense so I have to be selective.

Harry: Let me ask you some specific questions. During the attempts to determine the structure of DNA using X-rays, mistakes were made twice because of the difficulty of the problem. With this technique that you and your colleagues have developed, would it have been a lot easier to solve?

Richard: Not DNA actually, because the way the method works is you take an image but it is a noisy image. When the molecular weight is in excess of approximately 10^5, it is possible in principle to determine the position and orientation of individual particles, by the application of averaging methods over a large number of images. The base pair of DNA has a much smaller molecular weight. So far, no one has done the cryo-reconstruction of bare DNA.

Harry: But what about the macroscopic features of DNA, the double helix?

Richard: Yes, you can see the double helix, but only when it is bound to something else. But in bare DNA you see it as a kind of a line with a random curvature, but you cannot at the moment get the structure, not even the 3.5 Å stacking of the bases. If you did, you would see the average of all the bases. It may become possible to get an averaged structure for DNA when our list of outstanding problems is solved. But the base pairing would require an added level of understanding.

X-ray crystallography has produced a massive databank of more than 130,000 protein structures and that will continue to grow. Cryo-microscopy however, has enabled a lot of difficult structures to be determined more quickly, even when the protein could not be crystallised or was difficult to purify.

Harry: You started off as an X-ray crystallographer trying to look at proteins in membranes but did not get very far for many years?

Richard: I started in 1972 to try very hard to make three-dimensional crystals for X-ray diffraction but never got crystals until 1980, but even then the crystals were very bad. Hartmut Michel who also tried and did not succeed at first but coming from a biochemistry background he tried many other membrane proteins and in 1982 succeeded in crystallising one that led to the first atomic structure of a membrane protein and his 1988 Nobel Prize for Chemistry. We adopted a biophysical approach and solved the second membrane protein structure in 1990 – had it been the other way round...

The Laboratory for Molecular Biology (LMB) recruited Nigel Unwin after he finished his PhD in metallurgy in Cambridge in 1969, to work on biological electron microscopy. I came back from Yale in 1973 and heard his talk about the observation of tobacco virus using stained samples, where one is not looking directly at the protein. But clearly, Nigel was thinking about directly observing proteins. So I said to him after his talk that I have a one-molecule thick crystallised specimen that does not need to be stained; we could take direct images. We worked together for a year and published the first low-resolution membrane protein structure using electron microscopy in 1975. But it was not good enough to see the amino acids. Between 1975 and 1990 we worked to improve the technique. At the same time the biochemists improved the crystallisation of membrane proteins so X-ray crystallography provided a huge boost to the protein structure databank. X-ray work has to date led to orders of magnitude more structure determinations than electron microscopy. Nevertheless, in the last 4 or 5 years, microscopy has resolved some of the most interesting protein structures, and has now become the method of choice for such investigations. All the X-ray people are now switching to electron microscopy.

So you are right, I started out in X-ray crystallography, we then moved to electron crystallography without staining the samples. We thought two-dimensional crystals would be easier to work with but it turned out they were not, so in 1996 we stopped that and our focus turned to single-particle imaging using Dubochet's method of rapidly freezing the sample in vitrified water. Joachim Frank had been doing single particle imaging but initially on stained particles. But the work needed a lot of problems to be solved, one of them being development of better detectors for the transmission microscope. We began detector developments in our laboratory at LMB with the expertise of Wasi Faruqi who did his PhD at Harwell, now the Rutherford Appleton Laboratory (RAL). Subsequent collaboration with the detector development group at RAL gave us a significant technological advantage because we knew what we were doing and in addition, the LMB had a lot of people working on structural biology who could take advantage of the equipment. Now these detectors are obtained commercially.

Harry: You made the data of the purple membrane protein freely available. What effect did that have on the subject?

Richard: The pharmaceutical companies were the first to request the data, and used them even though we did not think this would be useful. In 1990 when we had the structure, the internet was at an early stage, so instead of sending hundreds of magnetic tapes, we requested email addresses. None of the companies used emails at the time, but I remember one using an email address borrowed from a friend.

When the new and powerful synchrotrons came along in the mid-1990s, many switched from electron crystallography to X-ray crystallography, but with the new detectors, the pendulum has now swung back. Interpretation and computation have also become easier with the development of more powerful computer programs that use Bayesian statistics.

Harry: The 1990 paper is said to have rationalised many previously unexplained observations. Can you describe these?

Richard: In 1975, we said, this idea that a bundle of helices criss-crosses a membrane is likely to be the way all membrane proteins are made. It turns out that 90% of membranes have this structure and the remainder are weakly bonded sheets arranged into a closed barrel structure. But the high-resolution observations later revealed fine features that explain the chemical behaviour of the protein including details of interaction with light.

Harry: What was the reason for picking that particular purple membrane protein for your studies?

Richard: It was readily available and easily formed two-dimensional crystals. In fact, when I went to Yale, I was intending to work on enzymes, but my sponsor, Ray Wang, suggested there are thousands of enzymes and you should instead pick a project that may come to fruition in 20 years, so I chose to work on membrane proteins. But after working on voltage-gated ion channels in membranes for two years, it became clear that the tools to investigate detail were simply not good enough, so I switched to a more tractable membrane protein – it actually took from 1972-1990 to solve even this one.

There is a rule that if you do a careful calculation of the time to complete work, you multiply by two and take the next time scale to convert that calculation into reality. So if you think it will take 2 months, it will actually take 4 years.

Harry: So I presume that the sponsors of your work are very tolerant?

Richard: It took us a year beginning 1973, to get a low-resolution structure. But then we were stuck for about 15 years. At one stage we said we would not publish anything until we had the structure. But the MRC then brought in 5-yearly reviews, and we had several referees stating "this will not work". We laughed this off, but as the years went by, we thought we ought to be pragmatic, and published incremental papers to show some semblance of progress.

Harry: Young academics these days would not survive waiting to publish until the problem is solved. Is the LMB special in supporting dedication to science rather than indicators?

Richard: The one difference is that the LMB recruits people who like doing the work themselves. A lot of the universities however, have Professors who are good at lecturing, writing proposals and getting the work done by students and post-docs. Something is lost in this process. I myself never wanted any students, and my first post-doc was thrust on me. I came here in 1973 and worked by myself or with Nigel Unwin who then went on to Stanford around 1978. The one student who I shared with Linda Amos, attended a course with Dubochet at my behest – the student came back and decided `this is the future' and left to work with others. I later had three or four students who worked on other aspects somewhat differentiated from my work.

Harry: So what is the function of a group leader in LMB?

Richard: Some of the leaders are managers, who delegate, others do things themselves and therefore, can, I think be bolder. Both Nigel and I are in this second category. There is a third category where the leader has broken the back of the problem but then a great deal of backup work needs to be done by others who are given considerable freedom to explore. The LMB has all these structures with the focus on the science getting priority rather than on personalities.

Harry: To an ordinary person, an image means what you see is what you get. But there is in fact a huge amount of analysis in your 1990 paper in order to get to the atomic model. Can you also explain the validation of any model?

Richard: The initial validation comes from examining the density features in the image. You know you are right, when those density features show you the amino acid sequence that someone else has determined using biochemistry. Later on, the knowledge of the structure can explain a wide range of other biochemical data. But you are right, there were a lot of problems to solve to interpret the images. I wrote a program to help, a very difficult one to write, so we never knew whether it was correct or not. Joyce Baldwin created some test data that revealed an important error; the corrected software stands to this day, albeit in a friendlier format.

Above:
Richard Henderson and Harry Bhadeshia
Photo Credit: Sir Cam

Harry: How long was it between obtaining the images and creating the model?

Richard: The big change between 1975 and 1990 was from indirect methods to direct high resolution imaging using cryo-microscopy. My first effort was here in Cambridge. John Meurig Thomas in Physical Chemistry had a liquid helium electron microscope, but the instrument was not good. Dubochet's team at EMBL then built their own cryo-microscope, which we used to get the first high-resolution image. But that instrument still was cumbersome. I then went to Berlin to work with Fritz Zemlin where we got many more images in the Fritz-Haber-Institut that Ernst Ruska had set up. More good images were obtained in collaboration with Ken Downing by using the Berkeley field emission gun microscope, which had a higher coherence. It took from 1984 to 1990 to get enough good images to analyse together using our programs. So there were many years of visiting and accumulation of images. We were completely focused.

Harry: In 2004 you wrote an article saying that more validation methods are required.

Richard: This is because some people would take images and produce a self-consistent structure, but this does not prove the structure is right. There was one structure that five groups had worked on independently, but they were all different in important detail. We felt that such work might cause a scandal in the subject, and hence the article. But the problem has now disappeared because the resolution is sufficient to avoid significant misinterpretation.

Harry: It is refreshing to see your focus on science rather than indicators that even in this University are used in appointments committees. Your most important work seems to be published in ordinary journals. Would you care to comment?

Richard: Sydney Brenner was asked recently what he thinks about the trend that people only want to publish in high-impact journals. He replied that often papers in these journals have large numbers of authors whereas the seminal work may have been done by a few key people. He also noted that papers in these journals have a higher probability of being wrong!

Harry: You were at work when you received the Nobel Prize and I hope you were as elated as we were.

Richard: I am delighted. My 14-year-old granddaughter told her chemistry teacher that her grandfather has won the Nobel Prize. The teacher asked her to see if I could visit the school - I shall be going to the chemistry class at her local school early in 2018. But bear in mind that in the LMB there have been 16 Nobel Prizes so we do not get overly excited. For example, we have a tree named after Hugh Huxley, who although he discovered the mechanism of muscle contraction unfortunately was never awarded a Nobel Prize.

Harry: Thank you very much indeed for sparing the time, it has been wonderful to talk to you.

Darwin College and the Nobel Institute

Our Prize Winners

In addition to our most recent Nobel Laureate, Darwin College has had another six prize winners associated with it. A fantastic achievement for a College which is only 53 years old!

Max Perutz (1914-2002)
Honorary Fellow from 1984

The Nobel Prize for Chemistry, 1962

Max Perutz shared the Nobel Prize with his colleague John Kendrew for their pioneering work on the elucidation of the structure of the biological macromolecules haemoglobin (Perutz) and myoglobin (Kendrew), the respiratory proteins of red blood cells and muscle.

César Milstein (1927-2002)
Fellow from 1980

The Nobel Prize in Physiology or Medicine 1984

The immune system includes cells, lymphocytes and antibodies that neutralise substances foreign to the body, or antigens. We have millions of different antibodies, but each cell can produce only one kind of antibody. Sometimes a cell that forms a certain kind of antibody grows abnormally and a tumour is formed. In 1975 César Milstein and George Kohler developed a method for combining such tumour cells with cells that are immune to a certain antigen so that antibodies of the same type (monoclonal antibodies) can be produced.

Professor Milstein's Nobel Prize has pride of place in the Richard King Room in College.

Eric Maskin
Visiting student, 1975-76

The Nobel Prize in Economic Sciences 2007

Eric Maskin is an economist and co-winner, along with Leonid Hurwicz and Roger Myerson, of the 2007 Nobel Prize in Economics "for having laid the foundations of mechanism design theory." The theory, allows economists to distinguish situations in which markets work well from those in which they do not. It takes into account information about individual preferences and available production technologies which is usually dispersed among many parties who may use their private information for selfish ends.

Images, left to right:

César Milstein's Nobel Prize and other notable awards his widow donated to Darwin.

Eric Maskin receiving his Honorary Cambridge Degree, photographed with Mary Fowler and alumna Janet Rossant in 2017.

Elizabeth Blackburn receiving her Nobel Prize from the King of Norway in 2009. Photo: Frida Westholm. © Nobel Media AB.

Elizabeth Blackburn

PhD Biology, 1971-1975

The Nobel Prize in Physiology or Medicine 2009

Elizabeth Blackburn shared the prize with Carol Greider and Jack Szostak for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase. An organism's genes are stored within the DNA molecules, which are found in chromosomes inside its cells' nuclei. When a cell divides, it is important that its chromosomes are copied in full, and that they are not damaged. At each end of a chromosome lies a 'cap or telomere, which protects it. In 1980, Elizabeth discovered that telomeres have a particular DNA. In 1982, she and Jack Szostak further proved that this DNA prevents chromosomes from being broken down. Then, in 1984, she and Carol Greider discovered the enzyme telomerase which produces the telomeres' DNA.

In addition there have been another two Nobel Laureates associated with the College:

Andrew Huxley, The Nobel Prize in Physiology or Medicine, 1963. Andrew Huxley was an Honorary Fellow of Darwin and former Master of Trinity College.

Amartya Sen, The Nobel Prize in Economic Sciences, 1998. Amaryta Sen is an Honorary Fellow of Darwin and is a former Master of Trinity College.

10 Nobel Prize Fun Facts

- Between 1901 and 2017, the Nobel Prizes and the Prize in Economic Sciences were awarded 585 times to 923 Laureates.
- Nobel Prizes haven't been awarded on 49 occasions. Most of them during the First and Second World Wars.
- The most common field for Physics Laureates is particle physics, for Chemistry its biochemistry, for Medicine its genetics, and Economic Sciences – macroeconomics. Most of the Literature Laureates write prose.
- Three laureates were in prison when they received the award, all of them winners of the Nobel Peace Prize. German pacifist and journalist Carl von Ossietzky in 1935, Burmese politician Aung San Suu Kyi in 1991 and Chinese human rights activist Liu Xiaobo in 2010.
- The average age of Nobel laureates, across all prize categories, is 59. But the oldest prizewinner was 90-year-old Leonid Hurwicz, who won the Economics Nobel (technically called the Sveriges Riksbank Prize in Economics Sciences in Memory of Alfred Nobel) in 2007. The youngest winner is Malala Yousafzai. She won the Peace Prize in 2014 when she was 17 years old.
- There is often a substantial delay between when a scientist makes a Nobel-worthy discovery and receiving the award—the average time often varies from between 20 and 30 years.
- Nobel prizes are announced in advance but awarded annually on December 10, the anniversary of Alfred Nobel's death.
- The Nobel Prizes for Physics, Chemistry, Medicine, Literature and Economics are awarded at a ceremony in Stockholm, Sweden.
- The Nobel Peace Prize is awarded at its own ceremony in Oslo, Norway. Periodically, no prize has been awarded. This happened most recently in 1972.
- The main inscription on the Physics, Chemistry, Medicine, and Literature Nobel Prize medals is the same: 'Inventas vitam juvat excoluisse per artes,' loosely translated, 'And they who bettered life on earth by new found mastery.' Word for word translation, 'inventions enhance life which is beautified through art.'

John Bradfield Court

On an icy January morning the sight of frogmen in the river beneath the Old Granary caused much surprise and not a little sympathy. They had been sent in by the College's building contractors to install a temporary cofferdam that will hold back the river and allow scaffolding to be erected on the riverside face of the Old Granary. The water temperature, the speed of the current and the depth of the river were presenting challenges for erecting the scaffolding.

Nonetheless the creation of John Bradfield Court is well underway. The Old Granary and Counting House has been stripped out. The removal of the accumulated wiring and pipes, superannuated boilers and bathtubs, plus many minor modifications which must have made sense at some time, has revealed interior spaces which immediately take us back to the work done by George Darwin and his architect JJ Stevenson in the 1890s in creating charming domestic rooms in a former industrial building. The reinstatement of 10 student rooms in the Old Granary will preserve as far as possible the period character of this listed heritage building.

There is no sign as yet aboveground of the new single story freestanding pavilion building to be named the Bradfield Room. Although the building is not grand and is designed to nestle into this corner of College, the groundworks would seem to have been no small undertaking. In addition to deep foundations appropriate for the proximity to the river, a ground source heat pump bore 130m deep has been drilled, and subterranean floodwater

"As Lent term 2018 gets underway the need for the College to provide more multipurpose space is more apparent than ever."

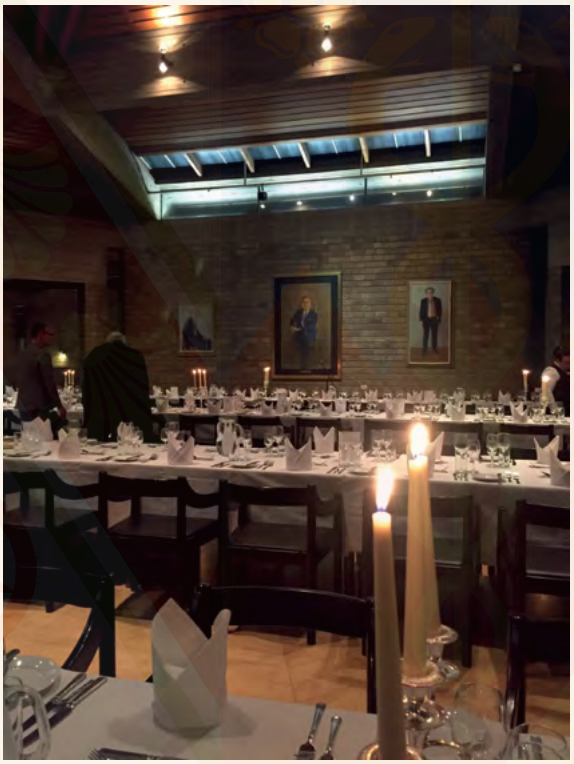
attenuation tanks have been installed. The steelwork for the Bradfield Room structure is however on site and action aboveground is expected any day.

As Lent term 2018 gets underway the need for the College to provide more multipurpose space is more apparent than ever. The Old Library has become the College's lecture room, art gallery, boardroom, drinks lounge, all at once. The Bradfield Room is intended to provide space for lectures with seating for 75, and for other meetings and receptions with a higher capacity standing. It can also be configured to provide a seated meal to 50 diners, and its default use will be as overflow student study space immediately adjacent to the Study Centre.

Sir John Bradfield, while Senior Bursar of Trinity College, instigated the founding of Darwin and he supported the College throughout his life until his death in 2014. We acknowledge the generous support of many alumni and other donors, and of Trinity for its major gift towards the project in memory of Sir John. We look forward with great excitement to welcoming students back into the Old Granary later this year and inaugurating the Bradfield Room in early 2019.

Left:
An artist's impression of Bradfield Court from Silver Street.
Right:
An artist's impression of Bradfield Court from the back of the College.
Illustrations: *Allies and Morrison*

From the Development and Alumni Relations Office



A big thank you to all of you who completed the 2017 Alumni Survey, we were overwhelmed with responses and are reading each entry with interest and care. We are currently updating our database with the bumper crop of responses! The good news is that the winner of the £100 worth of Amazon gift vouchers was drawn randomly from all the returns received and the lucky winner is Dr Erica Moodie - very many congratulations to her. If you didn't receive the survey it may be because we don't have a current email address for you. To receive email updates please go to our website and click 'Alumni & Development', 'Alumni' and then 'Alumni Update Survey' and send us your details.

Did you know that you can help the College Study Centre just by shopping through Amazon? By accessing Amazon via the Darwin website any purchase you make will credit the College library with a 5% referral fee. This costs you nothing but will ensure that you are helping to fund the Darwin library and its continuing growth.

Formal Hall has never been more popular at college and our food is widely agreed to be some of the best among Cambridge Colleges. While Formal Hall dinners are primarily for current students we are particularly pleased that increasing numbers of alumni are booking into dinner. The booking system has recently been updated, so if you are interested in attending, this is what you need to know:

- Book as early as you can to avoid disappointment. Contact us on alumni.relations@darwin.cam.ac.uk with your dates, we can then confirm your places or suggest alternative dates
- We will book you into dinner
- Drinks with the meal are now payable separately and we will send you a list to make a choice of either alcoholic or soft drinks
- Once chosen we will ask you to pay for your dinner and drinks and to confirm dietary requirements
- Your drinks will be given to you at the table. Enjoy your dinner in a wonderful setting!

In November we very much enjoyed hosting the Alumni and Fellows Guest Night and what a full hall we had! In fact, we were squeezing people in beyond its capacity. The evening's fun was enhanced by a group of rowers from the 1995-1998 cohort - brought together by Torsten Krude. They

made a weekend of it and the following day they were to be seen enjoying a vigorous row up the Cam.

In December, the Master and Development Director visited Darwin alumni in the USA, with events held in San Francisco, New York, and Washington DC.

In March this year the Master and Development Director will be touring the Far East and hope to meet as many alumni as they can during their time there. The tour will consist of Hong Kong, Singapore, and Kuala Lumpur; we will have a dinner or drinks reception in each city. A 'save the date' message has been sent to alumni in those vicinities, but if you are in the area during that time, please contact us and we will send you more details. Please also keep an eye on our website and e-bulletins for details of other events we run, both in Cambridge and worldwide!

The Master's introduction to this publication mentions our new Research Fellowships in honour of David Mackay and Patrick Sissons. Having successfully secured funds for the first 3 years of each appointment, we are now actively fund raising to endow these Fellowships in perpetuity. If you are interested in further information on either, please contact the Development Director.

Our next large fundraising project will be publicised before Easter and we aim to raise enough gifts from alumni to fund four new PhD studentships at a cost of £11,000 per student per year, we will be able to obtain half the cost through UK Research Councils and so every donation given will be matched pound for pound. More information will be with you in the next month or two, and we do hope you will 'get on board' with this!

On behalf of all at Darwin, thank you to all of you who have chosen to donate to College, whether by standing order, one-off donation, or by pledging a legacy. Your support – at all levels – is greatly appreciated.

As ever, do contact us with any comments or queries and we hope to see you very soon.

Above, left to right:
The Hall set up for Guest Night
Old Darwinians enjoying rowing on the Cam
Setting up the boat ready for a post- Guest Night row

New Student Accommodation: Hardwick House

In 2016–17 the College was presented with a rare opportunity in Newnham village to add to its stock of student rooms. Hardwick House is the first newly built hostel to be brought on stream by the College in over 20 years, and the first accommodation in which all the student rooms have en-suite facilities.

Some decades ago St John Ambulance acquired land on Hardwick Street around the edge of an older block of apartments, on which they put a small depot. When they decided to sell the site it was keenly pursued by developers. Such sites generally sell for high prices based on the potential for conversion to residential, rather than to student accommodation. However in this case the private purchaser approached the College keen to accommodate Darwin students on the site and planning permission was granted accordingly. The College has taken the hostel on a long but flexible lease, and the first students moved in in September 2017.

The hostel comprises 26 student rooms in total. These are spread across two buildings with bicycle parking and bin storage in-between. All of the rooms have their own en-suite facilities, so no separate bathrooms are required, and there are five generous kitchens. The exterior design was much scrutinised by local residents. The architect chose a simple traditional style which has since been praised for blending in with the existing streetscape. The resident students have everything they could wish for. All the College's facilities are within easy cycling or walking distance, and there is a Co-op and a grocer just round the corner and a pub directly opposite. Access to town and the University central sites is via a pleasant route across the common, and the hostel is on the right side of town for the newer university buildings at West Cambridge.

Images, clockwise from top left:
Hardwick House viewed from Hardwick Street
Covered bicycle parking
Student Lidija Mirella Honegger at her desk
One of the well equipped kitchens
Photo credit: Andrej Bugaski

Funding Graduate Studentships: New opportunities

Cambridge as a whole has increased its numbers of graduate students over recent years, an increase that has been reflected in numbers in individual Colleges as well. At present, Darwin has some 341 research 'PhD-track' students, which is more than any other College.

Over a similar time frame, available funding has become scarcer, especially in Arts, Humanities and Social Science. We are absolutely determined that the brightest students should have the opportunity to study for PhDs, unconstrained by their ability to pay. In short, postgraduate study must not become the preserve of the rich.

At Darwin, it is clear that we need to offer more studentships, both to ensure that we can support students who would otherwise be unable to study for a PhD, but also to ensure that we continue as one of the top Colleges in Cambridge at which to study for a PhD. To this end, we have explored options with the various UK Research Councils who operate Doctoral Training Programmes within the University, and we now have the prospect of offering Partner Studentships, where the College contributes half the University Fee and student stipend, with the remaining half being funded by the relevant research council.

Currently, the standard University Composition Fee for PhD students is £7,857 and a Research Council Student Stipend for 2017-18 is £14,625, meaning that the annual cost per student is around £22,482. With Partner Studentships the College's contribution would be 50 per cent of this, i.e.: £11,241.

The ability to attract additional funds from research councils is both exciting and timely, and there is a clear opportunity for donations to play a leading role in making this happen. We will be setting this out in further detail in our 'Studentships' fundraising mailing in a month or two's time. Some donors may feel able to fund an individual studentship outright. But the amounts need not be particularly large or onerous. For example, if 30 individual donors gave £25/month for 4 years, this would, with Gift Aid, generate £11,250 each year over the 4 years of a PhD; enough to attract the research Council funding, enabling us to offer a studentship to a top student.

Internationally, a number of trusts are operating to a similar model (half funding studentships on the basis that the recipient organization provides the other half of the funds). We are actively exploring such opportunities at present.

Above:
Darwin graduands processing on Kings Parade
Photo credit: Sir Cam

With help from our alumni, supporters and well-wishers, we hope to be able to offer a number of such studentships in the near future. Please do consider joining us in our ambition to attract the best students to Darwin by offering such studentships! As a donor, your gift will go further, and will enable the College to attract additional funds that it would not otherwise be able to access!

Further information is available from the Development Office and will be set out in our 'Studentships' fundraising mailing this year.

Top: *Filmon playing for the Cambridge Dons*
Bottom: *Filmon throwing the ball to the players*

Goal Ball

International Sporting Success for Darwin alumnus

Former student of Darwin College, Filmon Eyassu (PhD 2011) has achieved international sporting success as a member of Great Britain goalball team. Filmon's involvement in the sport is a direct consequence of his PhD study at Darwin, and thanks to a chance encounter at the Silver Street bus stop.

Goalball is a Paralympic team sport designed specifically for visually impaired and blind athletes. Played on a basketball size court with large ball with a bell in it and tactile floor to help with orientation and tracking. The sport is very inclusive – every player wears blindfolds – to ensure an even playing field.

Shortly after joining Cambridge Dons Goalball club, Filmon made a direct impact, helping the team in winning its first gold medal at a novice league. He moved up rapidly in the league and by the end of the season he represented club at an elite competition. In recognition, he was awarded Player of the Season for 2013/14.

Following this fantastic acheivement, Filmon was pleased to be invited to join the Great Britian goalball team. As an integral member of the GB team, he helped the team on its successful promotion to the European League A, winning gold and silver medals in Sweden 2015 and Portugal 2016 respectively.

Filmon very much enjoyed his time at Darwin where he met very interesting academics and made many friends. Adding that *"goalball allowed him to meet highly inspiring blind athletes. I love goalball for the fantastic balance it offers in my academic and sporting life".*

As a sportsperson, Filmon owes his success to Cambridge Dons Goalball club and the Talented Athlete Scholarship Scheme (TASS), awarded while at Darwin.

Illuminating Cambridge Libraries

Sara Rawlinson is a photographer who is undertaking a project to photograph one library from each of the Cambridge Colleges. To date, she has worked with Christ's, Churchill, Clare, Corpus Christi, Darwin, Emmanuel, Gonville & Caius, Homerton, Hughes Hall, Jesus, King's, Magdalene, Pembroke, Peterhouse, Queens', St Catharine's, St John's, and Trinity.

Her large photographic study of Cambridge College libraries aims to honour features that enable the dissemination and preservation of knowledge by highlighting the aesthetic environment in which books and documents are displayed and preserved.

Rather than focusing on the knowledge contained within the volumes, she illuminates the aesthetic environment in which such books and documents are displayed and preserved.

Whether light-filled or cosy, whether aged by centuries or by decades, the principal purpose always shines through: the preservation and dissemination of knowledge.

Sara's photographs are available for sale through her website – mention this article and she will donate a percentage to the Darwin College student support fund.
www.sararawlinson.com

Clockwise from top left:
The Study Centre Atrium. The weather beaten shutters reveal a wonderful view. Many fascinating books line the book shelves.

Prehistoric women were stronger than elite women Cambridge rowers

Dr Alison Macintosh (PhD Biological Anthropology, 2011), Darwin College Research Fellow

Alison Macintosh has undertaken the first study to compare ancient and living female bones which shows that women from early agricultural eras had stronger arms than the rowers of Cambridge University's famously competitive boat club. Researchers say the findings suggest a "hidden history" of gruelling manual labour performed by women that stretched across millennia.

The new study comparing the bones of Central European women that lived during the first 6,000 years of farming with those of modern athletes has shown that the average prehistoric agricultural woman had stronger upper arms than living female rowing champions.

Alison and her colleagues from the Department of Archaeology say this physical prowess was probably obtained through tilling soil and harvesting crops by hand, as well as the grinding of grain for as much as five hours a day to make flour.

Until now, bioarchaeological investigations of past behaviour have interpreted women's bones solely through direct comparison to those of men. However, male bones respond to strain in a more visibly dramatic way than female bones. This has resulted in the systematic underestimation of the nature and scale of the physical demands borne by women in prehistory. This is the first study to compare prehistoric female bones to those of living women.

"By interpreting women's bones in a female-specific context we can start to see how intensive, variable and laborious their behaviours were, hinting at a hidden history of women's work over thousands of years." said Dr Alison Macintosh, lead author of the study published in the journal Science Advances in November.

The study used a CT scanner to analyse the upper arm and lower leg bones of living women who engage in a range of physical activity: from runners, rowers and footballers to those with more sedentary lifestyles.

The bone strengths of modern women were compared to those of 94 women from early Neolithic agricultural eras through to farming communities of the Middle Ages, a range of about 6,000 years.

"It can be easy to forget that bone is a living tissue, one that responds to the rigours we put our bodies through. Physical impact and muscle activity both put strain on bone, called loading. The bone reacts by changing in shape, curvature, thickness and density over time to accommodate repeated strain," said Macintosh.

"By analysing the bone characteristics of living people whose regular physical exertion is known, and comparing them to ancient bones, we can start to interpret the kinds of labour our ancestors were performing in prehistory."

Macintosh scanned the limb bones of the Open- and Lightweight squads of the Cambridge University Women's Boat Club, who ended up winning last year's Boat Race and breaking the course record. These women were training twice a day and rowing an average of 120km a week at the time.

The Neolithic women analysed in the study had similar leg bone strength to modern rowers, but their arm bones were 11-16% stronger for their size than the rowers, and almost 30% stronger than typical Cambridge students. Bronze Age women, had 9-13% stronger arm bones than the rowers but 12% weaker leg bones.

A possible explanation for this fierce arm strength is the grinding of grain. "We can't say specifically what behaviours were causing the bone loading we found. However, a major activity in early agriculture was converting grain into flour, and this was likely performed by women," said Macintosh.

"By interpreting women's bones in a female-specific context we can start to see how intensive, variable and laborious their behaviours were, hinting at a hidden history of women's work over thousands of years."

"For millennia, grain would have been ground by hand between two large stones called a saddle quern. The repetitive arm action of grinding these stones together for hours may have loaded women's arm bones in a similar way to the laborious back-and-forth motion of rowing."

While grinding grain using stone tools was likely to be a key factor in boosting bone strength, other occupations including pottery making, planting and harvesting crops, and tending livestock could also have contributed.

The findings highlight the hard manual labour that women performed and their key role in farming communities. "Women have been doing rigorous labour over thousands of years, and that's been underestimated so far because we haven't been comparing them to living women"

Left:
The Cambridge University Women's Boat Club Openweight crew rowing during the 2017 Boat Race on the river Thames in London. The Cambridge women's crew beat Oxford in the race. The members of this crew were among those analysed in the study. Credit: Alastair Fyfe for the University of Cambridge.

Can biometrics beat the developing world's challenges?

Dan Storisteanu, Research Fellow and co-founder of Cambridge tech start-up Simprints, talks about biometrics and how it is a key driver in the fight against poverty and poor healthcare.

The World Bank estimates that as many as 1.1bn people worldwide do not officially exist. This lack of formal identification is a key challenge across the developing world – without reliable, unique and persistent identifiers, governments and development organisations struggle to provide essential goods and services to the populations they serve. The problem is wide-ranging: the dynamic nature of subsistence or agricultural communities and largely dysfunctional civil registration systems, combined with rapid population growth, has led to communities which are uncountable and poorly censused. Paper-based identity systems are resource-intensive, fragile and easily manipulated.

Specifically, continuity of care in healthcare provision requires some mechanism of linking clients to their records over time. Lack of official identity documentation such as national ID cards or birth certificates obstructs people's access to rights and services. This can cost lives, waste resources and prevent health, finance and other development organisations from reaching millions of beneficiaries. For example, systems that lack the critical 'backbone' to link records to individuals using unique identifiers may fail to recognise when pregnant women miss follow-up visits, which could prevent maternal and infant deaths.

Programmes often try to use personal information such as names, dates of birth and postcodes to identify beneficiaries. But the problem is these identifiers are rarely unique and naming conventions vary dramatically across, and sometimes within, cultural groups. Individual names or family name combinations can repeat multiple times in a community (over 60% of males in some areas of Bangladesh use an honorific first name 'Mohammed', combined with a second name from a fairly small pool of options).

Simprints Solution

Biometric identification can solve these intractable problems, providing a solution to help lift people out of poverty and to save lives.

Simprints, a Cambridge based tech start-up, founded by Dan Storisteanu, Alexandra Grigore,Tristram Norman and Toby Norman, have recently won a $2M 'Saving Lives at Birth' prize to prevent maternal and child deaths in the hardest to reach regions in the world funded by the Gates Foundation and governments.

The company has produced biometric fingerprint technology that enables NGOs and governments to deliver essential services like healthcare to the frontlines. This will in turn improve the treatment of pregnant women as it allows doctors and nurses to establish a mother's medical history. The scanner is pocket sized and instantly links an individual's fingerprint to his or her health record. This enables health workers to make better decisions by providing immediate and reliable access to medical information.

The prize will be used by the company to scale up its current project which covers 22,000 patients in Bangladesh to ensure that mothers and their children receive regular pre and post-natal check-ups. Working with BRAC, the world's largest NGO, it will take the scheme across the country, reaching 4.85 million mothers and children over the next 3 years. The road ahead is still long, but the device is cost effective and secure, and it is hoped it can give mothers and children the right to an identity and the better health care that comes with it.

Daniel Storisteanu is a Gates Scholar and Research Fellow at Darwin College, University of Cambridge. He is a co-founder of Simprints together with Toby Norman, who has a PhD in Management from Cambridge. Both are listed as Forbes 30 Under 30 Social Entrepreneurs.

Cohesu is leading the fight against Tunga penetrans in the schoolchildren of Kisumu, Kenya. These parasitic insects often burrow into the bare feet of children, making walking painful and risking infection and other serious health complications. Simprints helps Cohesu monitor and track the rate of Tunga infection in an area, deliver consistent treatment, and provide children with shoes to prevent future infection.

Weaving through bustling Dhaka slums, BRAC's Shasthya Kormis (community health workers) deliver lifesaving services to mothers and babies who may have been lost to health services. Using the Simprints biometric system, SKs are able to track the number of antenatal care visits a mother receives with unprecedented accuracy and efficiency, ultimately decreasing infant and maternal mortality.

Stephen Keynes (1927–2017)

Honorary Fellow and great, great grandson of Charles Darwin

Stephen Keynes was an Honorary Fellow of Darwin College from 2010 until his death in 2017. The College main site is housed in the former home of his grandfather, Sir George Darwin (1845-1912), second son of Charles. Stephen's mother Margaret's childhood years were recorded by his aunt Gwen Raverat in 'Period Piece' and again by his mother in 'A House by the River'. Stephen greatly enjoyed his association with the fellows and graduates of Darwin, and also regaled alumni with stories of his visits in his younger days. An obituary was published in The Times on 16th November 2017 and is published here with their permission.

Eccentric merchant banker who enjoyed naked gardening and promoted the legacy of Charles Darwin, his great-grandfather.

Going to a party with Stephen Keynes could prove to be a dangerous experience. Fellow revellers were liable to wake the next day with a groan as they recalled how they had promised him to make a film, choreograph a ballet, even open a bookshop.

A gregarious man with a huge smile, Keynes was a natural networker. As the great-grandson of the naturalist Charles Darwin, and nephew of the economist and patron of the arts JM Keynes, it was perhaps no surprise that he straddled the fields of art, science and finance with verve and ease.

In 1999 he founded the Charles Darwin Trust and played a significant role in saving Down House, the naturalist's home in Orpington, Kent, for the nation. When the owners, the Royal College of Surgeons, decided to sell the house, Keynes persuaded the Wellcome Trust and English Heritage to buy the building. Later he was involved in its restoration as a "Darwin-inspired learning centre for children".

As secretary, then chairman of the trust, Keynes had played a crucial role in rehabilitating the reputation of Darwin and his theory of evolution. "When I went up to Cambridge in 1946, he [Darwin] was almost forgotten," Keynes recalled. "He was a name, but his science was not fresh and there was a feud between many of the biologists about what he said and the evidence. It was only in the 1970s, after the human genome was beginning to be understood, which meant that they could — through DNA — trace the history of mankind from the beginning, and of animals and rocks and everything else, so suddenly he became very relevant."

He later brought Darwin to modern dance after being introduced to the choreographer Mark Baldwin. At a party in Cambridge one evening they thought up Comedy of Change, a ballet that articulated through dance the central idea of Darwin's book On the Origin of the Species — that those who adapt to change survive. The ballet received its premiere in 2009 to mark the 200th anniversary of Darwin's birth.

The turning point for Keynes had come in 1971. After working for a merchant bank for 20 years, he became disillusioned with the City and left his job. Blessed with the independence of mind displayed by his famous relations, he decided that he wanted a role in bringing culture to a wider audience.

His first venture in 1971 was the Centerprise community bookshop in Hackney in London, where gays, feminists and black people were welcomed, and children from poor families could play chess and take drama classes. He ignored warnings that people in the East End "don't read". The bookshop remained open for 40 years.

In 1979 he became chairman of the Whitechapel Gallery and supported its radical director, Nicholas

Serota, in putting on avant-garde shows and promoting young artists such as the sculptor Antony Gormley. He also sat on the board of the Independent Broadcasting Authority, before moving into programme-making. He was associate producer of Heart of the Dragon, the Channel 4 documentary on China

With an endearingly individual approach to life, he had a penchant for gardening in the nude. He also enjoyed croquet. Visitors to Lammas House, his elegant home near Newmarket in Suffolk, would invariably find him wandering naked, basking on the veranda or tending his garden. According to his great-niece, "he did this so innocently that it never seemed inappropriate".

Stephen John Keynes was born in London in 1927, the fourth son of Sir Geoffrey Keynes, an eminent surgeon and younger brother of the economist. His mother, Margaret Darwin, was the daughter of Sir George Darwin and granddaughter of Charles.

Stephen was educated at the Hall School, Hampstead, and Oundle. His early memories included visiting JM Keynes in Bloomsbury. "Maynard was not the least interested in children, but he was my godfather, so my mother used to take me to visit him . . . his bed was always covered with matters about which he was reading and thinking and with whatever he was engaged in writing at that time . . . His ideas often moved faster than he could talk and he had to speak very fast to catch up."

He remembered going to see Aladdin at the Cambridge Arts Theatre, which JM Keynes had founded, and watching fascinated as his godfather sang along with Widow Twankey's outrageously vulgar songs. John Tresidder Sheppard, the provost at King's College, Cambridge, had clearly enjoyed the same performance because he sang the Twankey ditty some months later in front of a group of nervous young people, including Stephen, who were taking the entrance exam. The provost then forgot the words and Stephen finished the song. He passed the exam.

After graduating in history and economics, he did National Service with the Royal Artillery, then joined the merchant bank JF Thomasson. In 1955 he married Mary Knatchbull-Hugessen, a student at the London School of Economics who had been accepted by the Canadian diplomatic service. Meeting Keynes changed her plans. "I rather ruined her career," he joked. "We had five children in six years."

Mary, who became a teacher at a north London comprehensive, survives him with their children: Gregory, who is a doctor; Elizabeth, who is an animation consultant; Toby, a humanist who campaigns for the Liberal Democrats; Martha, a teacher; and Zachary, who is a market trader.

After leaving the City, Keynes worked part-time on banking assignments in the Middle East, as well as on projects in the arts. He maintained his cheerfulness and his individual sense of style to the end, the naked gardener stroking plants just as his great-grandfather had done.

Stephen Keynes, OBE, banker who promoted Darwin's legacy, was born on October 19, 1927. He died from cancer on August 13, 2017, aged 89.

Left: Stephen Keynes at Trinity College, 2015

Above: From left to right: Chester White, Stephen Keynes and Stefan Paetke at the Master's Garden Party in 2010

Alumni Events in 2018

Friday 16th March
Darwin College Society Reunion Dinner during formal hall, and drinks afterwards
Venue: Dining Hall and Richard King Room

Saturday 24th March
Alumni Reception in **Hong Kong** hosted by the Master, Vice-Master and Development Director

Tuesday 27th March
Alumni Reception in **Kuala Lumpur** hosted by the Master and Development Director

Wednesday 28th or Thursday 29th March
Alumni Reception in **Singapore** hosted by the Master and Development Director

Saturday 28th April
Darwin College Society Spring Walk, Brampton Woods

Saturday 11th May
Alumni Reunion Dinner for matriculation years 1975-1985 and 2000-2010
Venue: Dining Hall and Richard King Room

Saturday 12th May
Darwin College Society 'Local Heritage Event' Royston Caves

Friday 15th June
Darwin College Society 'Bumps' Formal Hall, and drinks afterwards
Venue: Dining Hall and Richard King Room

Friday 6th July
Alumni Garden Party
Venue: College gardens

Saturday 22nd September
Alumni Family Lunch
Venue: Darwin College

Editors:
Sophia Smith, John Dix

The editors especially welcome short articles, pictures and news from all our alumni but particularly those overseas.

Correspondence to: darwinian@darwin.cam.ac.uk
To sign up for our ebulletin use this link: eepurl.com/pLzBH or scan our QR code

Front over image: Photo credit Sir Cam
Back cover image: Photo credit Julian Paren